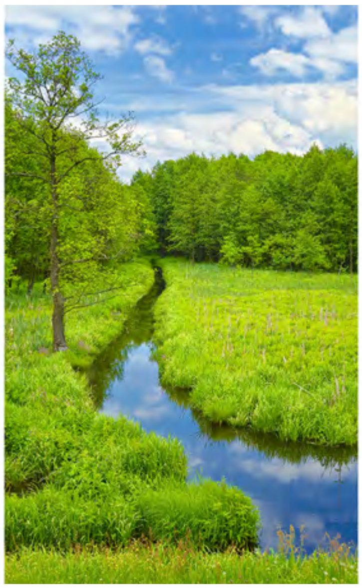
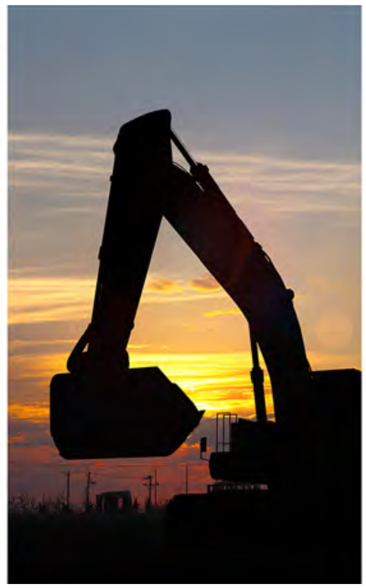
CONESTOGA-ROVERS & ASSOCIATES

www.CRAworld.com


Vapor Intrusion Pathway Mitigation Systems Design Plan

Occidental Chemical Corporation
Tacoma, Washington

Prepared for: Occidental Chemical Corporation

Conestoga-Rovers & Associates
2055 Niagara Falls Boulevard, Suite 3
Niagara Falls, New York 14304

July 2014 • 007843-M9-403 • Report No. 120

Partners in Sustainability

Table of Contents

Page

List of Figures
(Following Text)

List of Appendices

Section 1.0 Introduction

Conestoga-Rovers & Associates (CRA) has prepared this Vapor Intrusion Pathway Mitigation Systems Design Plan (VM Systems Design Plan), on behalf of Occidental Chemical Corporation (OCC), as follow-up to the December 24, 2013 Draft Vapor Mitigation Systems Work Plan and that incorporates comments from United States Environmental Protection Agency (USEPA) detailed in their June 14, 2014 letter. This VM Systems Design Plan presents the design of vapor mitigation systems for selected buildings on the OCC Property and Port of Tacoma controlled properties (POT Properties). The OCC Office Building, and Buildings 326 and 532 on the POT Properties were selected for mitigation following indoor air and sub-slab vapor sampling conducted in April 2013 and June to July 2013, which identified Site-related contaminants in the sub-slab vapor and indoor air above screening levels, driving the need to install vapor mitigation systems in these buildings. This VM Systems Design Plan presents the mitigation systems design and installation process to be followed, and identifies the monitoring, reporting, and schedule associated with the work. It also discusses the May 2014 identification of sub-slab ducting at Building 326, and the additional duct investigation/ decommissioning and vapor investigation work to be completed at Building 326 before a final decision is made regarding the need for mitigation of Building 326. The mitigation plans presented herein for Building 326 should therefore be considered preliminary pending a final decision that mitigation is even needed.

The three buildings selected for mitigation are shown on Figure 1.

This VM Systems Design Plan is organized as follows:

- Section 1.0 Presents the introduction, purpose, and organization of this VM Systems Design Plan
- Section 2.0 Presents the design goals, selected approach, parameter determination, and design criteria applied to the sub-slab depressurization systems (SSDSs) for each building
- Section 3.0 Presents the supporting evaluations for the SSDSs planned for each building
- Section 4.0 Presents the mitigation systems installation process for each building
- Section 5.0 Presents the start-up and potential installation of supplemental system components
- Section 6.0 Identifies the operation, maintenance, and monitoring (OM&M) aspect of this design
- Section 7.0 Identifies the reporting associated with the work
- Section 8.0 Identifies the schedule associated with the work

Section 2.0 Design Basis

This section presents the design goals, selected approach, parameter determination, and design criteria applied to the SSDSs for each building.

2.1 Design Goals

The goal of the full-scale SSDSs is to minimize the potential for sub-slab vapor migration into the indoor air of the occupied areas of the subject buildings. System operational objectives are to:

- Demonstrate a sufficient vacuum radius of influence (ROI) (i.e., negative pressure field extension) beneath the floor slab such that a minimum differential pressure can be maintained between the sub-slab and the indoor atmosphere, regardless of heating, ventilation, and air conditioning (HVAC) conditions. A minimum vacuum of 1 Pascal (Pa), or 0.004 inch water column (in. w.c.) is the generally accepted minimum requirement which conforms to the USEPA guidance for maintaining adequate depressurization under the floor slab of large buildings (Radon Prevention in the Design and Construction of Schools and Other Large Buildings, EPA/625/R-92/016).
- Maintain and operate the systems continuously with minimal downtime.
- Demonstrate by direct measurement and/or modeling that concentrations of volatile organic compounds (VOCs) in the exhaust discharged to the atmosphere are below applicable criteria.

2.2 Selected Approach and Design Parameters

SSDSs have been designed and will be installed. Based on performance of these mitigation systems, the need for additional extraction or monitoring points will be determined and installation of supplemental depressurization components will be performed. Thus, the design process will employ the following iterative approach and selected design parameters:

- Install the number of extraction points needed based on a typical areal density of one per 6,000 square feet (sq ft). This corresponds to an ROI of approximately 50 feet (ft) for each extraction point and is typical for SSDS performance.
- Assume typical mitigation fan performance capacity of 50 cubic feet per minute (cfm) at 15 in. w.c. vacuum for each extraction point.
- Test that an adequate pressure field extension (1 Pa) is achieved throughout the sub-slab target area.
- If sub-slab areas have poor communication and do not exhibit the minimal required negative pressure, then install additional extraction points and/or mitigation fans to extend the pressure field to these areas.

Using this approach, vapor mitigation systems have been designed to provide vacuum coverage across the entire footprint of each of the selected buildings.

2.3 Design Criteria

Basic design criteria have been determined consistent with the approach discussed above, including extraction point density, mitigation fan selection, achievable flow rates and applied vacuum, and pipe sizing to minimize friction losses (calculations in Appendix A) and are presented below:

- Effective ROI of 50 ft.
- Flow rate of 50 cfm at 15 in. w.c. vacuum at each extraction point.
- A dedicated fan for each extraction point in the mitigation systems at Building 326 and the OCC Office Building. A Radonaway Model HS2000 high flow fan (or equal) will be the standard mitigation fan.
- Building 532 will employ a larger blower (New York Blower Model 2306A or equal) manifolded to all the extraction points within the building. Due to the size of the area requiring mitigation, individual fans are not practical.
- Approximate areal coverage of 6,000 sq ft per extraction point/fan system.
- Building 532 extraction points will have 2-inch diameter carbon steel pipe to 6 ft above the floor to provide protection from damage. All other piping will be minimum 3-inch diameter for pipe runs of 50 ft or less from extraction point to discharge point and minimum 4-inch diameter for pipe runs over 50 ft.
- Install differential pressure sub-slab vapor monitoring points (SSVMPs) in target areas at locations furthest from extraction points or adjacent to office/break room areas in Building 532.
- Maintain minimum vacuum of 1 Pa (0.004 in. w.c.) at SSVMPs.

Section 3.0 Sub-Slab Depressurization System Building Evaluations

Initial building visits were conducted by the design engineer during September 24-28, 2012. Sampling of indoor air and sub-slab soil vapors was conducted in April 2013 and June to July 2013. Based on the sampling results, Building 532 was subsequently re-visited on November 19, 2013 and December 6, 2013 for the purpose of expanding the mitigation system to provide sub-slab depressurization beneath the entire building footprint, rather than to specific internal offices areas only. Draft design documents were submitted to the POT for review in the form of a Tenant Improvement Request on January 28, 2014. A site walk-through with representatives of the POT occurred on February 19, 2014. In response to this submittal and the site walk-through, POT supplied their comments and requirements to proceed with this work on February 20 and March 5, 2014. Those requirements are incorporated into this document and the attached design drawings as appropriate. A final set of drawings were sent to the POT for internal review. The POT's internal staffing review identified previously undisclosed building characteristics for Building 326, specifically the potential for HVAC ducting to be in use running beneath the concrete floor slab. These details were shared with CRA on May 15, 2014 via email from the POT's project manager. A building walk was completed by CRA and POT HVAC staff on May 21, 2014 to investigate the use of these sub-slab HVAC ducts. It was determined that at least one and potentially two cold air HVAC return ducts were in use beneath the slab. The information was presented to the USEPA in an email from GSH on May 22, 2014.

Based on the design criteria, the SSDSs will consist of the following for each building:

Building	***Number of Soil Vapor Extraction Points***	***Number of Mitigation Fans***	***Number of SSVMPs***
OCC Office Building	1	1	3
Building 326	4	4	3
Building 532	16	1	7

The locations of proposed extraction points, mitigation fans, piping routes, and SSVMPs for each building are shown in the Design Specification Drawings in Appendix B. Final locations of the extraction points, mitigation fans, piping runs, and SSVMPs may be modified slightly based on accessibility, location of support columns along which piping will be routed, obstructions or structures identified beneath the slab, and owner/tenant preferences. The spacing of extraction points will provide conservative coverage of each building's footprint with an estimated ROI of 50 ft.

Section 4.0 Sub-Slab Depressurization System Installation

Schematics of the extraction systems to be installed in each of the buildings are shown in the Design Specification Drawings in Appendix B. In general, each system will consist of an extraction point, piping, sample port, pressure gauge, a mitigation fan, and discharge piping. The system in Building 532 will connect multiple extraction points to one blower. While the final selected locations of floor penetrations will take the potential for utilities (especially plumbing) into consideration, all work on extraction and SSVMP installation other than drilling and coring of concrete, will be performed by hand. If agreement regarding the locations of floor penetrations relative to potential utilities cannot be reached between all parties, then the location may be adjusted or a private utility locate service may be employed. During installation activities, close attention will be paid to noting potential vapor intrusion pathways such as utility penetrations, floor/wall joints, and cracks in proximity of the areas targeted for mitigation. Identified pathways will be addressed during the start-up period. A description of the materials and methods to be used for installation of the SSDSs is provided below. Additional details and specifications are presented on the design drawings. Manufacturer cut sheets for the mitigation fans, vacuum gauges, SSVMP cover, and recommended vacuum and flow monitoring instruments are provided in Appendix C.

For Buildings 326 and 532, the POT requires that:

- All extraction piping is to be installed as close as possible to building walls, columns, or support beams, and in no case more than 3 ft from the wall/column/beam to the center of pipe unless approved by the engineer and POT.
- Protective barriers shall be installed as needed to protect piping from damage. Enclosures need to be provided for piping that is not located in a protected location, such as a small closet. This includes piping on the exterior of a building, as well as in the operational areas of buildings. Interior enclosures may be steel angle railing and painted safety yellow for visibility around the pipe. Exterior enclosures will be steel framing with siding/trim to match existing. Enclosures shall be kept as small as possible and no larger than 4 ft x 4 ft. The contractor will be directed on this need by the engineer and POT.
- Any exterior galvanized components shall be painted such that no galvanized surfaces are exposed.

For materials generated during installation:

- Dust mitigation measures are to be used to keep cement dust generation to a minimum. Any concrete, soil, or other debris generated will be containerized for characterization and proper disposal by OCC.
- If any suspected or known asbestos-containing material is encountered in an area that cannot be avoided, then it shall be removed or encapsulated as necessary by appropriately licensed persons.

Exhaust stacks will extend to above the roof as per building codes, supported as appropriate, and the discharge point will be greater than 10 ft from all HVAC intakes, windows, doors, and other potential air intakes to each building (greater distances from building openings will be considered where practical). All work is to comply with all local, state, and federal building codes, and mechanical and electrical installation is to be provided by a properly licensed contractor. OCC will be required to obtain any required building, air discharge, or local ordinance permits or exemptions.

4.1 OCC Office Building

The OCC Office Building extraction point will be constructed by coring a 6-inch diameter hole in the floor slab and hand excavation of the soil/gravel from beneath the concrete slab to form a "pit" of approximately 1 cubic foot. All removed soil, concrete cores, or debris generated will be containerized and properly disposed. A perforated 3-inch diameter polyvinyl chloride (PVC) pipe covered in a filter sock will be installed in the "pit" and bedded in clean pea gravel. The perforated pipe and filter sock will prevent dust and debris from being drawn into the system. A 3-inch Schedule 40 PVC pipe will be connected to the 3-inch perforated pipe with a PVC coupler. The annular space between the piping and concrete will be sealed using non-shrink grout. The extraction piping will be attached to the nearest vertical structural support (i.e., column or wall) and then connected to overhead piping. A vacuum gauge that measures in the 0 to 30 in. w.c. range and a 1/4-inch sample port will be installed on the vertical pipe approximately 5 ft above the floor penetration. A simple visual inspection of the pressure gauge will show if the fan system is operating. Instructions will be posted on each riser pipe indicating whom to contact if the extraction point is not operating properly.

Overhead horizontal piping will be installed to the mitigation fan location via the most direct possible route to minimize friction losses and will be sloped back towards the extraction point at a 1 percent slope in case condensation occurs in the line. The extraction piping will penetrate the east exterior wall and will discharge to the atmosphere via a vertical exhaust pipe.

The vacuum for the soil vapor extraction unit in the OCC Office Building will be provided by a Radonaway HS2000 centrifugal in-line fan or equivalent. The fan will be installed above the ceiling of the building. Access must be available for servicing. A 120-volt power source will be required for the mitigation fan.

4.2 Building 326

As discussed above, recent plan reviews have identified the potential for HVAC ducting to still be present and in operation beneath the concrete slab in Building 326. A plan for the investigation, mapping, rerouting, and subsequent decommissioning of the HVAC ducting is being completed. HVAC investigation work is currently being planned and is scheduled to be completed in July. Preliminary decommissioning plans call for the access points to be sealed with high density closed cell foam, sheet metal and plywood. The seals are designed to be removable should it be determined post sampling that building mitigation design could be adjusted to include the sub-slab ducts as evacuation points for the system. Following the successful mapping of the sub-slab ducts, a new HVAC plan will be prepared by OCC for the POT's review. The new HVAC plan will be designed to address the building's needs following the decommissioning of the sub-slab ducts. The new building HVAC system will be designed per POT specification to meet the needs of the POT and their building tenants, all new HVAC ducting will be in the buildings walls or ceiling. Once a new plan has been approved by the POT and commissioned, the existing sub-slab HVAC ducts will be decommissioned to eliminate the preferential pathway for sub-slab vapor intrusion into the building.

Following the rerouting of the HVAC and the decommissioning of the sub-slab HVAC ducts, Building 326 will be reevaluated for potential vapor intrusion. Within 2 weeks after the final decommissioning work, an addendum to the approved Vapor Investigation Work Plan will be submitted to the Agencies, for post-decommissioning sampling at Building 326 consistent with previous round 3 sampling (i.e., including both passive Radiello® badges and Summa™ canisters). The passive badges will again be deployed for a 7-day sample collection with the indoor and ambient Summa™ canisters set for 24-hour collection. A single sub-slab vapor sample will be collected from location SS-7 within the GR Silicate portion of Building 326. The sub-slab sampling will be consistent with all previous sub-slab samples, and be 2 hours in duration. A total of four indoor samples and one ambient outdoor sample will be collected. A co-located sample will be collected at location IA-7 with one additional sample collected in the GR Silicate side of the building. With the exception of the co-located sample at location IA-7, the three other indoor samples will be biased to areas near decommissioned ducting. Passive indoor badges will be deployed along side each of the indoor and outdoor sampling locations for a 7-day sample duration. The sampling methodologies described above are preliminary. Final proposed sample locations and sampling details will be submitted in the addendum to the approved Vapor Investigation Work Plan as described above.

Post-decommissioning sampling results will be used to assess the necessity for continued mitigation planning at Building 326. Rerouting of the cold air return ducts and securing other potential open conduits may eliminate the need for any additional infrastructure improvements and subsequent active mitigation. If however, the indoor air quality remains unchanged or is still adversely impacted by sub-slab vapors a final mitigation decision for Building 326 will be completed. A preliminary mitigation design for Building 326 is discussed below.

The Building 326 extraction points will each be constructed by excavating a shallow hole outside the building to enable coring a 6-inch diameter hole through the building foundation wall. After determining the location of any underground utilities in the area, the hole will be opened by hand excavation or careful use of a small excavator. Surface soil from this excavation will be stockpiled and used to backfill the hole unless odors are noted, in which case, the soil, concrete cores, or debris generated will be containerized and properly disposed. Once the hole through the foundation wall is cored, the soil/gravel from beneath the concrete slab will be removed to form a void of approximately 1 cubic foot. All removed soil from beneath the floor slab will be containerized and properly disposed. A perforated 3-inch diameter PVC pipe covered in a filter sock will be installed in the "pit" and bedded in clean pea gravel. The perforated pipe and filter sock will prevent dust and debris from being drawn into the system. A 3-inch Schedule 40 PVC pipe will be connected to the 3-inch perforated pipe with a PVC coupler. The annular space between the piping and concrete will be sealed using non-shrink grout. The 3-inch extraction piping will be attached to exterior wall for support. The mitigation fan will be mounted to the exterior wall in line with the extraction piping at a height convenient for servicing as needed. A vacuum gauge that measures in the 0- to 30-in. w.c. range and a 1/4-inch sample port will be installed on the vertical pipe below the mitigation fan. A simple visual inspection of the pressure gauge will show if the fan system is operating. Instructions will be posted on each riser pipe indicating whom to contact if the extraction point is not operating properly.

The vacuum for each soil vapor extraction point at Building 326 will be provided by a Radonaway HS2000 centrifugal in-line fan or equivalent. Each mitigation fan will require connection to a 120-volt minimum 15-amp power source, either on a dedicated circuit (preferred) or plugged into an existing outlet. The four fans could be on a single circuit. All are fractional horsepower (HP) units; therefore, one 20-amp circuit should suffice if two or more fans are on one circuit.

The area disturbed during installation shall be restored to the same or better condition than before work began. Any affected plantings will be replaced or replanted. Concrete or asphalt surfaces are to be cut out with square edges and replaced.

4.3 Building 532

The Building 532 extraction points will be constructed by coring an 8-inch diameter hole in the floor slab and hand excavation of the soil/gravel from beneath the concrete slab to form a "pit" of approximately 1 cubic foot. All removed soil, concrete, or debris will be containerized and properly disposed. A perforated 4-inch diameter PVC pipe covered in a filter sock will be installed in the "pit" and bedded in clean pea gravel. The perforated pipe and filter sock will prevent dust and debris from being drawn into the system. A 2-inch Schedule 40 carbon steel pipe will be connected to the 4-inch perforated pipe with a PVC coupler. The annular space between the piping and concrete will be sealed using non-shrink grout. The 2-inch diameter extraction piping will be attached to the nearest vertical structural support (i.e., column or wall) to a height of approximately 6 ft, and then connected to overhead PVC piping. A vacuum gauge that measures in the 0- to 30-in. w.c. range and a 1/4-inch sample port will be installed on the vertical pipe approximately 5 ft above the floor penetration. A simple visual inspection of the pressure gauge will show if the fan system is operating properly. Instructions will be posted on each riser pipe indicating whom to contact in the case that the extraction point is not operating properly.

All piping to approximately 6 ft above the top of floor is to be carbon steel to protect it from accidental bumps and incidental damage. This piping will be painted safety yellow for visibility.

The piping will transition to PVC for the overhead pipe runs as shown on Building 532 Figure ME-01 in Appendix B. Pipe routing will generally be as shown on Figure ME-01, allowing for minor variations based on actual field conditions to maximize proper installation. Pipe sizes and fittings will be as shown. All pipes will be adequately supported using mechanical supports, beam clamps, and threaded metal rod as needed to maintain installation with no major elevation changes unless approved by engineer. Horizontal piping is to be run with a slight pitch (not more than 1 percent) toward the extraction point. Overhead piping must be installed at an adequate height and alignment so as not to interfere with doors, openings, areas requiring access, or internal building traffic or activities.

The piping will exit the building through the east wall of the building and connect to the blower unit to be installed within a small (approximately 10 ft x 12 ft) portable building in this area. Typically, a wooden shed is used, but can be any type of enclosure (e.g., metal building, cargo box) as approved by the POT.

A pre-packaged blower skid and portable building/enclosure will be specified by engineer. The Contractor is required to provide and install this structure on a suitably-sized concrete pad or solid surface and provide mechanical and electrical connections per specifications. The existing power source and electrical tie-in details need to be evaluated in the field by a licensed electrician to determine whether the blower can be connected into the existing electrical system or if installation of a separate power supply is necessary, as this blower will be much larger than the blowers to be installed at the other buildings (expected to be 10 to 15 HP). An anticipated minimum service requirement of 3-phase 240V/60A or 3-phase 480V/40A is required at the blower location.

4.4 Sub-Slab Vapor Monitoring Point Installation

The locations of the SSVMPs will be selected in a manner that places them at a maximum distance from the soil vapor extraction points or will be biased toward the office spaces in Building 532. Since a maximum distance location is considered a "worst case scenario" with regards to the pressure field extension, concentric rings of SSVMPs closer to the extraction points are not required. However, should it be determined that insufficient vacuum exists at a SSVMP, additional SSVMPs may be necessary to evaluate the deficiency as well as for confirmation that any performed modifications are effective.

The SSVMPs will be installed through the concrete or asphalt floor to below the floor slab. The annular space between the stainless steel or brass pipe and concrete slab will be filled with non-VOC emitting caulk or non-shrink grout. The SSVMPs will be capped to prevent vapor from entering the building as well as preventing the short-circuiting of the SSDS.

Section 5.0 System Start-Up and Installation of Supplemental Depressurization Systems

Installation of the initial extraction points and SSVMPs will be followed by sealing of identified VI pathways and a 1-month start-up monitoring period to confirm the SSDSs are functioning as designed and acceptable pressure field extension results are observed.

5.1 Minimization of VI Pathways

Before system start-up, all potential VI pathways identified during the initial Site walkover and during installation activities (e.g., water and drain pipes, HVAC, utility penetrations, monitoring-well protective casings, floor/wall joints, floor cracks, expansion joints, etc.) will be addressed. Sealing any potential pathways with a flexible, expandable, urethane sealant will prevent short-circuiting of the system and further minimize the potential for VI into the building. Any additional potential VI pathways that are identified over the course of future operations will be inspected and evaluated. Based on this evaluation, a recommended plan of action will be prepared.

5.2 System Start-Up, Operational Testing, and Monitoring

During system installation, start-up, and operations, data will be collected to evaluate the efficiency and effectiveness of each SSDS. Following system construction, system start-up will be completed during a 1-month testing period as follows:

1. Pneumatic-pressure testing will be performed to test the entire above-grade piping and fitting connections for any possible leaks.
2. Current meteorological conditions, including barometric pressure and temperature, will be recorded. In addition, current ambient conditions (e.g., rain, sun, etc.) will be recorded along with whether the barometric pressure is currently rising or falling.
3. A baseline measurement of differential pressures will be made to determine ambient sub-slab pressure conditions with respect to current meteorological and HVAC operating conditions.
4. The system will be started and the vacuum at the extraction point will be recorded. System operation will be observed to ensure proper operation. For buildings with more than one SSDS, the systems will be started sequentially such that proper operation of each fan can be confirmed.
5. At approximately 30 minutes, 1 hour, and 4 hours after start-up, the following parameters will be collected:
    - Measurement of induced vacuum at all SSVMPs and existing probe locations within or near the expected ROI
    - Measurement of flow by pitot tube or hot tip anemometer though the sample port and vacuum at each extraction point
    - Collection of photoionization detector (PID) readings from each extraction point
6. After 1 full day of operation after system start-up, the following parameters will be measured:
    - Measurement of induced vacuum at each SSVMP and appropriate existing probe locations
    - Measurement of flow and vacuum at each extraction point location
    - Collection of PID readings from each extraction point location
    - Collection of PID readings from each discharge pipe
7. To verify the need for emissions treatment, approximately 24 hours following start-up of each of the SSD systems, an air sample of the vapor stream in each discharge pipe will be collected while the system is operating using 1 liter or larger Summa™ canisters. These samples will be analyzed using EPA Method TO-15. Flow rate information and PID measurements from each discharge pipe will also be measured and recorded.
8. Measurement of vacuum at the SSVMPs and appropriate existing probe locations, and flow and vacuum at the extraction points will be repeated periodically every 1 or 2 days for the next week

until adequate pressure field extension (1 Pa) is observed or until readings stabilize. At the same time, PID measurements will be collected from each discharge pipe.

9. If the minimum differential pressure of 1 Pa is not observed at the installed SSVMPs and appropriate existing probe locations, then further testing and system adjustments will be conducted to determine the need for supplemental components to the initial systems. The vacuum influence of each extraction point will be measured individually to determine the area of influence for each extraction point and to ensure that the area of influence for each extraction point overlaps the area of influence for nearby extraction points. If the sub-slab vacuum in an area is found to be less than 1 Pa or overlap does not exist, then additional extraction points and/or mitigation fans will be installed to ensure adequate pressure differential is established and maintained throughout the entire target area. POT approval will be required prior to installation of additional extraction or monitoring points.

10. Steps 8 and 9 will be repeated until acceptable pressure field extension is achieved.

5.3 Emissions

Emissions from each building will be evaluated relative to the substantive requirements presented by Puget Sound Clean Air Agency (PSCAA). According to PSCAA, vapor mitigation systems such as these are exempt from permitting as long as the emissions do not exceed the following loading criteria:

- Greater than 15 pounds per year of benzene or vinyl chloride
- Greater than 500 pounds per year of tetrachloroethene (PCE)
- Greater than 1,000 pounds per year of toxic air contaminants

Initial loading calculations were prepared for each of the three proposed systems. Each building and system is treated as separate operating units. The loading calculations were completed using sub-slab vapor data collected during round one sub-slab sampling in April 2013 and air flow data provided in the design of each system. The conclusions from these calculations suggest the following worst case loading scenarios:

- This Building 532 system is designed to have the highest flow rate (800 CFM). A review of the sub-slab data reveals the highest concentrations are 24 micrograms per cubic metre (µg/m^3) for 1,1,1-TCA, 27 µg/m^3 for PCE, and 27 µg/m^3 for TCE. Initial calculations show emission levels for Building 532 of less than 1 pound per year for each of the above parameters. This discharge scenario meets the PSCAA exemption criteria.
- Emissions from Building 326 are projected to be less than those estimated from Building 532 as both system flows and measured sub-slab contaminant concentrations are lower. This discharge scenario meets the PSCAA exemption criteria.

- OCC Office Building has the highest potential discharge rates of the three proposed systems. Considering the proposed air flows and the measured contaminant concentrations, the resulting projected loading for TCE and PCE is 24 and 40 pounds per year, respectively. These loading rates are both under the exemption criteria listed above for these compounds.

Initial projection calculations show the proposed systems meet the exemption criteria as detailed by PSCAA. Post-construction monitoring data collected per Item 7 of Section 5.2 will be used to facilitate verification of the initial evaluation.

Emissions treatment (vapor-phase carbon in drums or vessels) will be employed as needed. For Building 532 (single discharge from blower building), carbon vessels would be situated either within or adjacent to the blower building. For Building 326 (four discharges) and the OCC Office Building (one discharge), carbon drums would be installed individually for each discharge, as needed.

5.4 Condensate

Sloping of the extraction piping back toward the extraction pits is standard precautionary practice to discourage any condensation that does occur from getting drawn into the blower fans.

The system in the OCC Office Building will be mostly enclosed within the indoor environment and the building is heated; therefore, cooling of the sub-slab air as it passes through the piping should not occur, resulting in minimal condensate formation.

The outdoor piping on Building 326 has the potential to generate condensate; however, these piping routes are vertical and fairly short (15 ft) so any withdrawn air should exit the piping before the air cools and a significant amount of condensate can form.

The blower system at Building 532 will be designed to incorporate a lower velocity condensate vessel or "knock-out pot" as part of the blower skid. The knock out pot will create a lower velocity area to permit moisture to condense out of the air stream before entering the blower fan. The piping system is designed to move a relatively high volume of air and much of the piping is within an enclosed environment, thereby minimizing the amount of cooling of the withdrawn air that will occur within the pipes.

For each of the systems, the amount of condensate that could find its way back to the extraction pit should be insufficient to adversely affect the extraction pit's performance; however, if condensate does become a problem at any extraction pit, then condensate traps will be installed as needed.

Section 6.0 Operation, Maintenance, and Monitoring Plan

Following installation and successful start-up of the mitigation systems, the effectiveness of the installations will be confirmed through two semiannual monitoring events that will include, for each mitigated building, sampling of the indoor air and outdoor air, sampling of the air discharged by the mitigation system, and an inventory of the chemicals used in the building. The two semiannual confirmational monitoring events will be scheduled to characterize conditions during both the heating and non-heating seasons. Upon completion of the start-up period and receipt of results of the first semiannual monitoring event, sample results and an OM&M Plan including as-built drawings, equipment operating instructions, sampling frequencies, parameters, and methods, inspection procedures and checklists, and reporting requirements will be prepared that outlines the required activities that will be necessary to operate the system on a long-term basis. Results of the second confirmational monitoring event will be submitted approximately 6 months later.

The systems will be operated by OCC and will include alarms that will activate if the blowers are not operating. The alarms on each of the three systems will likely be an audible and lighted alarm local to the specific blower unit. System verification inspections will be conducted by the OCC operators every 2 weeks for the first 6 months of operations. The inspection schedule will be revised after 6 months of operation. The tenants will be provided a contingency plan with notification numbers for all appropriate OCC operators and staff deemed appropriate by POT officials.

If confirmational monitoring shows that indoor air concentrations exceed applicable criteria, then a reassessment of the system will be undertaken in consideration of the inventory of chemicals used in the building, to determine the need for additional mitigation.

Periodic monitoring will be necessary for as long as the mitigation systems are in operation. Long-term monitoring is typically done quarterly for a year, then less frequently (usually annually) for the duration of operation of the mitigation systems. During these visits, the following activities will be performed:

- Vacuum and flow at each of the extraction points will be measured.
- PID measurements and colorimetric tube analysis of vapor at the extraction points will be collected.
- Maintenance of system components, especially confirming proper operation of the fan system, and any needed repairs will be performed. Repairs or replacement of malfunctioning system components and response to any low vacuum conditions will be conducted immediately upon identification of these conditions.

Section 7.0 Reporting

Following completion system installation, start-up activities, and the first round of confirmational monitoring, the results of the monitoring and OM&M Plan, including as-built drawings, equipment operating instructions, sampling frequencies, parameters, and methods, inspection procedures and checklists, and reporting requirements will be submitted to the Agency, with copies to the POT.

Approximately 4 to 5 months after completion of the first round of confirmational monitoring, the second round of confirmational monitoring will be performed and the results will be submitted to the Agency, with copies to the POT.

An annual report of system operation will be submitted to the Agency, with copies to the POT. A fact sheet or letter describing the results will be prepared following each sampling event to inform building tenants of the results. The first and second confirmation monitoring events and annual monitoring reports will include the collected TO-15 data, PID readings, and annual discharge estimations.

Section 8.0 Schedule

The estimated schedule for the major tasks is shown below. The actual schedule will be subject to finalization of an access agreement between OCC and the POT, POT final approval of the designs, and the need for air permitting, and outcome of the Building 326 HVAC investigation, decommissioning, and commissioning.

Task	***Estimated Schedule***
Building 326 HVAC investigation, decommissioning, and commissioning	July 2014
Contractor Procurement and VM System Installation	July-September 2014
Start-up Monitoring	September-October 2014
First Confirmational Monitoring Event	October-November 2014
Submittal of Results of First Confirmational Monitoring Event and OM&M Plan	December 2014
Second Confirmational Monitoring Event	March 2015
Submittal of Results of Second Confirmational Monitoring Event	April 2015

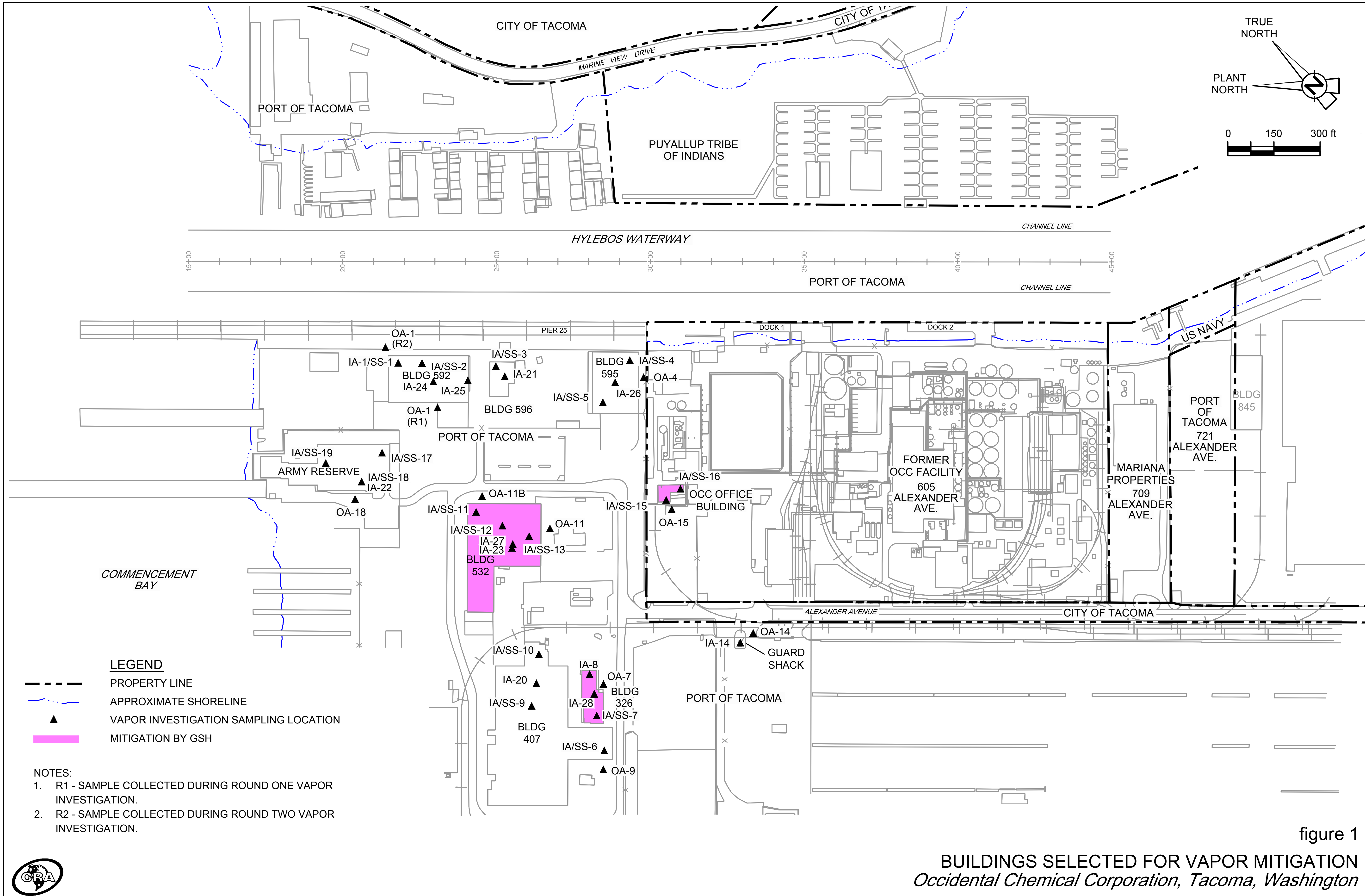


figure 1

BUILDINGS SELECTED FOR VAPOR MITIGATION

Occidental Chemical Corporation, Tacoma, Washington

07843-M9(120)GN-WA002 FEB 12/2014

Appendix A

Pipe Friction Loss Estimation

APPENDIX A

OCCIDENTAL CHEMICAL CORPORATION
PORT OF TACOMA VAPOR MITIGATION SYSTEM
PIPE FRICTION LOSS ESTIMATION

Building 532

Leg	*Pipe Size (inches)*	*Max. Flow (SCFM)*		*Friction Loss (in. wc/ft)* [1]	*Friction Loss (in. Hg/100 ft)* [2]	*Pipe Length (ft)*	*Total Friction Loss (in. wc)*	*(in. Hg)*
1	2"	50		0.0475	0.25	15	0.7125	1.6667
	4"	50	<	0.014	0.01	75	1.05	0.0133
	4"	100		0.014	0.03	65	0.91	0.0462
	4"	150		0.014	0.06	75	1.05	0.0800
	6"	200	<	0.014	0.005	75	1.05	0.0067
	6"	250	<	0.014	0.022	110	1.54	0.0200
1 each	6" (elbow)	250	<	0.014	0.022	15	0.21	0.1467
	8"	800		0.014	0.048	30	0.42	0.1600
2 each	8" (elbow)	800		0.014	0.048	40	0.56	0.1200
						TOTAL:	7.5025	2.2595
2	2"	50		0.0475	0.25	15	0.7125	1.6667
	4"	50	<	0.014	0.01	80	1.12	0.0125
	4"	100		0.014	0.03	70	0.98	0.0429
	6"	250	<	0.014	0.022	63	0.882	0.0349
	6"	400		0.014	0.052	67	0.938	0.0776
	6"	550		0.0245	0.1	30	0.735	0.3333
	8"	800		0.014	0.048	30	0.42	0.1600
2 each	8" (elbow)	800		0.014	0.048	20	0.28	0.2400
							6.0675	2.5679
Leg 3, 4, 5	2"	50		0.0475	0.25	15	0.7125	1.6667
(Each Leg)	4"	50	<	0.014	0.01	75	1.05	0.0133
	4"	100		0.014	0.03	65	0.91	0.0462
							2.6725	1.7262

Building 326

1	3"	50	<	0.014	0.032	15	0.21	0.2133
4 each	3" elbows	50	<	0.014	0.032	20	0.28	0.1600
							0.49	0.3733

OCC Office

1	3"	50	<	0.014	0.032	35	0.49	0.0914
4 each	3" elbows	50	<	0.014	0.032	20	0.28	0.1600
							0.77	0.2514

Notes:

[1] Source: EG&G Rotron

[2] Source: Spencer Turbine Company

Appendix B

Design Specification Drawings

DRAWING INDEX

DWG. Nº	REV. No.	DATE	TITLE
ENGINEERING FLOW SHEETS			
EF-00	-	10/12	ENGINEERING FLOW DIAGRAM - LEGEND
EF-01	-	10/12	ENGINEERING FLOW SHEET - SERVICE BUILDING
MECHANICAL/PIPING			
ME-01	-	10/12	PIPING PLAN AND DETAILS - OCC OFFICE BUILDING
ME-02	-	10/12	RADIUS OF INFLUENCE - OCC OFFICE BUILDING

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

SUB-SLAB DEPRESSURIZATION SYSTEM

OCC OFFICE BUILDING
DRAFT REVIEW

APRIL 21, 2014
07843-M9(120)

CRA CONESTOGA-ROVERS & ASSOCIATES

PROCESS / INSTRUMENT LINES

- MAIN PROCESS LINE
- SECONDARY PROCESS LINE
- UNDEFINED SIGNAL
- PNEUMATIC SIGNAL
- ELECTRICAL SIGNAL
- CAPILLARY TUBE, FILLED SYSTEM
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (NOT GUIDED)
- INTERNAL SYSTEM LINK
- HYDRAULIC SIGNAL
- MECHANICAL LINK
- ELECTRICAL BINARY SIGNAL
- TO / FROM SHEET No. — OFF PAGE CONNECTOR
- UTILITY — UTILITY IN/OUT
- 2 — HARDWIRED INTERLOCK LOGIC (-1,2,3...IS OPTIONAL REFERENCE TO INTERLOCK DETAIL DESCRIPTION)

VALVE SYMBOLS

- BA- * BALL VALVE
- BU- * BUTTERFLY VALVE
- CH- * CHECK VALVE
- GA- * GATE VALVE
- GL- * GLOBE VALVE
- THREE WAY VALVE (FAIL OPEN TO PATH A-C)
- FOUR WAY VALVE (FAIL OPEN TO PATH A-C AND B-D)
- DAMPER OR LOUVER

GENERAL INSTRUMENT SYMBOLS

- LOCALLY MOUNTED INSTRUMENTS
- PRIMARY PANEL MOUNTED INSTRUMENTS
- IPx — AUXILARY PANEL MOUNTED INSTRUMENTS WHERE x = PANEL No. WHEN MORE THAN ONE PANEL IS PRESENT
- BEHIND BOARD MOUNTED INSTRUMENTS
- INSTRUMENTS SHARING COMMON HOUSING
- IN LINE INSTRUMENTS AS INDENTIFIED
- XY — SIGNAL CONVERTER (INPUT/OUTPUT)
  - * E - VOLTAGE, I - CURRENT, P - PNEUMATIC, B - BINARY (MODBUS, R5232...)
- COLOR — PILOT LIGHT
  - A = AMBER, G = GREEN, W = WHITE, B = BLUE, R = RED, Y = YELLOW, C = CLEAR

DISTRIBUTED CONTROL / SHARED DISPLAY INSTRUMENTS

- INDICATOR/CONTROLLER/RECORDER OR ALARM POINTS - USUALLY USED TO INDICATE VIDEO DISPLAY (DCS OR HMI CONFIGURATIONS) * NORMALLY ACCESSIBLE TO OPERATOR
- NORMALLY BLIND OPERATION * NOT NORMALLY ACCESSIBLE TO OPERATOR
- DISTRIBUTED CONTROL INTERCONNECTING LOGIC CONTROLLER OR PLC WITH BINARY OR SEQUENTIAL LOGIC FUNCTIONS. * NORMALLY ACCESSIBLE TO OPERATOR
- NORMALLY BLIND OPERATION * NOT NORMALLY ACCESSIBLE TO OPERATOR

- 1 PLCx — INTERLOCK LOGIC IN CONTROLLER OR PLC WHERE: - 1,2,3.....IS OPTIONAL REFERENCE TO INTERLOCK DETAIL DESCRIPTION - x = PLC No. WHEN MORE THAN ONE PLC IS PRESENT IN THE SYSTEM

MISCELLANEOUS SYMBOLS

- REDUCER
- FLEXIBLE PIPE
- EXPANSION JOINT
- BLIND FLANGE
- HOSE CONNECTION
- SCREWED CAP, CLEANOUT
- Y-LINE STRAINER
- SPECIFICATION CHANGE
- FUNNEL DRAIN
- STATIC MIXER
- FILTER/REGULATOR/LUBRICATOR
- ANNUNCIATOR HORN
- FILTER/REGULATOR
- X" — EQUIPMENT INSULATED WITH X" OF INSULATION
- R — RESET FOR LATCH-TYPE ACTUATOR
- VENT — OPEN VENT TO ATMOSPHERE
- INLINE BLANK
- RESTRICTION ORIFICE
- AIR EJECTOR
- T — TRAP
- PULSATION DAMPER
- BB — BLOCK & BLEED ASSEMBLY
- TP 1 — TIE POINT TO EXISTING SYSTEM
- DRAIN (FLOOR, SEWER, ETC.)
- FLOW STRAIGHTENING VANE
- SP 4 — SPECIALITY PART
- AV — AIR VENT, AUTOMATIC
- SLUICE GATES

SELF-ACTUATED REGULATORS, VALVES, AND OTHER DEVICES

- RUPTURE DISC FOR PRESSURE RELIEF
- RUPTURE DISC FOR VACUUM RELIEF
- PRESSURE RELIEF VALVE
- VACUUM RELIEF VALVE
- PRESSURE REDUCING REGULATOR (SELF CONTAINED)
- BACKPRESSURE REGULATOR (SELF CONTAINED)
- LEVEL REGULATOR WITH MECHANICAL LINKAGE

- V P — CONSERVATION VENT
- XF — FLAME ARRESTOR

PRIMARY ELEMENT SYMBOLS

- FI — VARIABLE AREA FLOWMETER
- PI — DIAPHRAM SEAL WITH PRESSURE LEAD LINE
- PI — DIAPHRAM SEAL (LINE-MOUNTED)
- TE RTD — TEMPERATURE ELEMENT WITH THERMOWELL (OPTIONAL ELEMENT DESCRIPTION RTD, TYPE K...)
- FG — FLOW SIGHT GLASS (LG - LEVEL SIGHT GLASS, SG - GENERAL SIGHT GLASS)
- LEVEL DEVICE, FLOAT TYPE

ACTUATOR SYMBOLS

- DIAPHRAM ACTUATOR
- CYLINDER ACTUATOR
- M — ROTARY MOTOR ACTUATOR
- S — SOLENOID ACTUATOR
- HAND ACTUATOR OR HANDWHEEL
- D — AIR ACTUATED VALVE W/POSITIONER OPTIONAL:
  - D - DIRECT ACTING POSITIONER
  - R - REVERSE ACTING POSITIONER
- FC — VALVE FAIL SYMBOLS
  - FO - FAIL OPEN
  - FC - FAIL CLOSED
  - FL - FAIL LOCKED (LAST POSITION)
  - FI - FAIL INDETERMINATE
- ZSL — LIMIT SWITCH ACTIVATED WHEN VALVE CLOSED (ZSH ACTIVATED WHEN VALVE OPEN)

ABBREVIATIONS:

POWER SUPPLY OR PURGE FLUID TYPES

- AS - AIR SUPPLY
  - IA - INSTRUMENT AIR
  - PA - PLANT AIR
- ES - ELECTRICAL SUPPLY
- GS - GAS SUPPLY
- HS - HYDRAULIC SUPPLY
- NS - NITROGEN SUPPLY
- SS - STEAM SUPPLY
- WS - WATER SUPPLY

THE SUPPLY LEVEL MAY BE ADDED TO THE INSTRUMENT SUPPLY LINE, E.G., AG-100, A 100-PSI AIR SUPPLY; ES-24DC, A 24-VOLT DIRECT CURRENT POWER SUPPLY.

INSTRUMENTS:

- HOA - HAND/OFF/AUTO
- LOR - LOCAL/OFF/REMOTE
- OPN - OPEN
- CLS - CLOSE
- SP - SETPOINT
- NC - NORMALLY CLOSED
- NO - NORMALLY OPEN

INSTRUMENT / PROCESS LINES DESIGNATIONS

000	UNDERGROUND INSTRUMENTS
100	PROCESS INSTRUMENTS
200	VENDOR SUPPLIED INSTRUMENTS
300	UTILITY INSTRUMENTS
0000	UNDERGROUND LINES
1000	PROCESS LINES
2000	VENDOR SUPPLIED LINES
3000	UTILITY LINES
CS	CARBON STEEL PIPE
CSVD	CARBON STEEL VENT DUCT (12 GAUGE)
DVW	DRAIN VENT WASTE PIPE
HDPE	HIGH DENSITY POLYETHYLENE PIPE
KYA	KYNAR
PDE	CPVC, SOLID
PVC	POLYVINYL CHLORIDE PIPE SCHEDULE 40
PVE	POLYVINYL CHLORIDE PIPE SCHEDULE 80
PPL	POLYPROPYLENE LINED/LINED DUCTILE PIPE
SS	STAINLESS STEEL
TFD	TEFLON
B	BARE
I	INSULATED
J	JACKETED AND INSULATED
TE	ELECTRICALLY TRACED AND INSULATED

TYPICAL ISA LETTER COMBINATIONS

First-Letters	Initiating or Measured Variable	Controllers Recording	Controllers Indicating	Controllers Blind	Self-Actuated Control Valves	Readout Devices Recording	Readout Devices Indicating	Switches and Alarm Devices * High **	Switches and Alarm Devices * Low	Switches and Alarm Devices * Comb	Transmitters Recording	Transmitters Indicating	Transmitters Blind	Solenoids, Relays, Computing Devices	Primary Element	Test Point	Well or Probe	Viewing Device, Glass	Safety Device	Final Element
A	Analysis	ARC	AIC	AC		AR	AI	ASH	ASL	ASHL	ART	AIT	AT	AY	AE	AP	AW			AV
B	Burner/Combustion	BRC	BIC	BC		BR	BI	BSH	BSL	BSHL	BRT	BIT	BT	BY	BE		BW	BG		BZ
C	User's Choice																			
D	User's Choice																			
E	Voltage	ERC	EIC	EC		ER	EI	ESH	ESL	ESHL	ERT	EIT	ET	EY	EE					EZ
F	Flow Rate	FRC	FIC	FC	FCV, FICV	FR	FI	FSH	FSL	FSHL	FRT	FIT	FT	FY	FE	FP		FG		FV
FQ	Flow Quantity	FQRC	FQIC			FQR	FQI	FQSH	FQSL			FQIT	FQT	FQY	FQE					FQV
FF	Flow Ratio	FFRC	FFIC	FFC		FFR	FFI	FFSH	FFSL						FE					FFV
G	User's Choice																			
H	Hand		HIC	HC						HS										HV
I	Current	IRC	IIC			IR	II	ISH	ISL	ISHL	IRT	IIT	IT	IY	IE					IZ
J	Power	JRC	JIC			JR	JI	JSH	JSL	JSHL	JRT	JIT	JT	JY	JE					JV
K	Time	KRC	KIC	KC	KCV	KR	KI	KSH	KSL	KSHL	KRT	KIT	KT	KY	KE					KV
L	Level	LRC	LIC	LC	LCV	LR	LI	LSH	LSL	LSHL	LRT	LIT	LT	LY	LE		LW	LG		LV
M	User's Choice																			
N	User's Choice																			
O	User's Choice																			
P	Pressure/Vacuum	PRC	PIC	PC	PCV	PR	PI	PSH	PSL	PSHL	PRT	PIT	PT	PY	PE	PP			PSV, PSE	PV
PD	Pressure, Differential	PDRC	PDIC	PDC	PDCV	PDR	PDI	PDSH	PDSL		PDRT	PDIT	PDT	PDY	PE	PP				PDV
Q	Quantity	QRC	QIC			QR	QI	QSH	QSL	QSHL	QRT	QIT	QT	QY	QE					QZ
R	Radiation	RRC	RIC	RC		RR	RI	RSH	RSL	RSHL	RRT	RIT	RT	RY	RE		RW			RZ
S	Speed/Frequency	SRC	SIC	SC	SCV	SR	SI	SSH	SSL	SSHL	SRT	SIT	ST	SY	SE					SV
T	Temperature	TRC	TIC	TC	TCV	TR	TI	TSH	TSL	TSHL	TRT	TIT	TT	TY	TE	TP	TW		TSE	TV
TD	Temperature, Differential	TDRC	TDIC	TDC	TDCV	TDR	TDI	TDSH	TDSL		TDRT	TDIT	TDT	TDY	TE	TP	TW			TDV
U	Multivariable					UR	UI							UY						UV
V	Vibration/Machinery Analysis					VR	VI	VSH	VSL	VSHL	VRT	VIT	VT	VY	VE					VZ
W	Weight/Force	WRC	WIC	WC	WCV	WR	WI	WSH	WSL	WSHL	WRT	WIT	WT	WY	WE					WZ
WD	Weight/Force, Differential	WDRC	WDIC	WDC	WDCV	WDR	WDI	WDSH	WDSL		WDRT	WDIT	WDT	WDY	WE					WDZ
X	Unclassified																			
Y	Event/State/Presence		YIC	YC		YR	YI	YSH	YSL				YT	YY	YE					YZ
Z	Position/Dimension	ZRC	ZIC	ZC	ZCV	ZR	ZI	ZSH	ZSL	ZSHL	ZRT	ZIT	ZT	ZY	ZE					ZV
ZD	Gauging/Deviation	ZDRC	ZDIC	ZDC	ZDCV	ZDR	ZDI	ZDSH	ZDSL		ZDRT	ZDIT	ZDT	ZDY	ZDE					ZDV

Note: This table is not all-inclusive.
* A, alarm, the annunciating device, may be used in the same fashion as S, switch, the actuating device.

** The letters H and L may be omitted in the undefined case.

Other Possible Combinations:

FO	(Restriction Orifice)	LLH	(Level Light High)	KQI	(Running Time Indicator)	HMS	(Hand Momentary Switch)
FRK, HIK	(Control Stations)	LCH	(Level Control High)			LCL	(Level Control Low)

IDENTIFICATION LETTERS

	FIRST-LETTER: MEASURED OR INITIATING VARIABLE	FIRST-LETTER: MODIFIER	SUCCEEDING-LETTERS: READOUT OR PASSIVE FUNCTION	SUCCEEDING-LETTERS: OUTPUT FUNCTION	SUCCEEDING-LETTERS: MODIFIER
A	Analysis		Alarm		
B	Burner/Combustion		User's Choice	User's Choice	User's Choice
C	User's Choice			Control	
D	User's Choice	Differential			
E	Voltage		Sensor (Primary Element)		
F	Flow Rate	Ratio (Fraction)			
G	User's Choice		Glass, Viewing Device		
H	Hand				High
I	Current (Electrical)		Indicate		
J	Power	Scan			
K	Time, Time Schedule	Time Rate of Change		Control Station	
L	Level		Light		Low
M	User's Choice	Momentary			Middle, Intermediate
N	User's Choice		User's Choice	User's Choice	User's Choice
O	User's Choice		Orifice, Restriction		
P	Pressure, Vacuum		Point (Test) Connection		
Q	Quantity	Integrate, Totalize			
R	Radiation		Record		
S	Speed, Frequency	Safety		Switch	
T	Temperature			Transmit	
U	Multivariable		Multifunction	Multifunction	Multifunction
V	Vibration, Machinery Analysis			Valve, Damper, Louver	
W	Weight, Force		Well		
X	Unclassified	X Axis	Unclassified	Unclassified	Unclassified
Y	Event, State, or Presence	Y Axis		Relay, Compute, Convert	
Z	Position, Dimension	Z Axis		Driver, Actuator, Unclassified Final Control Element	

DRAFT FOR REVIEW

SCALE VERIFICATION: THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

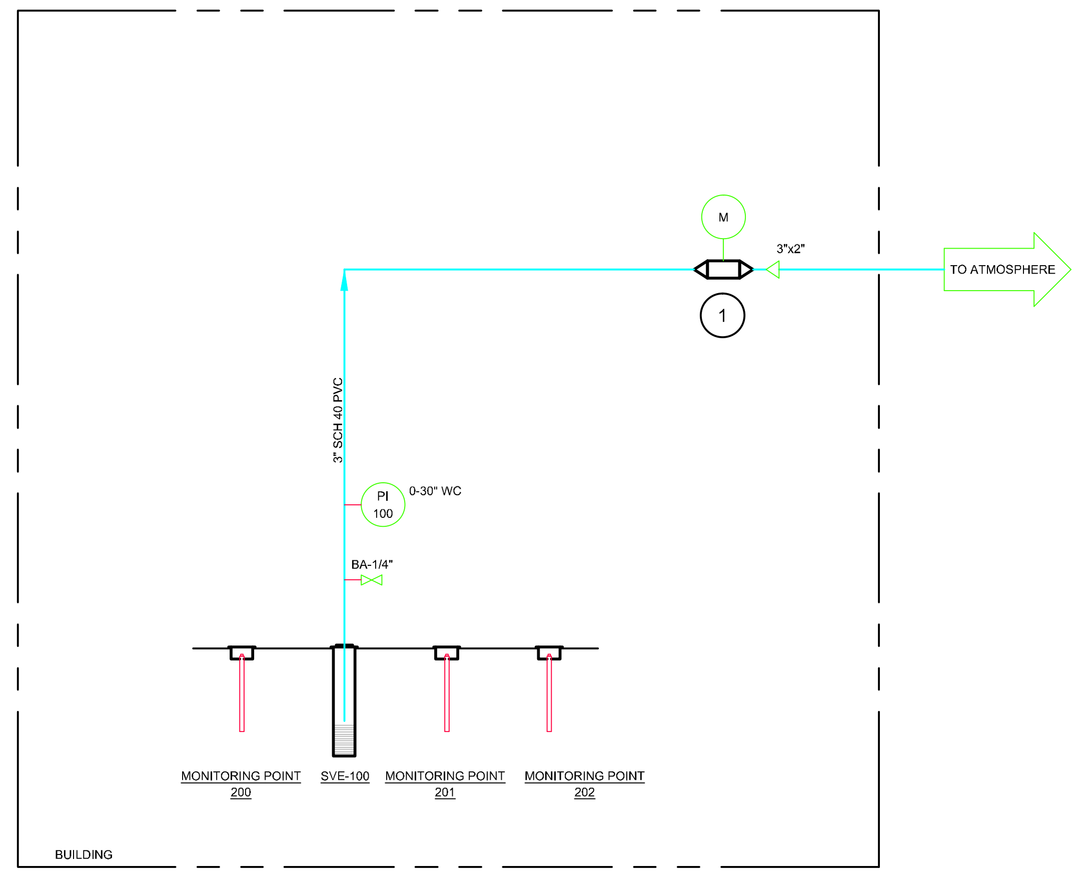
SUB-SLAB DEPRESSURIZATION SYSTEM

ENGINEERING FLOW DIAGRAM
LEGEND

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: OCTOBER 2012
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: NONE	Project No: 07843-M9	Report No: 120	Drawing No: EF-00

07843-M9(120)EF-BU002 APR 21/2014



PLANT ID.	1	2	3	4	5	6	7	8	9	10	11	12
NAME												
DESCRIPTION – MATERIAL	-											
SIZE	15"Wx13"Hx8"D											
CAPACITY	40 CFM@ 15" W.C.											
TEMP/PRESS	-											
HP/V/RPM	120V(270W)											
WEIGHT	18 LBS											
MANUFACTURE	RADONAWAY											
MODEL	HS-2000E											
VENDOR	-											
	-											
	-											

No	Revision	Date	Initial

DRAFT FOR REVIEW

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

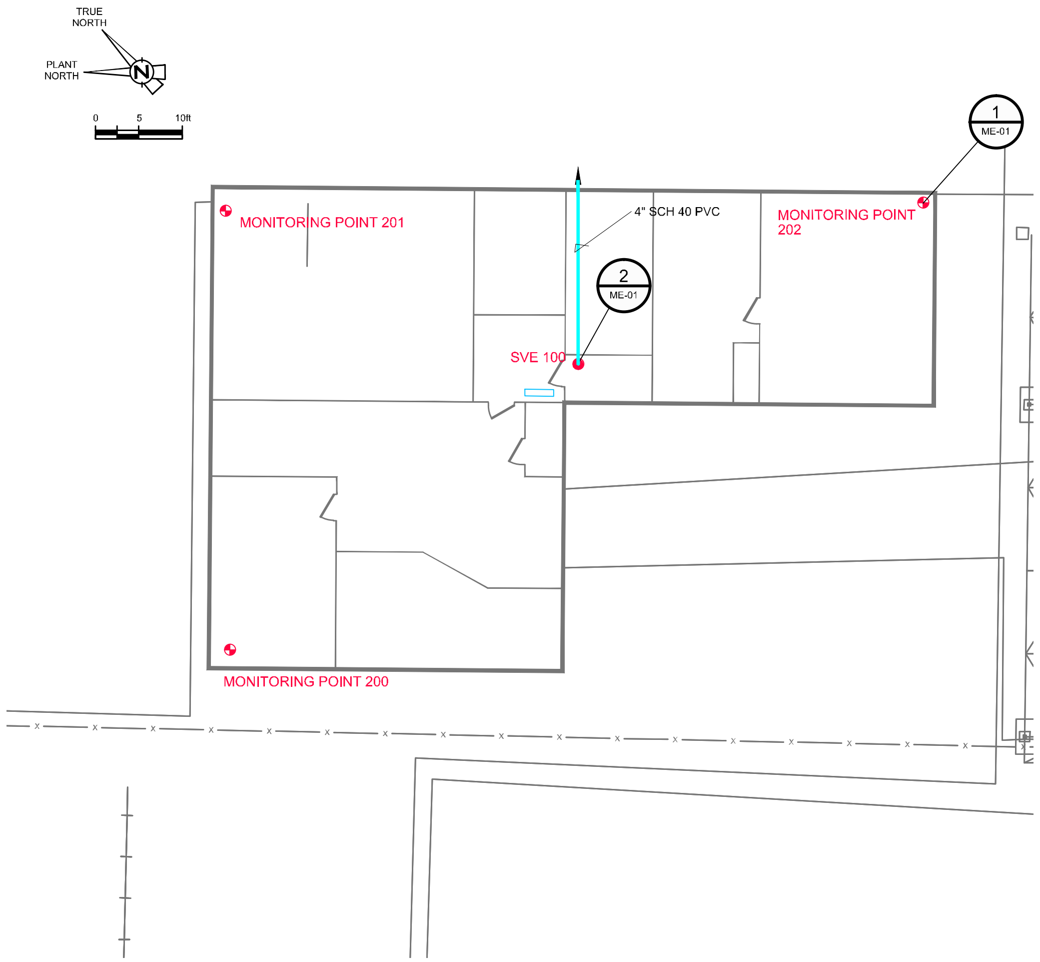
SUB-SLAB DEPRESSURIZATION SYSTEM

ENGINEERING FLOW SHEET
OCC OFFICE BUILDING

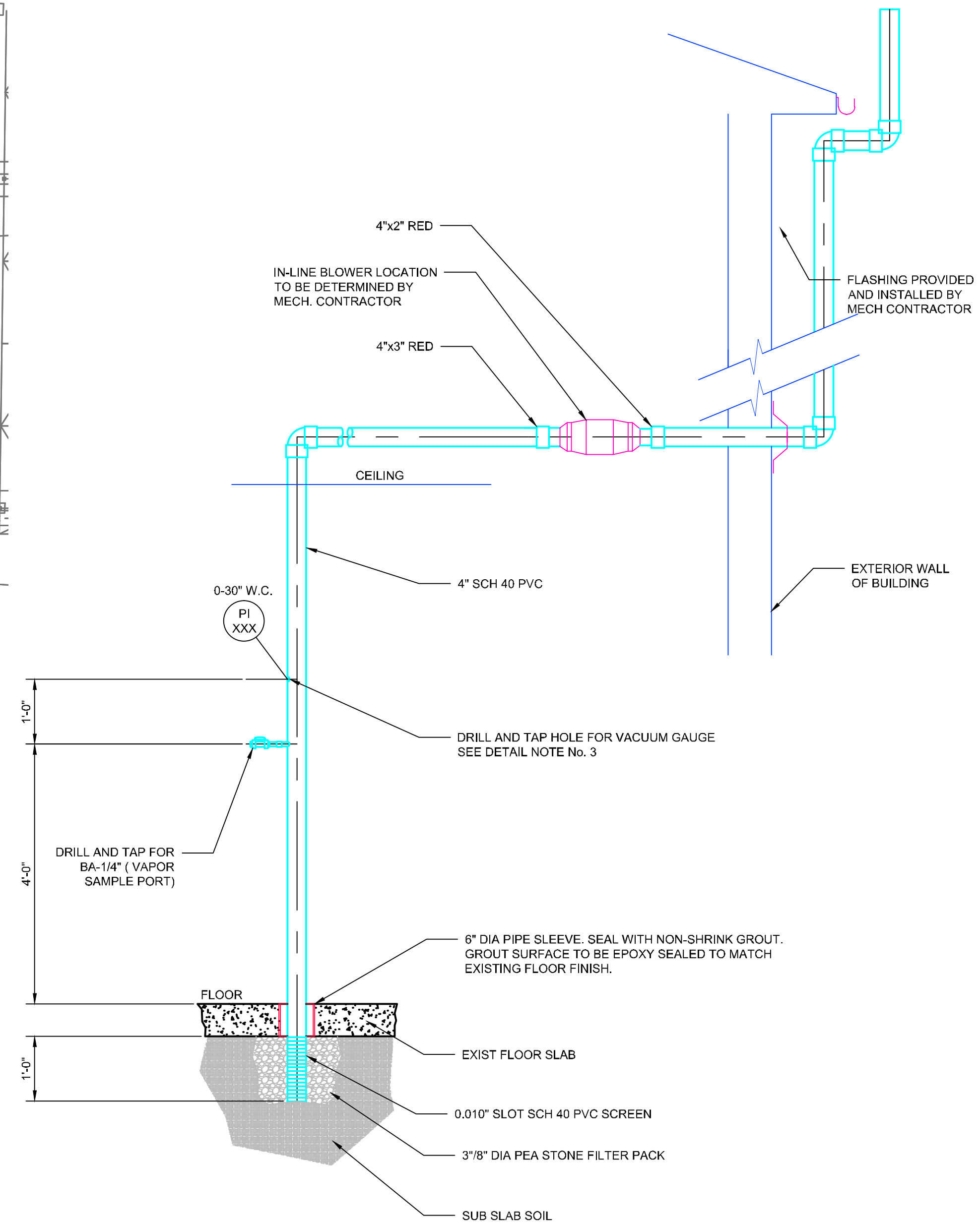
CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: OCTOBER 2012
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: NONE	Project No: 07843-M9	Report No: 120	Drawing No: EF-01

07843-M9(120)EF-BU002 APR 21/2014



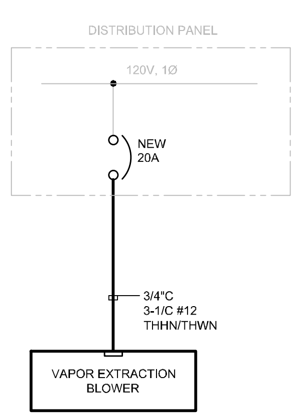
OCC OFFICE BUILDING PIPING PLAN VIEW



TYPICAL SVE PIPING DETAIL (2 / ME-01)

3/4" = 1'-0"

DETAIL NOTES
1. SUPPORT AS REQUIRED
2. ALL HORIZONTAL PIPE RUNS TO BE SLOPED BACK TO SLAB PENETRATION
3. VACUUM GAUGE WIKA 30" H2O, PART No. 9851852, TYPE 611.10 2.5"



SINGLE LINE DIAGRAM

GENERAL NOTES:

1. SCOPE OF WORK:
CONTRACTOR SHALL COMPLETE A TURN-KEY ELECTRICAL INSTALLATION TO PROVIDE A 1-PHASE, 120V, 20A RATED POWER SERVICE TO THE VAPOR EXTRACTION BLOWER. THIS TASK SHALL INCLUDE CONNECTION TO A 1-PHASE, 120V DISTRIBUTION PANEL AND INTERCONNECTING WIRING.

2. INSPECTION AND VERIFICATION:
IMMEDIATELY AFTER THE INSTALLATION CONTRACT IS SIGNED, CONTRACTOR SHALL INSPECT THE EXISTING FACILITY TO VERIFY AND CONFIRM THAT THE EXISTING LIGHTING DISTRIBUTION PANEL (AMPERAGE CAPACITY AND VOLTAGE) ARE ADEQUATE FOR THE SPECIFIED TASK. THIS WORK SHALL BE IN CLOSE COMMUNICATION WITH OWNER AND ENGINEER.

3. REGULATORY REQUIREMENTS:
THE ENTIRE INSTALLATION SHALL COMPLY WITH THE REQUIREMENT OF THE LATEST REVISION OF THE APPLICABLE CODES, STANDARDS, GUIDES, AND PRACTICES PERTAINING TO THE JOB SITE, ALL INSTALLATION COMPONENTS SHALL CARRY APPROVAL LABEL WHERE REQUIRED BY LAW. AT A MINIMUM, CONTRACTOR'S WORK SHALL COMPLY WITH THE REQUIREMENTS OF ANSI/NFPA 70 - NATIONAL ELECTRICAL CODE (NEC); ANSI/IEEE C2 - NATIONAL ELECTRICAL SAFETY CODE(NESC); OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) REQUIREMENTS APPLICABLE TO THE PROJECT WORK; AND LOCAL AUTHORITY HAVING JURISDICTION AT THE PROJECT SITE.

4. MATERIAL REQUIREMENTS:
ALL MATERIALS SHALL BE UL- APPROVED, FOR INDUSTRIAL APPLICATION, AS SHOWN ON THE DRAWINGS, AS SPECIFIED HEREIN, AND AS REQUIRED TO SUCCESSFULLY COMPLETE THE PROJECT.
ALL WIRE AND CABLE SHALL BE NEC/UL TYPE FOR INSTALLATION IN RMC, 600V, SINGLE-CONDUCTOR STRANDED COPPER, THHN/THWN, SIZES AS SHOWN ON THE DRAWING AND AS REQUIRED BY NEC. THE GROUND WIRE SHALL BE PROVIDED WITH "GREEN" OUTER JACKET.
ALL WIRING CONDUIT AND FITTINGS SHALL BE NEC RMC TYPE RIGID GALVANIZED STEEL, SIZES AS SHOWN ON THE DRAWINGS AND AS REQUIRED BY NEC.

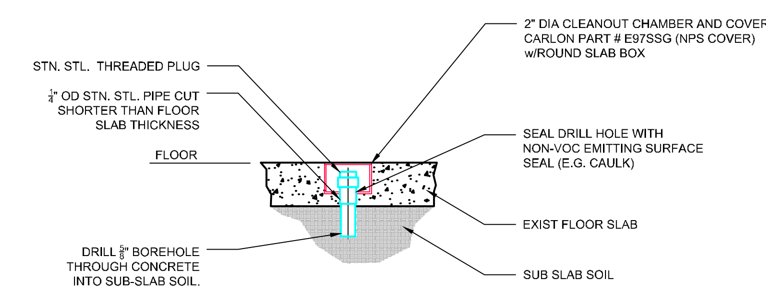
5. INSTALLATION REQUIREMENTS:
CONTRACTOR SHALL COMPLETE INSTALLATION AS SHOWN ON THE DRAWINGS, IN ACCORDANCE WITH NEC, NESC, OSHA AND AS REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION.
COMPLETE INSTALLATION OF THE VAPOR EXTRACTION BLOWER, INTERCONNECTING WIRING AS SPECIFIED.
IF REQUIRED, OBTAIN INSTALLATION FINAL INSPECTION AND APPROVAL BY THE LOCAL AUTHORITY HAVING JURISDICTION.
ON COMPLETION BUT PRIOR TO THE EQUIPMENT ENERGIZATION, CARRY OUT THE INSTALLATION INSPECTION WITH THE PROJECT ENGINEER TO HIS SATISFACTION. DEMONSTRATE TO ENGINEER THAT THE INSTALLATION HAS BEEN SUCCESSFULLY COMPLETED AS SHOWN AND SPECIFIED.
PROVIDE EQUIPMENT ENERGIZATION.
ALL EXISTING CONDITIONS SHALL BE RESTORED AT EACH SYSTEM LOCATION. FLOORING, PAINT, DRYWALL, CEILING TILE, ETC TO MATCH EXISTING WHERE APPLICABLE.
IT IS THE CONTRACTORS RESPONSIBILITY TO MINIMIZE CONSTRUCTION DISTURBANCES AND MAINTAIN WORK AREAS.
ALL EXTRACTION PIPING IS TO BE INSTALLED AS CLOSE AS POSSIBLE TO BUILDING WALLS, COLUMNS, OR SUPPORT BEAMS, AND IN NO CASE MORE THAN 3 FEET FROM THE WALL TO THE CENTER OF PIPE UNLESS APPROVED BY THE ENGINEER.
PROTECTIVE BARRIERS AROUND EXTRACTION PIPING MAY BE REQUIRED BASED ON ACTUAL EXTRACTION POINT LOCATION. CONTRACTOR WILL BE DIRECTED ON THIS NEED BY ENGINEER ON A CASE BY CASE BASIS.

6. TO AVOID ENTRY OF EXTRACTED SUBSURFACE VAPORS INTO THE BUILDING, THE VENT PIPE'S EXHAUST SHOULD BE:
   a. ABOVE THE EAVE OF THE ROOF (PREFERABLY, ABOVE THE HIGHEST EAVE OF THE BUILDING AT LEAST 12 INCHES ABOVE THE SURFACE OF THE ROOF).
   b. AT LEAST 10 FEET ABOVE GROUND LEVEL.
   c. AT LEAST 10 FEET AWAY FROM ANY OPENING THAT IS LESS THAN 2 FEET BELOW THE EXHAUST POINT, AND
   d. 10 FEET FROM ANY ADJOINING OR ADJACENT BUILDINGS, OR HVAC INTAKES OR SUPPLY REGISTERS.
GREATER DISTANCES FROM BUILDING OPENINGS WILL BE CONSIDERED WHERE PRACTICAL.

7. RAIN CAPS, IF USED, SHOULD BE INSTALLED SO AS NOT TO INCREASE THE POTENTIAL FOR EXTRACTED SUBSURFACE VAPORS TO ENTER THE BUILDING.

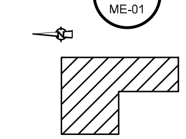
8. SUBMITTAL REQUIREMENTS:
SUBMITTALS FOR ALL EQUIPMENT AND MATERIALS SHALL ALL BE REQUIRED AND SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL.

9. MATERIALS GENERATED DURING INSTALLATION:
DUST MITIGATION MEASURES ARE TO BE USED TO KEEP CEMENT DUST GENERATION TO A MINIMUM. ANY CONCRETE, SOIL, OR OTHER DEBRIS GENERATED WILL BE CONTAINERIZED FOR CHARACTERIZATION AND PROPER DISPOSAL BY OCC. IF ANY SUSPECTED OR KNOWN ASBESTOS-CONTAINING MATERIAL IS ENCOUNTERED IN AN AREA THAT CANNOT BE AVOIDED, THEN IT SHALL BE REMOVED OR ENCAPSULATED AS NECESSARY BY APPROPRIATELY LICENSED PERSONS.



TYPICAL MONITORING POINT DETAIL (1 / ME-01)

NTS



OCC OFFICE BLDG KEY PLAN

DRAFT FOR REVIEW

LEGEND

NEW INSTALLATION

SCALE VERIFICATION: THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

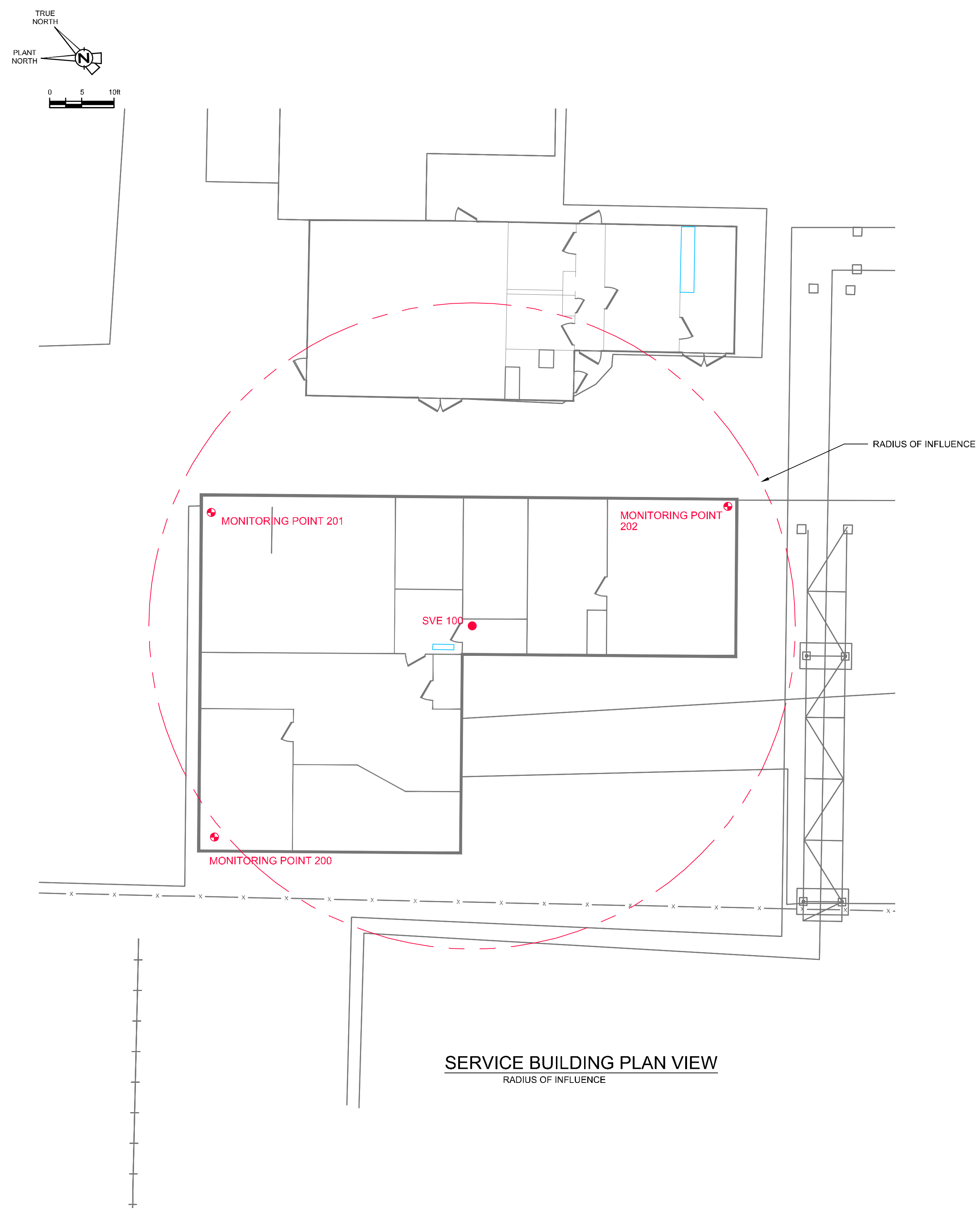
SUB-SLAB DEPRESSURIZATION SYSTEM

PIPING PLAN AND DETAILS
OCC OFFICE BUILDING

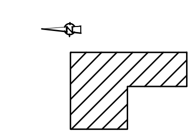
CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: APRIL 2014
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: AS NOTED	Project No: 07843-M9	Report No: 120	Drawing No: ME-01

07843-M9(120)ME-BU007 APR 21/2014



SERVICE BUILDING PLAN VIEW
RADIUS OF INFLUENCE



OCC OFFICE BLDG
KEY PLAN

DRAFT FOR REVIEW

SCALE VERIFICATION: THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

SUB-SLAB DEPRESSURIZATION SYSTEM

RADIUS OF INFLUENCE
OCC OFFICE BUILDING

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: OCTOBER 2012
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: AS NOTED	Project No: 07843-M9	Report No: 120	Drawing No: ME-02

07843-M9(120)ME-BU007 APR 21/2014

DRAWING INDEX

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

SUB-SLAB DEPRESSURIZATION SYSTEM

BUILDING 326
DRAFT REVIEW

APRIL 21, 2014
07843-M9(120)

CONESTOGA-ROVERS & ASSOCIATES

PROCESS / INSTRUMENT LINES

- MAIN PROCESS LINE
- SECONDARY PROCESS LINE
- UNDEFINED SIGNAL
- PNEUMATIC SIGNAL
- ELECTRICAL SIGNAL
- CAPILLARY TUBE, FILLED SYSTEM
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (NOT GUIDED)
- INTERNAL SYSTEM LINK
- HYDRAULIC SIGNAL
- MECHANICAL LINK
- ELECTRICAL BINARY SIGNAL
- TO / FROM SHEET No. — OFF PAGE CONNECTOR
- UTILITY — UTILITY IN/OUT
- 2 — HARDWIRED INTERLOCK LOGIC (-1,2,3...IS OPTIONAL REFERENCE TO INTERLOCK DETAIL DESCRIPTION)

VALVE SYMBOLS

- BA-* BALL VALVE
- BU-* BUTTERFLY VALVE
- CH-* CHECK VALVE
- GA-* GATE VALVE
- GL-* GLOBE VALVE
- A B C — THREE WAY VALVE (FAIL OPEN TO PATH A-C)
- A B C D — FOUR WAY VALVE (FAIL OPEN TO PATH A-C AND B-D)
- DAMPER OR LOUVER

GENERAL INSTRUMENT SYMBOLS

- LOCALLY MOUNTED INSTRUMENTS
- PRIMARY PANEL MOUNTED INSTRUMENTS
- IPx — AUXILARY PANEL MOUNTED INSTRUMENTS WHERE x = PANEL No. WHEN MORE THAN ONE PANEL IS PRESENT
- BEHIND BOARD MOUNTED INSTRUMENTS
- INSTRUMENTS SHARING COMMON HOUSING
- IN LINE INSTRUMENTS AS INDENTIFIED
- XY — SIGNAL CONVERTER (INPUT/OUTPUT)
  - * E - VOLTAGE, I - CURRENT, P - PNEUMATIC, B - BINARY (MODBUS, R5232...)
- COLOR — PILOT LIGHT
  - A = AMBER, G = GREEN, W = WHITE
  - B = BLUE, R = RED, Y = YELLOW
  - C = CLEAR

DISTRIBUTED CONTROL / SHARED DISPLAY INSTRUMENTS

- INDICATOR/CONTROLLER/RECORDER OR ALARM POINTS - USUALLY USED TO INDICATE VIDEO DISPLAY (DCS OR HMI CONFIGURATIONS) * NORMALLY ACCESSIBLE TO OPERATOR
- NORMALLY BLIND OPERATION * NOT NORMALLY ACCESSIBLE TO OPERATOR
- DISTRIBUTED CONTROL INTERCONNECTING LOGIC CONTROLLER OR PLC WITH BINARY OR SEQUENTIAL LOGIC FUNCTIONS. * NORMALLY ACCESSIBLE TO OPERATOR
- NORMALLY BLIND OPERATION * NOT NORMALLY ACCESSIBLE TO OPERATOR

- 1 PLCx — INTERLOCK LOGIC IN CONTROLLER OR PLC WHERE: - 1,2,3......IS OPTIONAL REFERENCE TO INTERLOCK DETAIL DESCRIPTION - x = PLC No. WHEN MORE THAN ONE PLC IS PRESENT IN THE SYSTEM

MISCELLANEOUS SYMBOLS

- REDUCER
- FLEXIBLE PIPE
- EXPANSION JOINT
- BLIND FLANGE
- HOSE CONNECTION
- SCREWED CAP, CLEANOUT
- Y-LINE STRAINER
- SPECIFICATION CHANGE
- FUNNEL DRAIN
- STATIC MIXER
- FILTER/REGULATOR/LUBRICATOR
- ANNUNCIATOR HORN
- FILTER/REGULATOR
- X" — EQUIPMENT INSULATED WITH X" OF INSULATION
- R — RESET FOR LATCH-TYPE ACTUATOR
- VENT — OPEN VENT TO ATMOSPHERE
- INLINE BLANK
- RESTRICTION ORIFICE
- AIR EJECTOR
- T — TRAP
- PULSATION DAMPER
- BB — BLOCK & BLEED ASSEMBLY
- TP 1 — TIE POINT TO EXISTING SYSTEM
- DRAIN (FLOOR, SEWER, ETC.)
- FLOW STRAIGHTENING VANE
- SP 4 — SPECIALITY PART
- AV — AIR VENT, AUTOMATIC
- SLUICE GATES

SELF-ACTUATED REGULATORS, VALVES, AND OTHER DEVICES

- RUPTURE DISC FOR PRESSURE RELIEF
- RUPTURE DISC FOR VACUUM RELIEF
- PRESSURE RELIEF VALVE
- VACUUM RELIEF VALVE
- PRESSURE REDUCING REGULATOR (SELF CONTAINED)
- BACKPRESSURE REGULATOR (SELF CONTAINED)
- LEVEL REGULATOR WITH MECHANICAL LINKAGE

- V P — CONSERVATION VENT
- XF — FLAME ARRESTOR

PRIMARY ELEMENT SYMBOLS

- FI — VARIABLE AREA FLOWMETER
- PI — DIAPHRAM SEAL WITH PRESSURE LEAD LINE
- PI — DIAPHRAM SEAL (LINE-MOUNTED)
- TE RTD — TEMPERATURE ELEMENT WITH THERMOWELL (OPTIONAL ELEMENT DESCRIPTION RTD, TYPE K...)
- FG — FLOW SIGHT GLASS (LG - LEVEL SIGHT GLASS, SG - GENERAL SIGHT GLASS)
- LEVEL DEVICE, FLOAT TYPE

ACTUATOR SYMBOLS

- DIAPHRAM ACTUATOR
- CYLINDER ACTUATOR
- M — ROTARY MOTOR ACTUATOR
- S — SOLENOID ACTUATOR
- HAND ACTUATOR OR HANDWHEEL
- D — AIR ACTUATED VALVE W/POSITIONER
  - OPTIONAL:
  - D - DIRECT ACTING POSITIONER
  - R - REVERSE ACTING POSITIONER
- FC — VALVE FAIL SYMBOLS
  - FO - FAIL OPEN
  - FC - FAIL CLOSED
  - FL - FAIL LOCKED (LAST POSITION)
  - FI - FAIL INDETERMINATE
- ZSL — LIMIT SWITCH ACTIVATED WHEN VALVE CLOSED (ZSH ACTIVATED WHEN VALVE OPEN)

ABBREVIATIONS:

POWER SUPPLY OR PURGE FLUID TYPES

AS - AIR SUPPLY
  IA - INSTRUMENT AIR
  PA - PLANT AIR
ES - ELECTRICAL SUPPLY
GS - GAS SUPPLY
HS - HYDRAULIC SUPPLY
NS - NITROGEN SUPPLY
SS - STEAM SUPPLY
WS - WATER SUPPLY

THE SUPPLY LEVEL MAY BE ADDED TO THE INSTRUMENT SUPPLY LINE, E.G., AG-100, A 100-PSI AIR SUPPLY; ES-24DC, A 24-VOLT DIRECT CURRENT POWER SUPPLY.

INSTRUMENTS:

HOA - HAND/OFF/AUTO
LOR - LOCAL/OFF/REMOTE
OPN - OPEN
CLS - CLOSE
SP - SETPOINT
NC - NORMALLY CLOSED
NO - NORMALLY OPEN

INSTRUMENT / PROCESS LINES DESIGNATIONS

000	UNDERGROUND INSTRUMENTS
100	PROCESS INSTRUMENTS
200	VENDOR SUPPLIED INSTRUMENTS
300	UTILITY INSTRUMENTS
0000	UNDERGROUND LINES
1000	PROCESS LINES
2000	VENDOR SUPPLIED LINES
3000	UTILITY LINES
CS	CARBON STEEL PIPE
CSVD	CARBON STEEL VENT DUCT (12 GAUGE)
DVW	DRAIN VENT WASTE PIPE
HDPE	HIGH DENSITY POLYETHYLENE PIPE
KYA	KYNAR
PDE	CPVC, SOLID
PVC	POLYVINYL CHLORIDE PIPE SCHEDULE 40
PVE	POLYVINYL CHLORIDE PIPE SCHEDULE 80
PPL	POLYPROPYLENE LINED/LINED DUCTILE PIPE
SS	STAINLESS STEEL
TFD	TEFLON
B	BARE
I	INSULATED
J	JACKETED AND INSULATED
TE	ELECTRICALLY TRACED AND INSULATED

TYPICAL ISA LETTER COMBINATIONS

First-Letters	Initiating or Measured Variable	Controllers: Recording	Controllers: Indicating	Controllers: Blind	Self-Actuated Control Valves	Readout Devices: Recording	Readout Devices: Indicating	Switches and Alarm Devices *: High **	Switches and Alarm Devices *: Low	Switches and Alarm Devices *: Comb	Transmitters: Recording	Transmitters: Indicating	Transmitters: Blind	Solenoids, Relays, Computing Devices	Primary Element	Test Point	Well or Probe	Viewing Device, Glass	Safety Device	Final Element
A	Analysis	ARC	AIC	AC		AR	AI	ASH	ASL	ASHL	ART	AIT	AT	AY	AE	AP	AW			AV
B	Burner/Combustion	BRC	BIC	BC		BR	BI	BSH	BSL	BSHL	BRT	BIT	BT	BY	BE		BW	BG		BZ
C	User's Choice																			
D	User's Choice																			
E	Voltage	ERC	EIC	EC		ER	EI	ESH	ESL	ESHL	ERT	EIT	ET	EY	EE					EZ
F	Flow Rate	FRC	FIC	FC	FCV, FICV	FR	FI	FSH	FSL	FSHL	FRT	FIT	FT	FY	FE	FP		FG		FV
FQ	Flow Quantity	FQRC	FQIC			FQR	FQI	FQSH	FQSL			FQIT	FQT	FQY	FQE					FQV
FF	Flow Ratio	FFRC	FFIC	FFC		FFR	FFI	FFSH	FFSL						FE					FFV
G	User's Choice																			
H	Hand		HIC	HC						HS										HV
I	Current	IRC	IIC			IR	II	ISH	ISL	ISHL	IRT	IIT	IT	IY	IE					IZ
J	Power	JRC	JIC			JR	JI	JSH	JSL	JSHL	JRT	JIT	JT	JY	JE					JV
K	Time	KRC	KIC	KC	KCV	KR	KI	KSH	KSL	KSHL	KRT	KIT	KT	KY	KE					KV
L	Level	LRC	LIC	LC	LCV	LR	LI	LSH	LSL	LSHL	LRT	LIT	LT	LY	LE		LW	LG		LV
M	User's Choice																			
N	User's Choice																			
O	User's Choice																			
P	Pressure/Vacuum	PRC	PIC	PC	PCV	PR	PI	PSH	PSL	PSHL	PRT	PIT	PT	PY	PE	PP			PSV, PSE	PV
PD	Pressure, Differential	PDRC	PDIC	PDC	PDCV	PDR	PDI	PDSH	PDSL		PDRT	PDIT	PDT	PDY	PE	PP				PDV
Q	Quantity	QRC	QIC			QR	QI	QSH	QSL	QSHL	QRT	QIT	QT	QY	QE					QZ
R	Radiation	RRC	RIC	RC		RR	RI	RSH	RSL	RSHL	RRT	RIT	RT	RY	RE		RW			RZ
S	Speed/Frequency	SRC	SIC	SC	SCV	SR	SI	SSH	SSL	SSHL	SRT	SIT	ST	SY	SE					SV
T	Temperature	TRC	TIC	TC	TCV	TR	TI	TSH	TSL	TSHL	TRT	TIT	TT	TY	TE	TP	TW		TSE	TV
TD	Temperature, Differential	TDRC	TDIC	TDC	TDCV	TDR	TDI	TDSH	TDSL		TDRT	TDIT	TDT	TDY	TE	TP	TW			TDV
U	Multivariable					UR	UI							UY						UV
V	Vibration/Machinery Analysis					VR	VI	VSH	VSL	VSHL	VRT	VIT	VT	VY	VE					VZ
W	Weight/Force	WRC	WIC	WC	WCV	WR	WI	WSH	WSL	WSHL	WRT	WIT	WT	WY	WE					WZ
WD	Weight/Force, Differential	WDRC	WDIC	WDC	WDCV	WDR	WDI	WDSH	WDSL		WDRT	WDIT	WDT	WDY	WE					WDZ
X	Unclassified																			
Y	Event/State/Presence		YIC	YC		YR	YI	YSH	YSL				YT	YY	YE					YZ
Z	Position/Dimension	ZRC	ZIC	ZC	ZCV	ZR	ZI	ZSH	ZSL	ZSHL	ZRT	ZIT	ZT	ZY	ZE					ZV
ZD	Gauging/Deviation	ZDRC	ZDIC	ZDC	ZDCV	ZDR	ZDI	ZDSH	ZDSL		ZDRT	ZDIT	ZDT	ZDY	ZDE					ZDV

Note: This table is not all-inclusive.
* A, alarm, the annunciating device, may be used in the same fashion as S, switch, the actuating device.
** The letters H and L may be omitted in the undefined case.

Other Possible Combinations:

FO	(Restriction Orifice)	LLH	(Level Light High)
FRK, HIK	(Control Stations)	LCH	(Level Control High)
KQI	(Running Time Indicator)	HMS	(Hand Momentary Switch)
		LCL	(Level Control Low)

IDENTIFICATION LETTERS

	FIRST-LETTER		SUCCEEDING-LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	Analysis		Alarm		
B	Burner/Combustion		User's Choice	User's Choice	User's Choice
C	User's Choice			Control	
D	User's Choice	Differential			
E	Voltage		Sensor (Primary Element)		
F	Flow Rate	Ratio (Fraction)			
G	User's Choice		Glass, Viewing Device		
H	Hand				High
I	Current (Electrical)		Indicate		
J	Power	Scan			
K	Time, Time Schedule	Time Rate of Change		Control Station	
L	Level		Light		Low
M	User's Choice	Momentary			Middle, Intermediate
N	User's Choice		User's Choice	User's Choice	User's Choice
O	User's Choice		Orifice, Restriction		
P	Pressure, Vacuum		Point (Test) Connection		
Q	Quantity	Integrate, Totalize			
R	Radiation		Record		
S	Speed, Frequency	Safety		Switch	
T	Temperature			Transmit	
U	Multivariable		Multifunction	Multifunction	Multifunction
V	Vibration, Machinery Analysis			Valve, Damper, Louver	
W	Weight, Force		Well		
X	Unclassified	X Axis	Unclassified	Unclassified	Unclassified
Y	Event, State, or Presence	Y Axis		Relay, Compute, Convert	
Z	Position, Dimension	Z Axis		Driver, Actuator, Unclassified Final Control Element	

DRAFT FOR REVIEW

SCALE VERIFICATION: THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

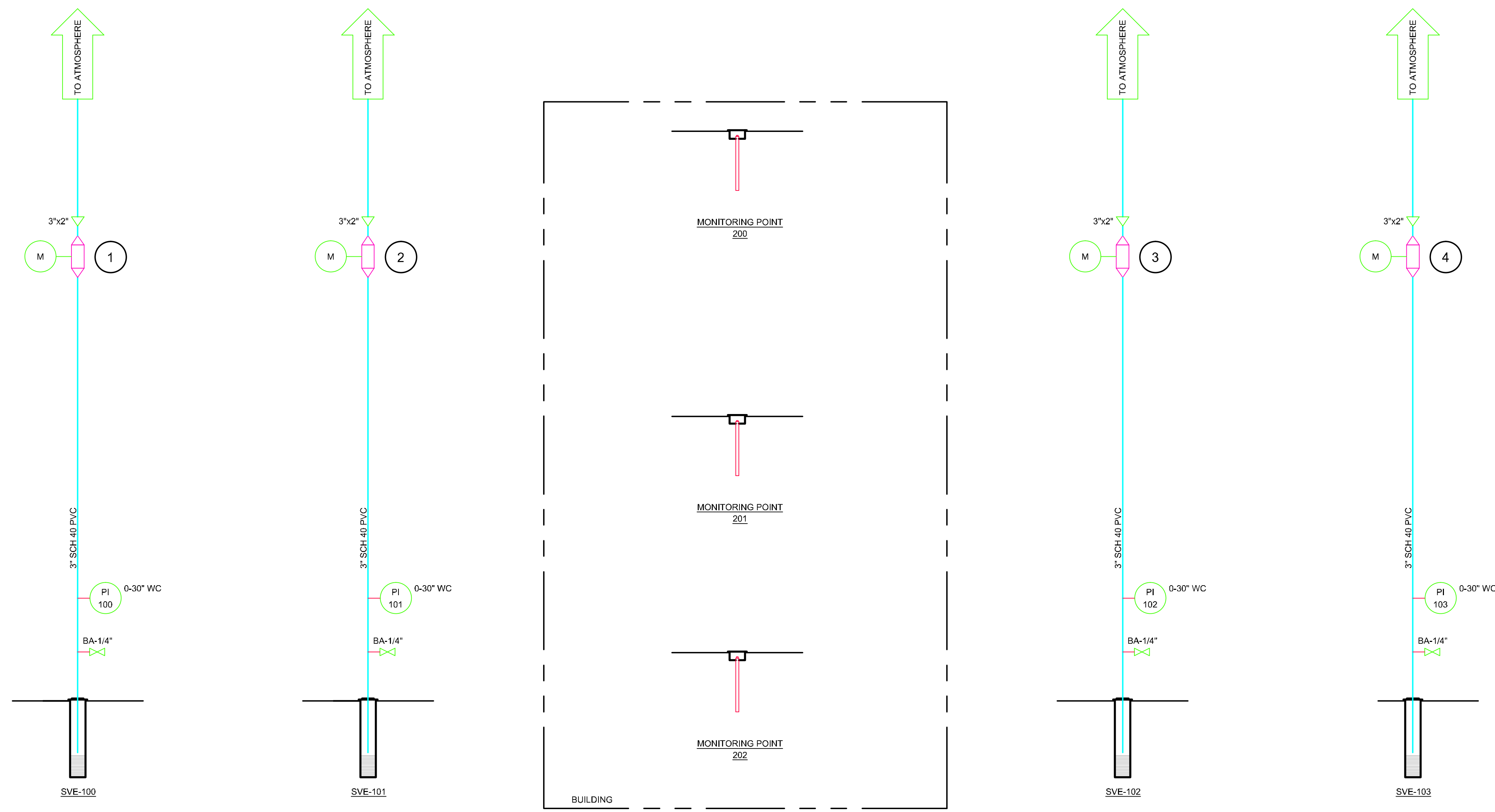
SUB-SLAB DEPRESSURIZATION SYSTEM

ENGINEERING FLOW DIAGRAM
LEGEND

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: OCTOBER 2012
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: NONE	Project No: 07843-M9	Report No: 120	Drawing No: EF-00

07843-M9(120)EF-BU002 APR 21/2014



PLANT ID.	1	2	3	4	5	6	7	8	9	10	11	12
NAME												
DESCRIPTION: MATERIAL	-	-	-	-								
SIZE	15"Wx13"Hx8"D	15"Wx13"Hx8"D	15"Wx13"Hx8"D	15"Wx13"Hx8"D								
CAPACITY	40 CFM@ 15" W.C.	40 CFM@ 15" W.C.	40 CFM@ 15" W.C.	40 CFM@ 15" W.C.								
TEMP/PRESS	-	-	-	-								
HP/V/RPM	120V(270W)	120V(270W)	120V(270W)	120V(270W)								
WEIGHT	18 LBS	18 LBS	18 LBS	18 LBS								
MANUFACTURE	RADONAWAY	RADONAWAY	RADONAWAY	RADONAWAY								
MODEL	HS-2000E	HS-2000E	HS-2000E	HS-2000E								
VENDOR	-	-	-	-								
	-	-	-	-								
	-	-	-	-								

No	Revision	Date	Initial

DRAFT FOR REVIEW

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

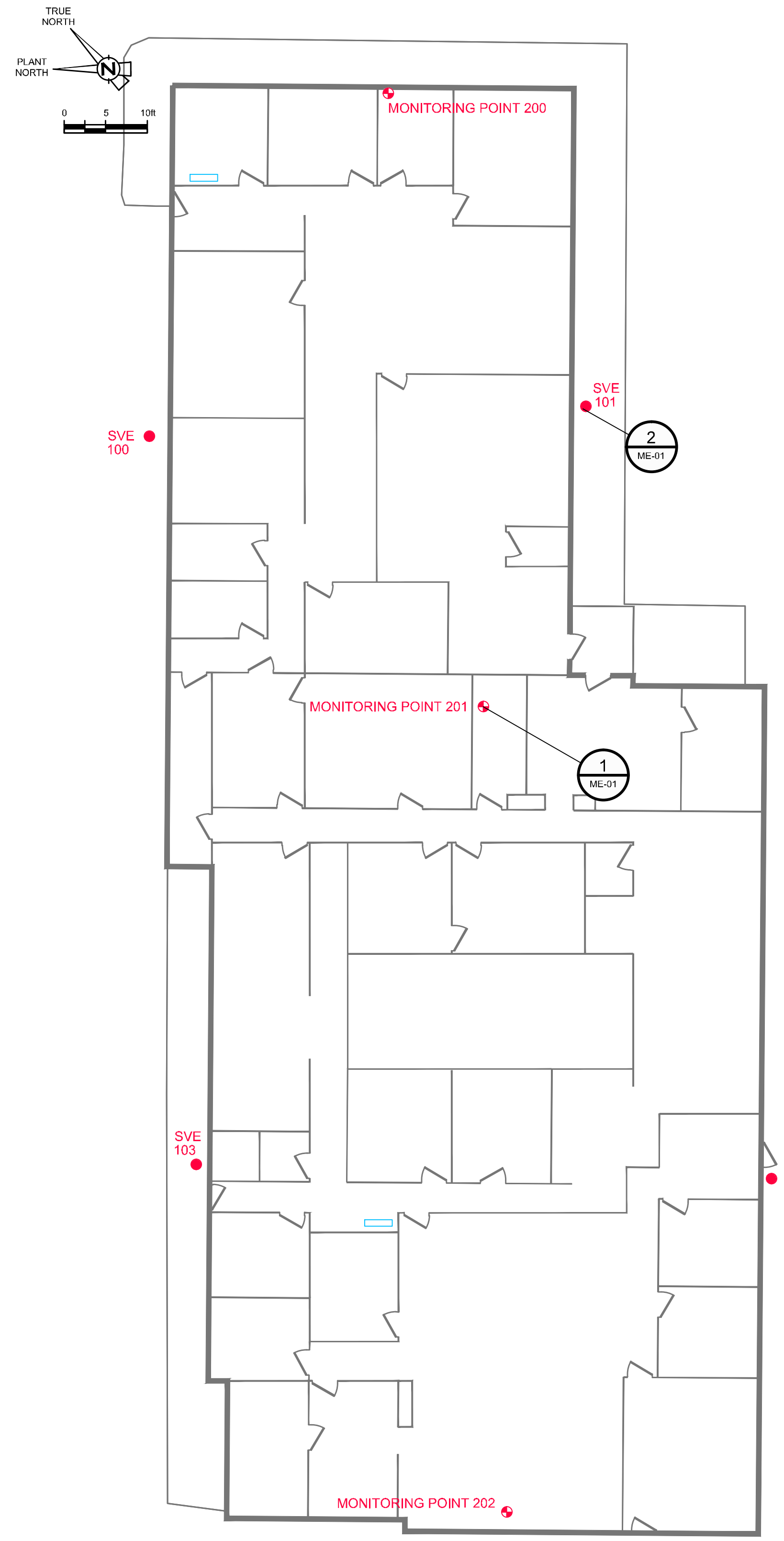
SUB-SLAB DEPRESSURIZATION SYSTEM

ENGINEERING FLOW SHEET
BUILDING 326

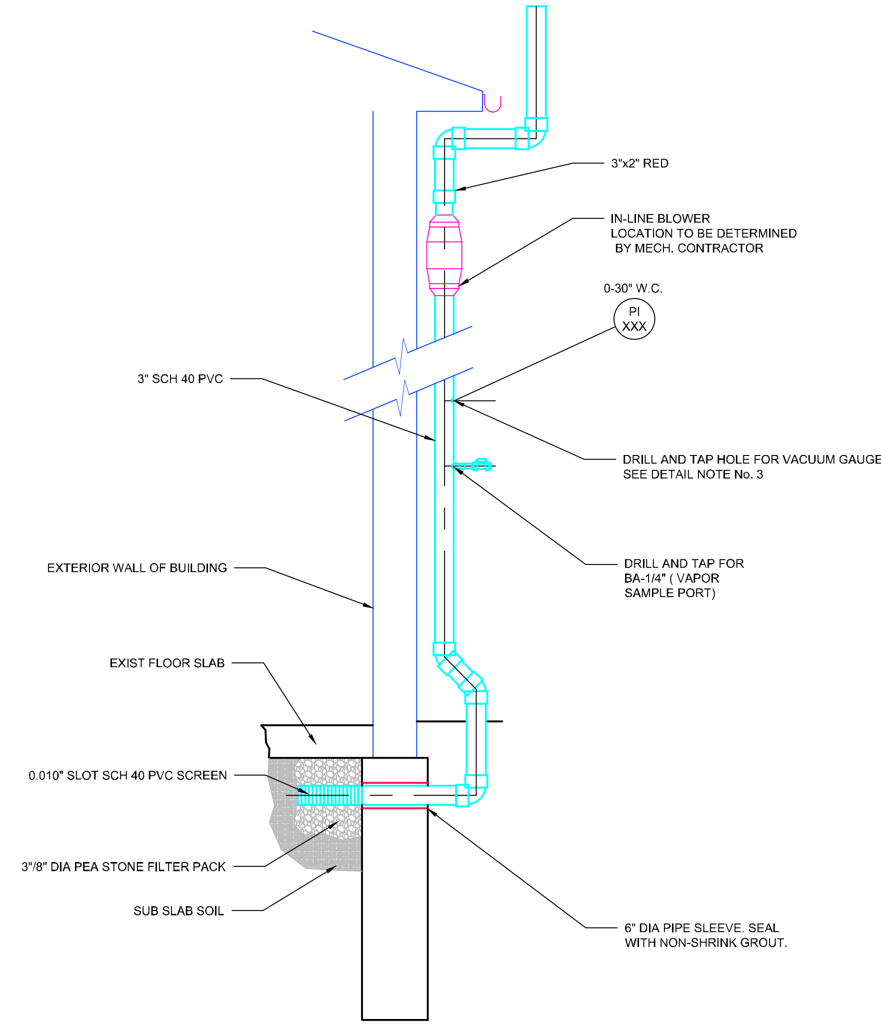
CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: OCTOBER 2012
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: NONE	Project No: 07843-M9	Report No: 120	Drawing No: EF-01

07843-M9(120)EF-BU002 APR 21/2014



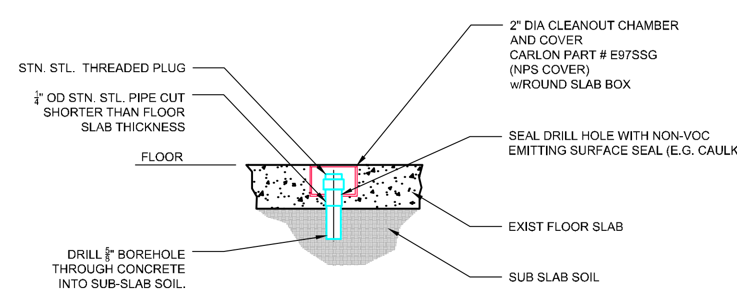
BUILDING 326 PIPING PLAN VIEW



TYPICAL SVE PIPING DETAIL 2 ME-01

3/4" = 1'-0"

DETAIL NOTES
1. SUPPORT AS REQUIRED
2. ALL HORIZONTAL PIPE RUNS TO BE SLOPED BACK TO SLAB PENETRATION
3. VACUUM GAUGE WIKA 30" H2O, PART No. 9851852, TYPE 611.10 2.5"



TYPICAL MONITORING POINT DETAIL 1 ME-01

NTS

GENERAL NOTES:

1. SCOPE OF WORK:
CONTRACTOR SHALL COMPLETE A TURN-KEY ELECTRICAL INSTALLATION TO PROVIDE A 1-PHASE, 120V, 15A RATED POWER SERVICE TO THE VAPOR EXTRACTION BLOWER. THIS TASK SHALL INCLUDE CONNECTION TO A 1-PHASE, 120V DISTRIBUTION PANEL AND INTERCONNECTING WIRING.

2. INSPECTION AND VERIFICATION:
IMMEDIATELY AFTER THE INSTALLATION CONTRACT IS SIGNED, CONTRACTOR SHALL INSPECT THE EXISTING FACILITY TO VERIFY AND CONFIRM THAT THE EXISTING LIGHTING DISTRIBUTION PANEL (AMPERAGE CAPACITY AND VOLTAGE) ARE ADEQUATE FOR THE SPECIFIED TASK. THIS WORK SHALL BE IN CLOSE COMMUNICATION WITH OWNER AND ENGINEER.

3. REGULATORY REQUIREMENTS:
THE ENTIRE INSTALLATION SHALL COMPLY WITH THE REQUIREMENT OF THE LATEST REVISION OF THE APPLICABLE CODES, STANDARDS, GUIDES, AND PRACTICES PERTAINING TO THE JOB SITE, ALL INSTALLATION COMPONENTS SHALL CARRY APPROVAL LABEL WHERE REQUIRED BY LAW. AT A MINIMUM, CONTRACTOR'S WORK SHALL COMPLY WITH THE REQUIREMENTS OF ANSI/NFPA 70 - NATIONAL ELECTRICAL CODE (NEC); ANSI/IEEE C2 - NATIONAL ELECTRICAL SAFETY CODE(NESC); OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) REQUIREMENTS APPLICABLE TO THE PROJECT WORK; AND LOCAL AUTHORITY HAVING JURISDICTION AT THE PROJECT SITE.

4. MATERIAL REQUIREMENTS:
ALL MATERIALS SHALL BE UL- APPROVED, FOR INDUSTRIAL APPLICATION, AS SHOWN ON THE DRAWINGS, AS SPECIFIED HEREIN, AND AS REQUIRED TO SUCCESSFULLY COMPLETE THE PROJECT.
ALL WIRE AND CABLE SHALL BE NEC/UL TYPE FOR INSTALLATION IN RMC, 600V, SINGLE-CONDUCTOR STRANDED COPPER, THHN/THWN, SIZES AS SHOWN ON THE DRAWING AND AS REQUIRED BY NEC. THE GROUND WIRE SHALL BE PROVIDED WITH "GREEN" OUTER JACKET.
ALL WIRING CONDUIT AND FITTINGS SHALL BE NEC RMC TYPE RIGID GALVANIZED STEEL, SIZES AS SHOWN ON THE DRAWINGS AND AS REQUIRED BY NEC.

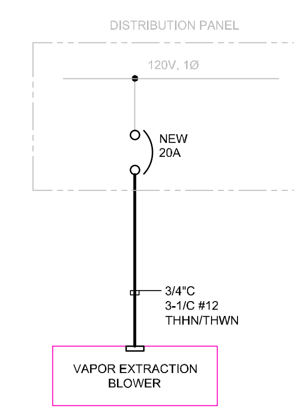
5. INSTALLATION REQUIREMENTS:
CONTRACTOR SHALL COMPLETE INSTALLATION AS SHOWN ON THE DRAWINGS, IN ACCORDANCE WITH NEC, NESC, OSHA AND AS REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION.
COMPLETE INSTALLATION OF THE VAPOR EXTRACTION BLOWER, INTERCONNECTING WIRING AS SPECIFIED.
IF REQUIRED, OBTAIN INSTALLATION FINAL INSPECTION AND APPROVAL BY THE LOCAL AUTHORITY HAVING JURISDICTION.
ON COMPLETION BUT PRIOR TO THE EQUIPMENT ENERGIZATION, CARRY OUT THE INSTALLATION INSPECTION WITH THE PROJECT ENGINEER TO HIS SATISFACTION. DEMONSTRATE TO ENGINEER THAT THE INSTALLATION HAS BEEN SUCCESSFULLY COMPLETED AS SHOWN AND SPECIFIED.
PROVIDE EQUIPMENT ENERGIZATION.
ALL EXISTING CONDITIONS SHALL BE RESTORED AT EACH SYSTEM LOCATION. FLOORING, PAINT, DRYWALL, CEILING TILE, ETC TO MATCH EXISTING WHERE APPLICABLE.
ALL EXTRACTION PIPING IS TO BE INSTALLED AS CLOSE AS POSSIBLE TO BUILDING WALLS, COLUMNS, OR SUPPORT BEAMS, AND IN NO CASE MORE THAN 3 FEET FROM THE WALL TO THE CENTER OF PIPE UNLESS APPROVED BY THE ENGINEER AND PORT OF TACOMA. PROTECTIVE BARRIERS SHALL BE INSTALLED AS NEEDED TO PROTECT PIPING FROM DAMAGE. ENCLOSURES NEED TO BE PROVIDED FOR PIPING THAT IS NOT LOCATED IN A PROTECTED LOCATION, SUCH AS A SMALL CLOSET. THIS INCLUDES PIPING ON THE EXTERIOR OF A BUILDING, AS WELL AS IN THE OPERATIONAL AREAS OF BUILDINGS. INTERIOR ENCLOSURES MAY BE STEEL ANGLE RAILING AND PAINTED SAFETY YELLOW FOR VISIBILITY AROUND PIPE. EXTERIOR ENCLOSURES WILL BE STEEL FRAMING WITH SIDING/TRIM TO MATCH EXISTING. ENCLOSURES SHALL BE KEPT AS SMALL AS POSSIBLE AND NO LARGER THAN 4 FT x 4 FT. THE CONTRACTOR WILL BE DIRECTED ON THIS NEED BY THE ENGINEER AND POT. ANY EXTERIOR GALVANIZED COMPONENTS SHALL BE PAINTED SUCH THAT NO GALVANIZED SURFACES ARE EXPOSED.

6. TO AVOID ENTRY OF EXTRACTED SUBSURFACE VAPORS INTO THE BUILDING, THE VENT PIPE'S EXHAUST SHOULD BE:
   a. ABOVE THE EAVE OF THE ROOF (PREFERABLY, ABOVE THE HIGHEST EAVE OF THE BUILDING AT LEAST 12 INCHES ABOVE THE SURFACE OF THE ROOF).
   b. AT LEAST 10 FEET ABOVE GROUND LEVEL.
   c. AT LEAST 10 FEET AWAY FROM ANY OPENING THAT IS LESS THAN 2 FEET BELOW THE EXHAUST POINT, AND
   d. 10 FEET FROM ANY ADJOINING OR ADJACENT BUILDINGS, OR HVAC INTAKES OR SUPPLY REGISTERS.
GREATER DISTANCES FROM BUILDING OPENINGS WILL BE CONSIDERED WHERE PRACTICAL.

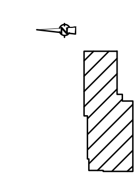
7. RAIN CAPS, IF USED, SHOULD BE INSTALLED SO AS NOT TO INCREASE THE POTENTIAL FOR EXTRACTED SUBSURFACE VAPORS TO ENTER THE BUILDING.

8. SUBMITTAL REQUIREMENTS:
SUBMITTALS FOR ALL EQUIPMENT AND MATERIALS SHALL ALL BE REQUIRED AND SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL.

9. MATERIALS GENERATED DURING INSTALLATION:
DUST MITIGATION MEASURES ARE TO BE USED TO KEEP CEMENT DUST GENERATION TO A MINIMUM. ANY CONCRETE, SOIL, OR OTHER DEBRIS GENERATED WILL BE CONTAINERIZED FOR CHARACTERIZATION AND PROPER DISPOSAL BY OCC. IF ANY SUSPECTED OR KNOWN ASBESTOS-CONTAINING MATERIAL IS ENCOUNTERED IN AN AREA THAT CANNOT BE AVOIDED, THEN IT SHALL BE REMOVED OR ENCAPSULATED AS NECESSARY BY APPROPRIATELY LICENSED PERSONS.



SINGLE LINE DIAGRAM



BLDG 326 KEY PLAN

DRAFT FOR REVIEW

LEGEND

NEW INSTALLATION

SCALE VERIFICATION: THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

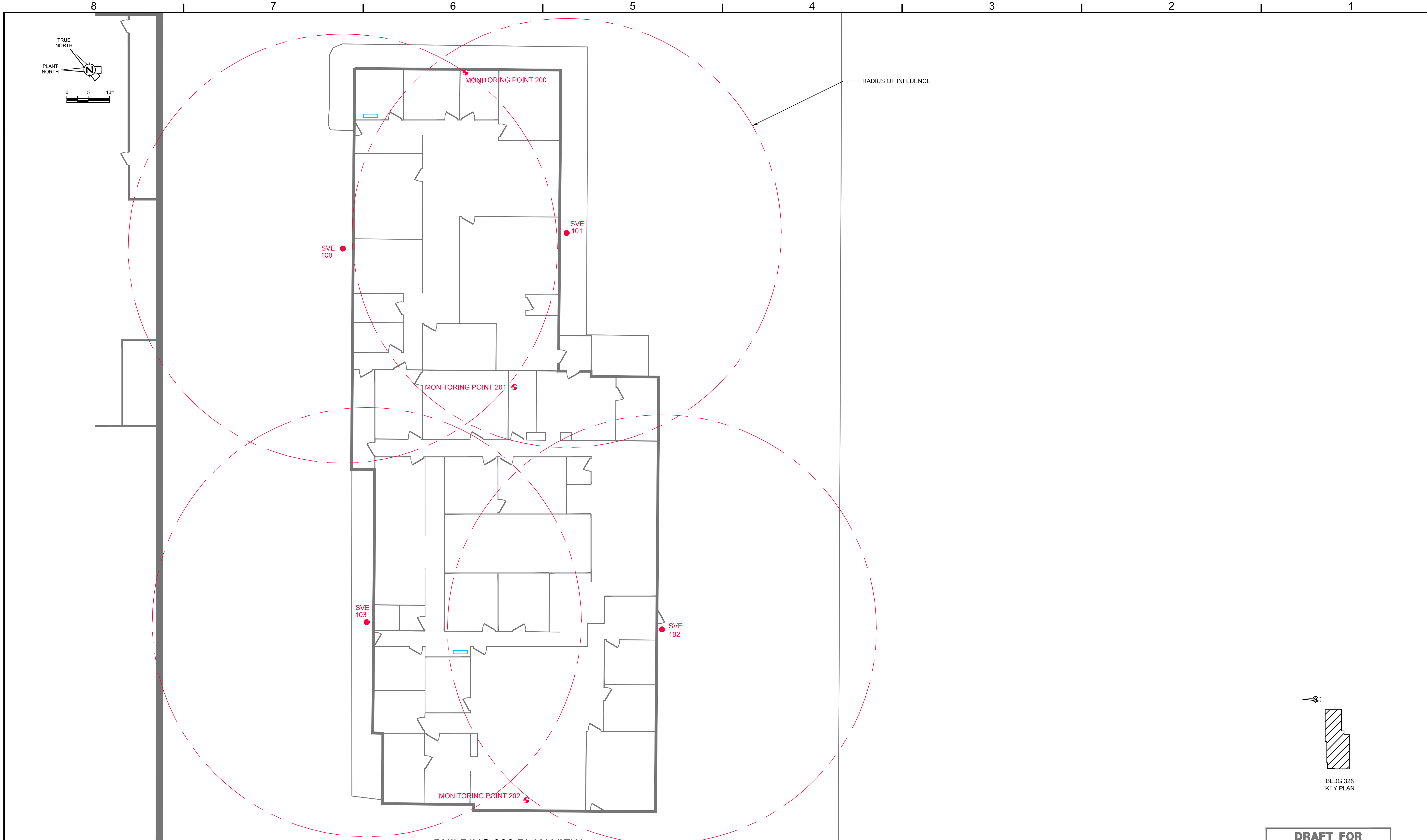
SUB-SLAB DEPRESSURIZATION SYSTEM

PIPING PLAN AND DETAILS
BUILDING 326

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: APRIL 2014
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: AS NOTED	Project No: 07843-M9	Report No: 120	Drawing No: ME-01

07843-M9(120)ME-BU001 APR 21/2014



BUILDING 326 PLAN VIEW

DRAFT FOR REVIEW

SCALE VERIFICATION: THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

SUB-SLAB DEPRESSURIZATION SYSTEM

RADUIS OF INFLUENCE
BUILDING 326

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: OCTOBER 2012
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: AS NOTED	Project No: 07843-M9	Report No: 120	Drawing No: ME-02

07843-M9(120)ME-BU001 APR 21/2014

DRAWING INDEX

DWG. Nº	REV. No.	DATE	TITLE
ENGINEERING FLOW SHEETS			
EF-00	-	12/13	ENGINEERING FLOW DIAGRAM - LEGEND
EF-01	-	12/13	ENGINEERING FLOW SHEET - BUILDING 532
MECHANICAL/PIPING			
ME-01	-	12/13	PIPING PLAN AND DETAILS - BUILDING 532
ME-02	-	12/13	RADIUS OF INFLUENCE - BUILDING 532

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

SUB-SLAB DEPRESSURIZATION SYSTEM

BUILDING 532
DRAFT REVIEW

APRIL 21, 2014
07843-M9(120)

CONESTOGA-ROVERS & ASSOCIATES

PROCESS / INSTRUMENT LINES

- MAIN PROCESS LINE
- SECONDARY PROCESS LINE
- UNDEFINED SIGNAL
- PNEUMATIC SIGNAL
- ELECTRICAL SIGNAL
- CAPILLARY TUBE, FILLED SYSTEM
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (NOT GUIDED)
- INTERNAL SYSTEM LINK
- HYDRAULIC SIGNAL
- MECHANICAL LINK
- ELECTRICAL BINARY SIGNAL
- TO / FROM SHEET No. — OFF PAGE CONNECTOR
- UTILITY — UTILITY IN/OUT
- HARDWIRED INTERLOCK LOGIC (-1,2,3...IS OPTIONAL REFERENCE TO INTERLOCK DETAIL DESCRIPTION)

VALVE SYMBOLS

- BA-* BALL VALVE
- BU-* BUTTERFLY VALVE
- CH-* CHECK VALVE
- GA-* GATE VALVE
- GL-* GLOBE VALVE
- THREE WAY VALVE (FAIL OPEN TO PATH A-C)
- FOUR WAY VALVE (FAIL OPEN TO PATH A-C AND B-D)
- DAMPER OR LOUVER

GENERAL INSTRUMENT SYMBOLS

- LOCALLY MOUNTED INSTRUMENTS
- PRIMARY PANEL MOUNTED INSTRUMENTS
- IPx — AUXILARY PANEL MOUNTED INSTRUMENTS WHERE x = PANEL No. WHEN MORE THAN ONE PANEL IS PRESENT
- BEHIND BOARD MOUNTED INSTRUMENTS
- INSTRUMENTS SHARING COMMON HOUSING
- IN LINE INSTRUMENTS AS INDENTIFIED
- XY — SIGNAL CONVERTER (INPUT/OUTPUT)
  - * E - VOLTAGE
  - I - CURRENT
  - P - PNEUMATIC
  - B - BINARY (MODBUS, R5232...)
- COLOR — PILOT LIGHT
  - A = AMBER
  - B = BLUE
  - C = CLEAR
  - G = GREEN
  - R = RED
  - W = WHITE
  - Y = YELLOW

DISTRIBUTED CONTROL / SHARED DISPLAY INSTRUMENTS

- INDICATOR/CONTROLLER/RECORDER OR ALARM POINTS - USUALLY USED TO INDICATE VIDEO DISPLAY (DCS OR HMI CONFIGURATIONS)
  * NORMALLY ACCESSIBLE TO OPERATOR
- NORMALLY BLIND OPERATION
  * NOT NORMALLY ACCESSIBLE TO OPERATOR
- DISTRIBUTED CONTROL INTERCONNECTING LOGIC CONTROLLER OR PLC WITH BINARY OR SEQUENTIAL LOGIC FUNCTIONS.
  * NORMALLY ACCESSIBLE TO OPERATOR
- NORMALLY BLIND OPERATION
  * NOT NORMALLY ACCESSIBLE TO OPERATOR

PLCx — INTERLOCK LOGIC IN CONTROLLER OR PLC WHERE:
- 1,2,3.....IS OPTIONAL REFERENCE TO INTERLOCK DETAIL DESCRIPTION
- x = PLC No. WHEN MORE THAN ONE PLC IS PRESENT IN THE SYSTEM

MISCELLANEOUS SYMBOLS

- REDUCER
- FLEXIBLE PIPE
- EXPANSION JOINT
- BLIND FLANGE
- HOSE CONNECTION
- SCREWED CAP, CLEANOUT
- Y-LINE STRAINER
- SPECIFICATION CHANGE
- FUNNEL DRAIN
- STATIC MIXER
- FILTER/REGULATOR/LUBRICATOR
- ANNUNCIATOR HORN
- FILTER/REGULATOR
- X" — EQUIPMENT INSULATED WITH X" OF INSULATION
- R — RESET FOR LATCH-TYPE ACTUATOR
- VENT — OPEN VENT TO ATMOSPHERE
- INLINE BLANK
- RESTRICTION ORIFICE
- AIR EJECTOR
- T — TRAP
- PULSATION DAMPER
- BB — BLOCK & BLEED ASSEMBLY
- TP 1 — TIE POINT TO EXISTING SYSTEM
- DRAIN (FLOOR, SEWER, ETC.)
- FLOW STRAIGHTENING VANE
- SP 4 — SPECIALITY PART
- AV — AIR VENT, AUTOMATIC
- SLUICE GATES

SELF-ACTUATED REGULATORS, VALVES, AND OTHER DEVICES

- RUPTURE DISC FOR PRESSURE RELIEF
- RUPTURE DISC FOR VACUUM RELIEF
- PRESSURE RELIEF VALVE
- VACUUM RELIEF VALVE
- PRESSURE REDUCING REGULATOR (SELF CONTAINED)
- BACKPRESSURE REGULATOR (SELF CONTAINED)
- LEVEL REGULATOR WITH MECHANICAL LINKAGE

- V P — CONSERVATION VENT
- XF — FLAME ARRESTOR

PRIMARY ELEMENT SYMBOLS

- FI — VARIABLE AREA FLOWMETER
- PI — DIAPHRAM SEAL WITH PRESSURE LEAD LINE
- PI — DIAPHRAM SEAL (LINE-MOUNTED)
- TE RTD — TEMPERATURE ELEMENT WITH THERMOWELL (OPTIONAL ELEMENT DESCRIPTION RTD, TYPE K...)
- FG — FLOW SIGHT GLASS (LG - LEVEL SIGHT GLASS, SG - GENERAL SIGHT GLASS)
- LEVEL DEVICE, FLOAT TYPE

ACTUATOR SYMBOLS

- DIAPHRAM ACTUATOR
- CYLINDER ACTUATOR
- M — ROTARY MOTOR ACTUATOR
- S — SOLENOID ACTUATOR
- HAND ACTUATOR OR HANDWHEEL
- D — AIR ACTUATED VALVE W/POSITIONER
  OPTIONAL:
  D - DIRECT ACTING POSITIONER
  R - REVERSE ACTING POSITIONER

VALVE FAIL SYMBOLS

- FC
- FO - FAIL OPEN
- FC - FAIL CLOSED
- FL - FAIL LOCKED (LAST POSITION)
- FI - FAIL INDETERMINATE

ZSL — LIMIT SWITCH ACTIVATED WHEN VALVE CLOSED (ZSH ACTIVATED WHEN VALVE OPEN)

ABBREVIATIONS:

POWER SUPPLY OR PURGE FLUID TYPES

- AS - AIR SUPPLY
  - IA - INSTRUMENT AIR
  - PA - PLANT AIR
- ES - ELECTRICAL SUPPLY
- GS - GAS SUPPLY
- HS - HYDRAULIC SUPPLY
- NS - NITROGEN SUPPLY
- SS - STEAM SUPPLY
- WS - WATER SUPPLY

THE SUPPLY LEVEL MAY BE ADDED TO THE INSTRUMENT SUPPLY LINE, E.G., AG-100, A 100-PSI AIR SUPPLY; ES-24DC, A 24-VOLT DIRECT CURRENT POWER SUPPLY.

INSTRUMENTS:

- HOA - HAND/OFF/AUTO
- LOR - LOCAL/OFF/REMOTE
- OPN - OPEN
- CLS - CLOSE
- SP - SETPOINT
- NC - NORMALLY CLOSED
- NO - NORMALLY OPEN

INSTRUMENT / PROCESS LINES DESIGNATIONS

000	UNDERGROUND INSTRUMENTS
100	PROCESS INSTRUMENTS
200	VENDOR SUPPLIED INSTRUMENTS
300	UTILITY INSTRUMENTS
0000	UNDERGROUND LINES
1000	PROCESS LINES
2000	VENDOR SUPPLIED LINES
3000	UTILITY LINES
CS	CARBON STEEL PIPE
CSVD	CARBON STEEL VENT DUCT (12 GAUGE)
DVW	DRAIN VENT WASTE PIPE
HDPE	HIGH DENSITY POLYETHYLENE PIPE
KYA	KYNAR
PDE	CPVC, SOLID
PVC	POLYVINYL CHLORIDE PIPE SCHEDULE 40
PVE	POLYVINYL CHLORIDE PIPE SCHEDULE 80
PPL	POLYPROPYLENE LINED/LINED DUCTILE PIPE
SS	STAINLESS STEEL
TFD	TEFLON
B	BARE
I	INSULATED
J	JACKETED AND INSULATED
TE	ELECTRICALLY TRACED AND INSULATED

TYPICAL ISA LETTER COMBINATIONS

First-Letters	Initiating or Measured Variable	Controllers: Recording	Controllers: Indicating	Controllers: Blind	Self-Actuated Control Valves	Readout Devices: Recording	Readout Devices: Indicating	Switches and Alarm Devices *: High **	Low	Comb	Transmitters: Recording	Transmitters: Indicating	Transmitters: Blind	Solenoids, Relays, Computing Devices	Primary Element	Test Point	Well or Probe	Viewing Device, Glass	Safety Device	Final Element
A	Analysis	ARC	AIC	AC		AR	AI	ASH	ASL	ASHL	ART	AIT	AT	AY	AE	AP	AW			AV
B	Burner/Combustion	BRC	BIC	BC		BR	BI	BSH	BSL	BSHL	BRT	BIT	BT	BY	BE		BW	BG		BZ
C	User's Choice																			
D	User's Choice																			
E	Voltage	ERC	EIC	EC		ER	EI	ESH	ESL	ESHL	ERT	EIT	ET	EY	EE					EZ
F	Flow Rate	FRC	FIC	FC	FCV, FICV	FR	FI	FSH	FSL	FSHL	FRT	FIT	FT	FY	FE	FP		FG		FV
FQ	Flow Quantity	FQRC	FQIC			FQR	FQI	FQSH	FQSL			FQIT	FQT	FQY	FQE					FQV
FF	Flow Ratio	FFRC	FFIC	FFC		FFR	FFI	FFSH	FFSL						FE					FFV
G	User's Choice																			
H	Hand		HIC	HC						HS										HV
I	Current	IRC	IIC			IR	II	ISH	ISL	ISHL	IRT	IIT	IT	IY	IE					IZ
J	Power	JRC	JIC			JR	JI	JSH	JSL	JSHL	JRT	JIT	JT	JY	JE					JV
K	Time	KRC	KIC	KC	KCV	KR	KI	KSH	KSL	KSHL	KRT	KIT	KT	KY	KE					KV
L	Level	LRC	LIC	LC	LCV	LR	LI	LSH	LSL	LSHL	LRT	LIT	LT	LY	LE		LW	LG		LV
M	User's Choice																			
N	User's Choice																			
O	User's Choice																			
P	Pressure/Vacuum	PRC	PIC	PC	PCV	PR	PI	PSH	PSL	PSHL	PRT	PIT	PT	PY	PE	PP			PSV, PSE	PV
PD	Pressure, Differential	PDRC	PDIC	PDC	PDCV	PDR	PDI	PDSH	PDSL		PDRT	PDIT	PDT	PDY	PE	PP				PDV
Q	Quantity	QRC	QIC			QR	QI	QSH	QSL	QSHL	QRT	QIT	QT	QY	QE					QZ
R	Radiation	RRC	RIC	RC		RR	RI	RSH	RSL	RSHL	RRT	RIT	RT	RY	RE		RW			RZ
S	Speed/Frequency	SRC	SIC	SC	SCV	SR	SI	SSH	SSL	SSHL	SRT	SIT	ST	SY	SE					SV
T	Temperature	TRC	TIC	TC	TCV	TR	TI	TSH	TSL	TSHL	TRT	TIT	TT	TY	TE	TP	TW		TSE	TV
TD	Temperature, Differential	TDRC	TDIC	TDC	TDCV	TDR	TDI	TDSH	TDSL		TDRT	TDIT	TDT	TDY	TE	TP	TW			TDV
U	Multivariable					UR	UI							UY						UV
V	Vibration/Machinery Analysis					VR	VI	VSH	VSL	VSHL	VRT	VIT	VT	VY	VE					VZ
W	Weight/Force	WRC	WIC	WC	WCV	WR	WI	WSH	WSL	WSHL	WRT	WIT	WT	WY	WE					WZ
WD	Weight/Force, Differential	WDRC	WDIC	WDC	WDCV	WDR	WDI	WDSH	WDSL		WDRT	WDIT	WDT	WDY	WE					WDZ
X	Unclassified																			
Y	Event/State/Presence		YIC	YC		YR	YI	YSH	YSL				YT	YY	YE					YZ
Z	Position/Dimension	ZRC	ZIC	ZC	ZCV	ZR	ZI	ZSH	ZSL	ZSHL	ZRT	ZIT	ZT	ZY	ZE					ZV
ZD	Gauging/Deviation	ZDRC	ZDIC	ZDC	ZDCV	ZDR	ZDI	ZDSH	ZDSL		ZDRT	ZDIT	ZDT	ZDY	ZDE					ZDV

Note: This table is not all-inclusive.
* A, alarm, the annunciating device, may be used in the same fashion as S, switch, the actuating device.
** The letters H and L may be omitted in the undefined case.

Other Possible Combinations:

- FO (Restriction Orifice)
- FRK, HIK (Control Stations)
- LLH (Level Light High)
- LCH (Level Control High)
- KQI (Running Time Indicator)
- HMS (Hand Momentary Switch)
- LCL (Level Control Low)

IDENTIFICATION LETTERS

	FIRST-LETTER: MEASURED OR INITIATING VARIABLE	FIRST-LETTER: MODIFIER	SUCCEEDING-LETTERS: READOUT OR PASSIVE FUNCTION	SUCCEEDING-LETTERS: OUTPUT FUNCTION	SUCCEEDING-LETTERS: MODIFIER
A	Analysis		Alarm		
B	Burner/Combustion		User's Choice	User's Choice	User's Choice
C	User's Choice			Control	
D	User's Choice	Differential			
E	Voltage		Sensor (Primary Element)		
F	Flow Rate	Ratio (Fraction)			
G	User's Choice		Glass, Viewing Device		
H	Hand				High
I	Current (Electrical)		Indicate		
J	Power	Scan			
K	Time, Time Schedule	Time Rate of Change		Control Station	
L	Level		Light		Low
M	User's Choice	Momentary			Middle, Intermediate
N	User's Choice		User's Choice	User's Choice	User's Choice
O	User's Choice		Orifice, Restriction		
P	Pressure, Vacuum		Point (Test) Connection		
Q	Quantity	Integrate, Totalize			
R	Radiation		Record		
S	Speed, Frequency	Safety		Switch	
T	Temperature			Transmit	
U	Multivariable		Multifunction	Multifunction	Multifunction
V	Vibration, Machinery Analysis			Valve, Damper, Louver	
W	Weight, Force		Well		
X	Unclassified	X Axis	Unclassified	Unclassified	Unclassified
Y	Event, State, or Presence	Y Axis		Relay, Compute, Convert	
Z	Position, Dimension	Z Axis		Driver, Actuator, Unclassified Final Control Element	

DRAFT FOR REVIEW

SCALE VERIFICATION: THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

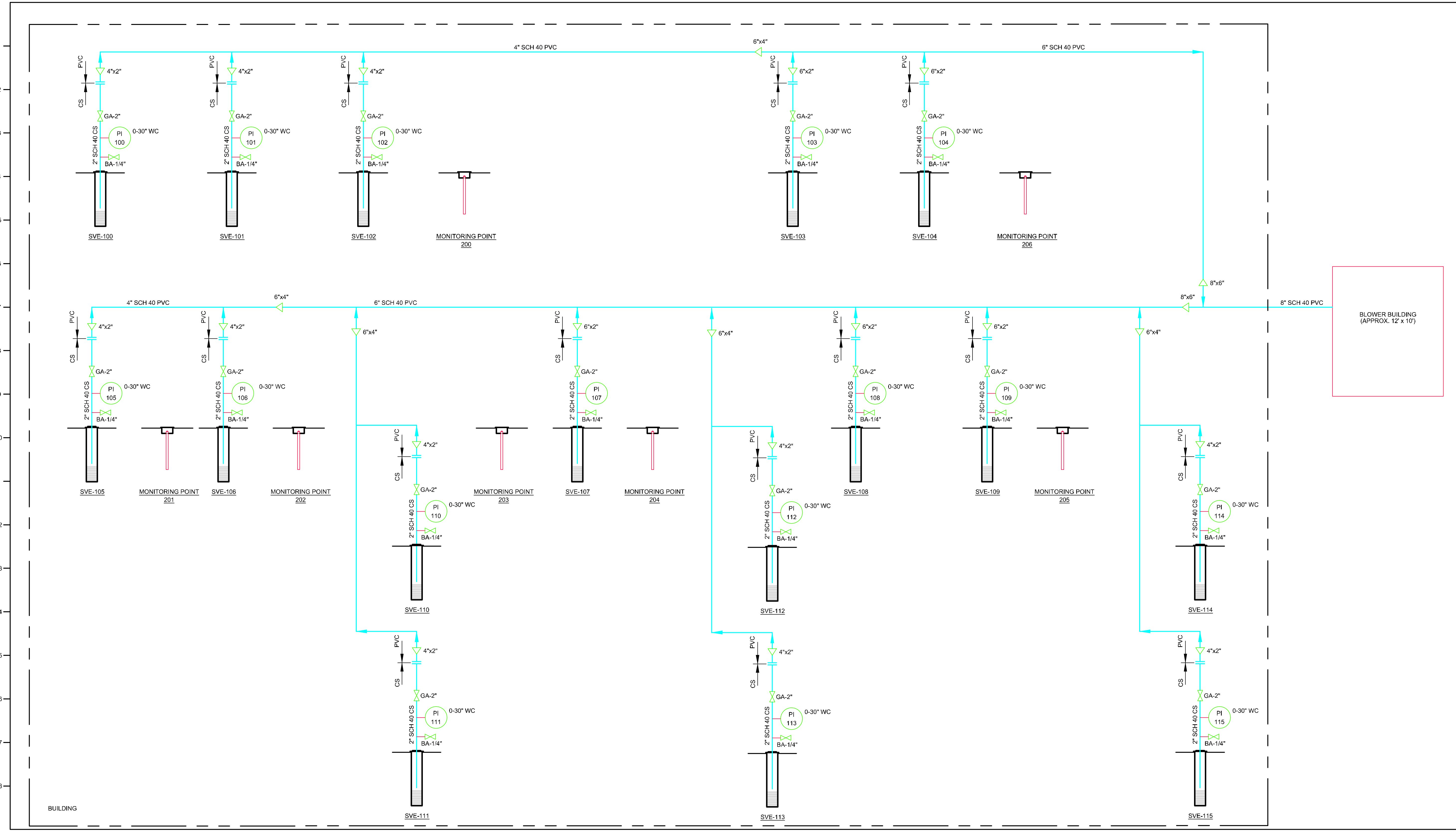
SUB-SLAB DEPRESSURIZATION SYSTEM

ENGINEERING FLOW DIAGRAM
LEGEND

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: OCTOBER 2012
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: NONE	Project No: 07843-M9	Report No: 120	Drawing No: EF-00

07843-M9(120)EF-BU002 APR 21/2014



PLANT ID.	1	2	3	4	5	6	7	8	9	10	11	12
NAME												
DESCRIPTION: MATERIAL												
SIZE												
CAPACITY												
TEMP/PRESS												
HP/VRPM												
WEIGHT												
MANUFACTURE												
MODEL												
VENDOR												

No	Revision	Date	Initial

DRAFT FOR REVIEW

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

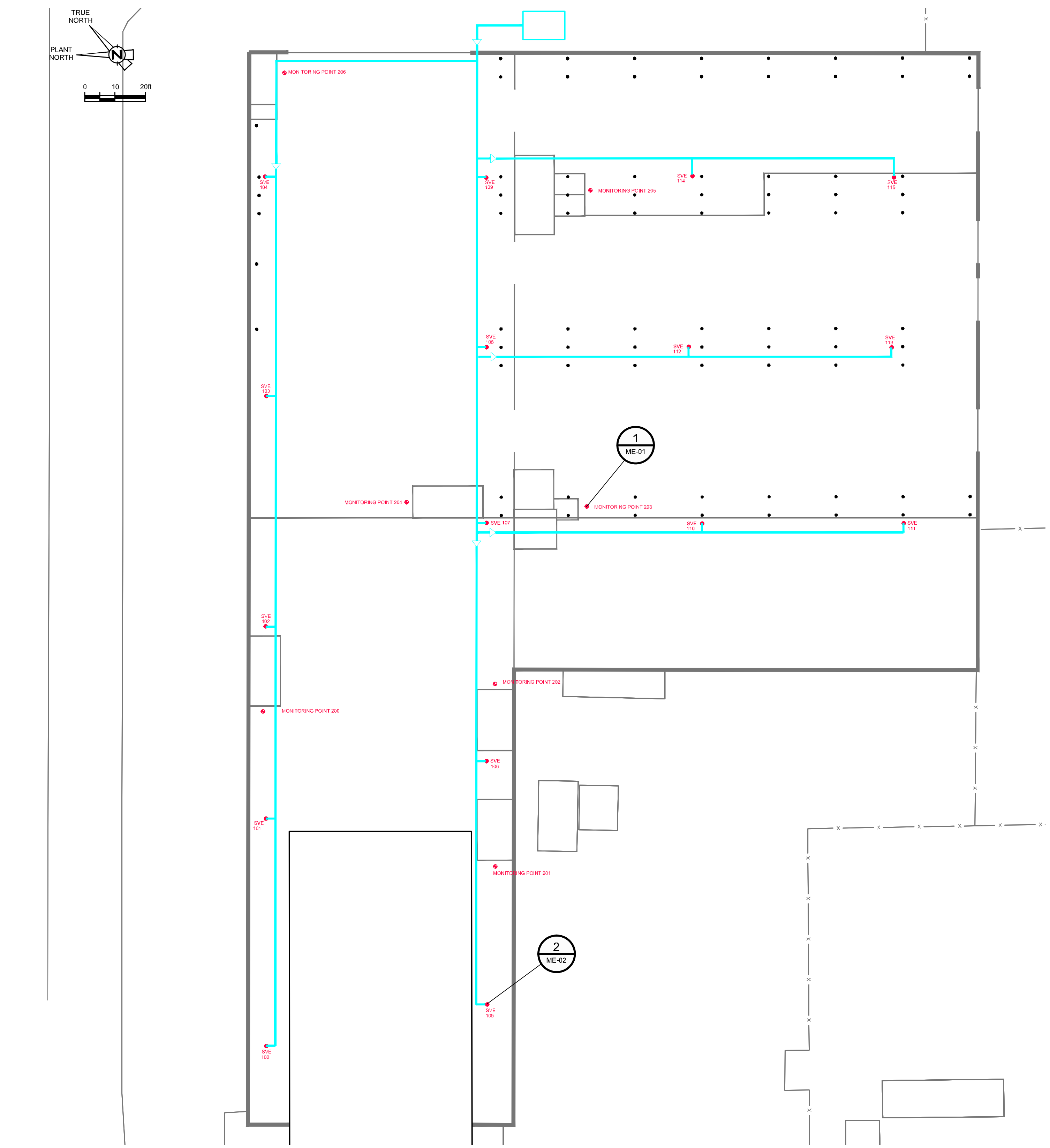
SUB-SLAB DEPRESSURIZATION SYSTEM

ENGINEERING FLOW SHEET
BUILDING 532

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: APRIL 2014
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: NONE	Project No: 07843-M9	Report No: 120	Drawing No: EF-01

07843-M9(120)EF-BU002 APR 21/2014



BUILDING 532 PIPING PLAN VIEW

GENERAL NOTES:

1. SCOPE OF WORK:
   CONTRACTOR SHALL COMPLETE A TURN-KEY ELECTRICAL INSTALLATION TO PROVIDE AN ANTICIPATED MINIMUM SERVICE REQUIREMENT OF 3-PHASE 240V/60A OR 3-PHASE 480V/40A
   SERVICE TO THE VAPOR EXTRACTION BLOWER. THIS TASK SHALL INCLUDE CONNECTION TO A, 3-PHASE DISTRIBUTION PANEL AND INTERCONNECTING WIRING.

2. INSPECTION AND VERIFICATION:
   IMMEDIATELY AFTER THE INSTALLATION CONTRACT IS SIGNED, CONTRACTOR SHALL INSPECT THE EXISTING FACILITY TO VERIFY AND CONFIRM THAT THE EXISTING DISTRIBUTION PANEL (AMPERAGE CAPACITY AND VOLTAGE) ARE ADEQUATE FOR THE SPECIFIED TASK. THIS WORK SHALL BE IN CLOSE COMMUNICATION WITH OWNER AND ENGINEER.

3. REGULATORY REQUIREMENTS:
   THE ENTIRE INSTALLATION SHALL COMPLY WITH THE REQUIREMENT OF THE LATEST REVISION OF THE APPLICABLE CODES, STANDARDS, GUIDES, AND PRACTICES PERTAINING TO THE JOB SITE, ALL INSTALLATION COMPONENTS SHALL CARRY APPROVAL LABEL WHERE REQUIRED BY LAW. AT A MINIMUM, CONTRACTOR'S WORK SHALL COMPLY WITH THE REQUIREMENTS OF ANSI/NFPA 70 - NATIONAL ELECTRICAL CODE (NEC); ANSI/IEEE C2 - NATIONAL ELECTRICAL SAFETY CODE(NESC); OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) REQUIREMENTS APPLICABLE TO THE PROJECT WORK; AND LOCAL AUTHORITY HAVING JURISDICTION AT THE PROJECT SITE.

4. MATERIAL REQUIREMENTS:
   ALL MATERIALS SHALL BE UL- APPROVED, FOR INDUSTRIAL APPLICATION, AS SHOWN ON THE DRAWINGS, AS SPECIFIED HEREIN, AND AS REQUIRED TO SUCCESSFULLY COMPLETE THE PROJECT.
   ALL WIRE AND CABLE SHALL BE NEC/UL TYPE FOR INSTALLATION IN RMC, 600V, SINGLE-CONDUCTOR STRANDED COPPER, THHN/THWN, SIZES AS SHOWN ON THE DRAWING AND AS REQUIRED BY NEC. THE GROUND WIRE SHALL BE PROVIDED WITH "GREEN" OUTER JACKET.
   ALL WIRING CONDUIT AND FITTINGS SHALL BE NEC RMC TYPE RIGID GALVANIZED STEEL, SIZES AS SHOWN ON THE DRAWINGS AND AS REQUIRED BY NEC.

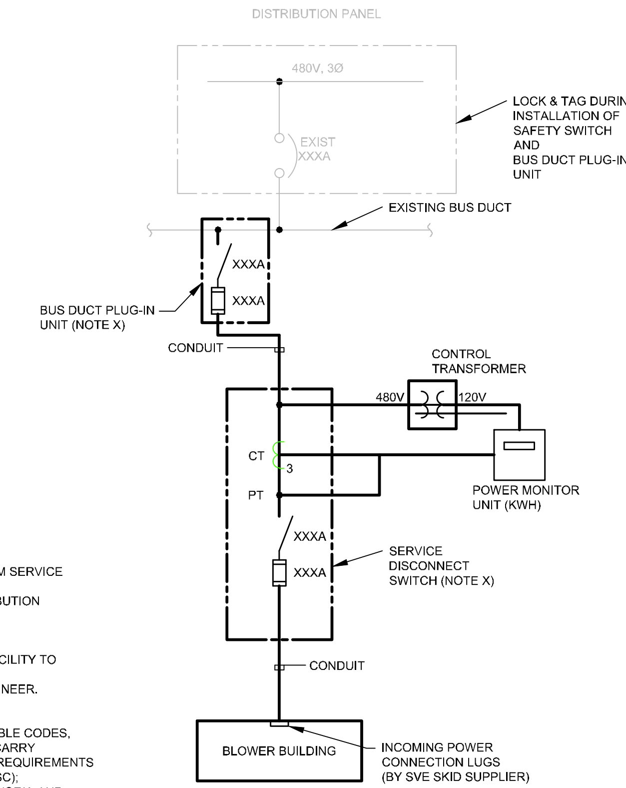
5. INSTALLATION REQUIREMENTS:
   CONTRACTOR SHALL COMPLETE INSTALLATION AS SHOWN ON THE DRAWINGS, IN ACCORDANCE WITH NEC, NESC, OSHA AND AS REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION.
   COMPLETE INSTALLATION OF THE VAPOR EXTRACTION BLOWER, INTERCONNECTING WIRING AS SPECIFIED.
   IF REQUIRED, OBTAIN INSTALLATION FINAL INSPECTION AND APPROVAL BY THE LOCAL AUTHORITY HAVING JURISDICTION.
   ON COMPLETION BUT PRIOR TO THE EQUIPMENT ENERGIZATION, CARRY OUT THE INSTALLATION INSPECTION WITH THE PROJECT ENGINEER TO HIS SATISFACTION. DEMONSTRATE TO ENGINEER THAT THE INSTALLATION HAS BEEN SUCCESSFULLY COMPLETED AS SHOWN AND SPECIFIED.
   PROVIDE EQUIPMENT ENERGIZATION.
   ALL EXISTING CONDITIONS SHALL BE RESTORED AT EACH SYSTEM LOCATION. FLOORING, PAINT, DRYWALL, CEILING TILE, ETC TO MATCH EXISTING WHERE APPLICABLE.
   ALL EXTRACTION PIPING IS TO BE INSTALLED AS CLOSE AS POSSIBLE TO BUILDING WALLS, COLUMNS, OR SUPPORT BEAMS, AND IN NO CASE MORE THAN 3 FEET FROM THE WALL TO THE CENTER OF PIPE UNLESS APPROVED BY THE ENGINEER AND PORT OF TACOMA. PROTECTIVE BARRIERS SHALL BE INSTALLED AS NEEDED TO PROTECT PIPING FROM DAMAGE. ENCLOSURES NEED TO BE PROVIDED FOR PIPING THAT IS NOT LOCATED IN A PROTECTED LOCATION, SUCH AS A SMALL CLOSET. THIS INCLUDES PIPING ON THE EXTERIOR OF A BUILDING, AS WELL AS IN THE OPERATIONAL AREAS OF BUILDINGS. INTERIOR ENCLOSURES MAY BE STEEL ANGLE RAILING AND PAINTED SAFETY YELLOW FOR VISIBILITY AROUND PIPE. EXTERIOR ENCLOSURES WILL BE STEEL FRAMING WITH SIDING/TRIM TO MATCH EXISTING. ENCLOSURES SHALL BE KEPT AS SMALL AS POSSIBLE AND NO LARGER THAN 4 FT x 4 FT. THE CONTRACTOR WILL BE DIRECTED ON THIS NEED BY THE ENGINEER AND POT. ANY EXTERIOR GALVANIZED COMPONENTS SHALL BE PAINTED SUCH THAT NO GALVANIZED SURFACES ARE EXPOSED.

6. TO AVOID ENTRY OF EXTRACTED SUBSURFACE VAPORS INTO THE BUILDING, THE VENT PIPE'S EXHAUST SHOULD BE:
   a. ABOVE THE EAVE OF THE ROOF (PREFERABLY, ABOVE THE HIGHEST EAVE OF THE BUILDING AT LEAST 12 INCHES ABOVE THE SURFACE OF THE ROOF).
   b. AT LEAST 10 FEET ABOVE GROUND LEVEL.
   c. AT LEAST 10 FEET AWAY FROM ANY OPENING THAT IS LESS THAN 2 FEET BELOW THE EXHAUST POINT, AND
   d. 10 FEET FROM ANY ADJOINING OR ADJACENT BUILDINGS, OR HVAC INTAKES OR SUPPLY REGISTERS.
   GREATER DISTANCES FROM BUILDING OPENINGS WILL BE CONSIDERED WHERE PRACTICAL.

7. RAIN CAPS, IF USED, SHOULD BE INSTALLED SO AS NOT TO INCREASE THE POTENTIAL FOR EXTRACTED SUBSURFACE VAPORS TO ENTER THE BUILDING.

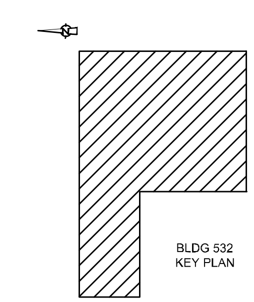
8. SUBMITTAL REQUIREMENTS:
   SUBMITTALS FOR ALL EQUIPMENT AND MATERIALS SHALL ALL BE REQUIRED AND SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL.

9. MATERIALS GENERATED DURING INSTALLATION:
   DUST MITIGATION MEASURES ARE TO BE USED TO KEEP CEMENT DUST GENERATION TO A MINIMUM.
   ANY CONCRETE, SOIL, OR OTHER DEBRIS GENERATED WILL BE CONTAINERIZED FOR CHARACTERIZATION AND PROPER DISPOSAL BY OCC. IF ANY SUSPECTED OR KNOWN ASBESTOS-CONTAINING MATERIAL IS ENCOUNTERED IN AN AREA THAT CANNOT BE AVOIDED, THEN IT SHALL BE REMOVED OR ENCAPSULATED AS NECESSARY BY APPROPRIATELY LICENSED PERSONS.



SINGLE LINE DIAGRAM

NOTE:
1. TO BE DETERMINED



BLDG 532 KEY PLAN

DRAFT FOR REVIEW

SCALE VERIFICATION: THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

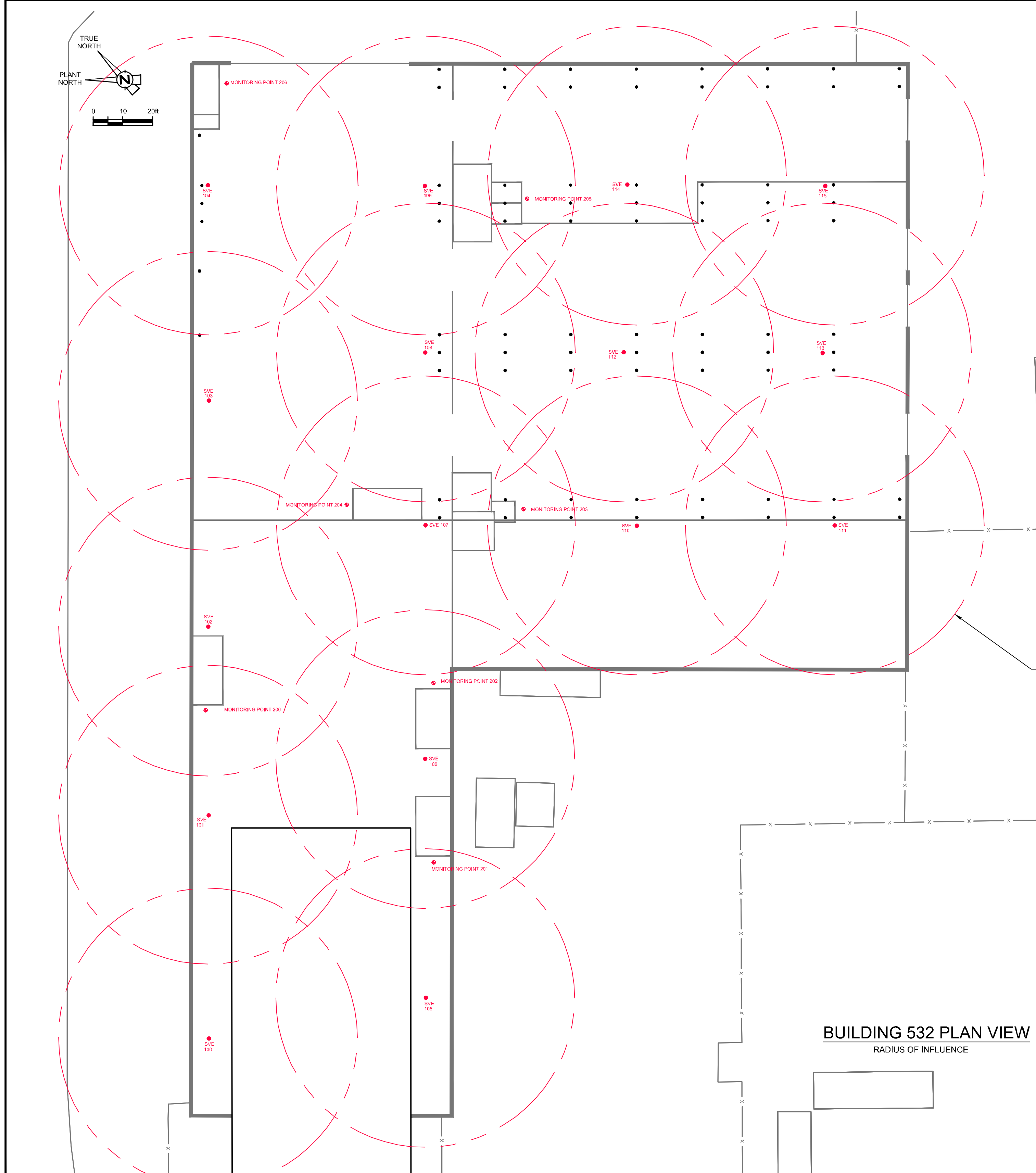
SUB-SLAB DEPRESSURIZATION SYSTEM

PIPING PLAN AND DETAILS
BUILDING 532

CONESTOGA-ROVERS & ASSOCIATES

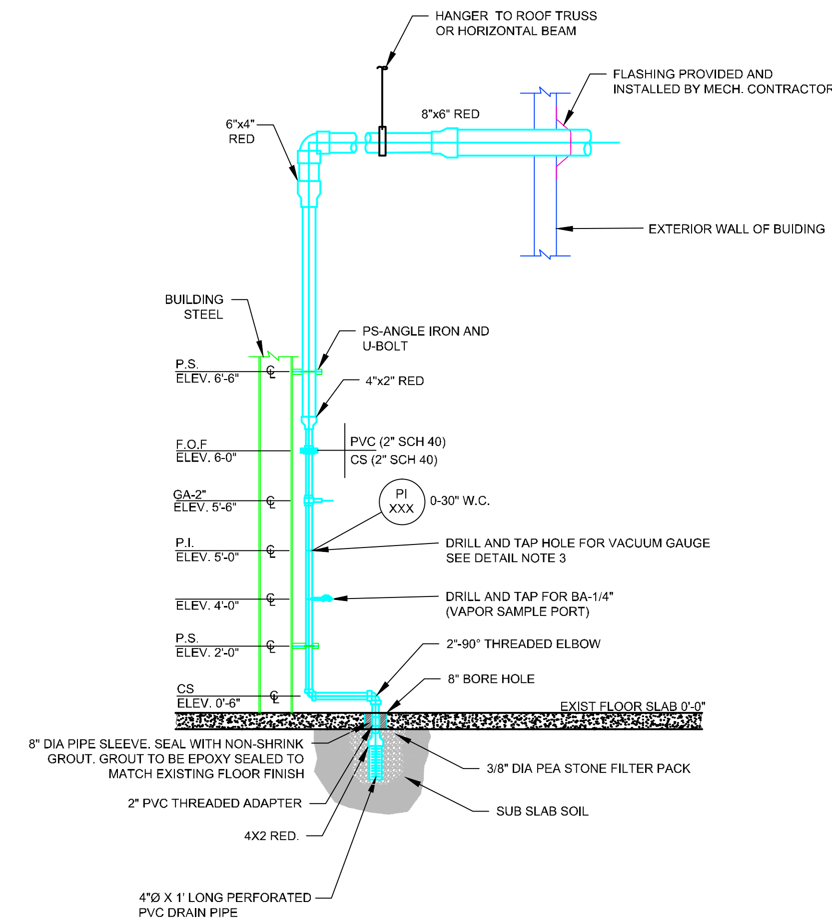
Source Reference:			Date: APRIL 2014
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: AS NOTED	Project No: 07843-M9	Report No: 120	Drawing No: ME-01

07843-M9(120)ME-BU004 APR 21/2014



BUILDING 532 PLAN VIEW

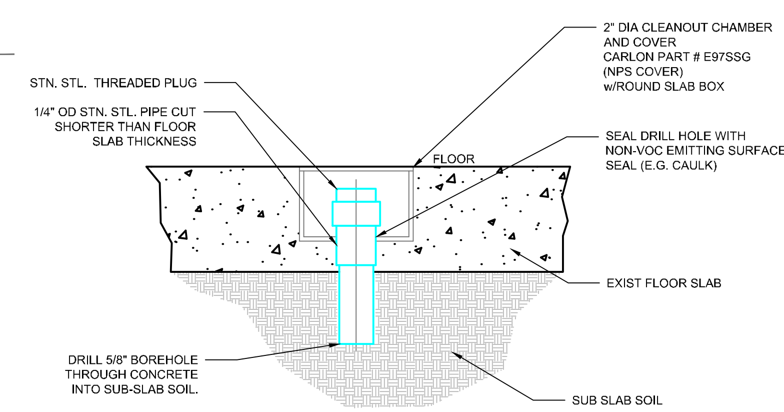
RADIUS OF INFLUENCE



DETAIL NOTES
1. SUPPORT AS REQUIRED
2. ALL HORIZONTAL PIPE RUNS TO BE SLOPED BACK TO SLAB PENETRATION
3. VACUUM GAUGE WIKA 30" H2O, PART No. 9851852, TYPE 611.10 2.5

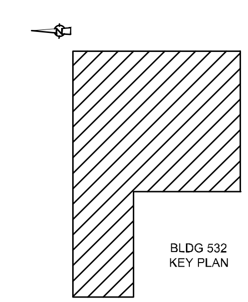
TYPICAL SVE PIPING DETAIL 2 ME-01

NTS



TYPICAL MONITORING POINT DETAIL 1 ME-01

NTS



BLDG 532 KEY PLAN

DRAFT FOR REVIEW

SCALE VERIFICATION: THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

No	Revision	Date	Initial

OCCIDENTAL CHEMICAL CORP.
TACOMA, WASHINGTON

SUB-SLAB DEPRESSURIZATION SYSTEM

RADIUS OF INFLUENCE AND DETAILS
BUILDING 532

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:			Date: APRIL 2014
Project Manager: B. KRAMER	Reviewed By: B. KRAMER	Designed By: J. WORRALL	Drawn By: L. VAN NOTE
Scale: AS NOTED	Project No: 07843-M9	Report No: 120	Drawing No: ME-02

07843-M9(120)ME-BU004 APR 21/2014

Appendix C

Manufacturer Cut Sheets

HS2000E Radon Fan w/ Electrical Switch Box

Item # 23004-4

Description - HS fans offer a proven solution for tough radon mitigation jobs, providing up to 25 times the suction of inline tube fans to deal with sand, tight soil or clay sub-slab material.

Quantity Price Discounts apply at 5+. Pricing will update when added to Shopping Cart.

RadonAway is a B2B business only. You must be an approved RadonAway customer to purchase products through this website. If you are an existing RadonAway customer and need a website login, click here. If you are a professional and would like to become a RadonAway customer, click here.

Technical Specifications:

Features:

- Internal condensate bypass
- Mounts vertically indoors or outdoors
- Inlet: 3.0" PVC/Outlet: 2.0" PVC
- Weight: 18 lbs.
- Size: 15"W x 13"H x 8"D
- One-year limited warranty (3-year option available)

Radon Fan Model Selection Guidelines:

(Choice of model is dependent on building characteristics and should be made by a radon professional.)

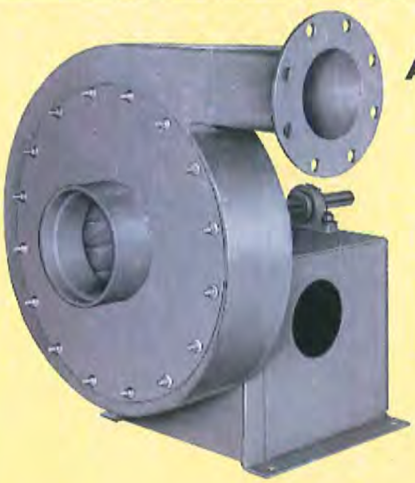
- **HS2000** - High suction and high flow for large areas such as schools and commercial buildings
- **HS3000** - Single family homes with very tight sub-slab material

- **HS5000** - For extremely tight sub-slab material or where the number of holes is restricted; also useful for high altitudes

Additional Fan Information:

- Downloadable Fan Installation Instructions (PDF format)
- Calculate your estimated annual electrical cost.

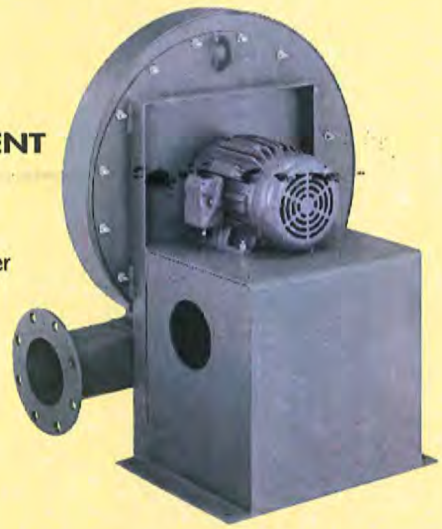
				Typical CFM vs. Static Pressure WC					
Model	**P/N**	**Watts**	**Max Pressure "WC**	**0"**	**10"**	**15"**	**20"**	**25"**	**35"**
HS2000	23004-1	150-270	18	110	72	40	-	-	-
HS3000	23004-2	105-195	27	40	33	30	23	18	-
HS5000	23004-3	180-320	50	53	47	42	38	34	24



ARRANGEMENT

1

Pressure Blower with plain pipe inlet.



ARRANGEMENT

4

Pressure Blower with motor.

ARRANGEMENT

4-V

Pressure Blower with motor.

The New York Blower Company certifies that the Pressure Blowers shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program.

PRESSURE BLOWERS

...for process systems

DESIGN FEATURES

- Pressures to 58"WG.
- Capacities to 5,200 CFM.
- Stable performance . . . the pressure curve remains stable from wide-open to closed-off . . . fan instability, or pulsation, is eliminated even when "turn-down" approaches zero flow.
- Choice of wheel designs . . . standard aluminum wheel for optimum efficiency or optional steel wheel for more rugged applications.
- Efficiency . . . advanced wheel and aerodynamic housing design combine for air-handling efficiency superior to conventional radial-wheel designs.
- Variable wheel diameters and a choice of six outlet sizes enable efficient fan selection across a wide range of volumes and pressures.
- Choice of arrangements . . . direct-drive and belt-drive.
- Wide application range . . . designed for continuous operation in combustion, cooling, conveying, drying, and various process systems.

CONSTRUCTION FEATURES

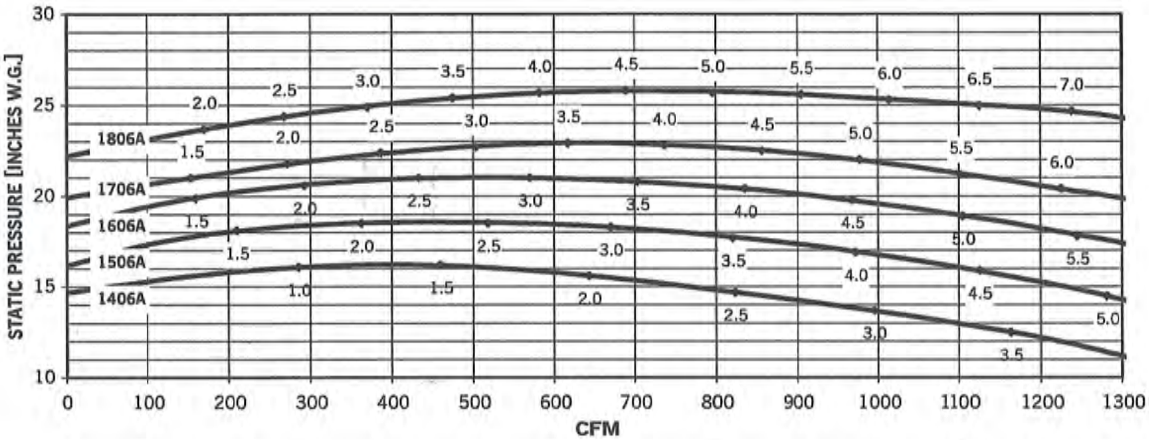
- All-welded steel housings . . . heavy-gauge housings are designed specifically to prevent "flexing" at high pressures.
- Flanges . . . continuously welded flanges match ANSI Class 125/150 hole pattern.
- Balance . . . all wheels are precision-balanced prior to assembly . . . fans with motors and drives mounted by **nyb** are given a final trim balance check at the specified running speed.
- Shafting . . . straightened to close tolerance to minimize "run-out" and ensure smooth operation.
- Inlet configuration . . . a choice of three inlet types allows units to be tailored to specific application requirements.
- Lifting eyes . . . standard on all units for ease of handling and installation.
- Finish . . . medium-green industrial coating.

PERFORMANCE AT 3500 RPM

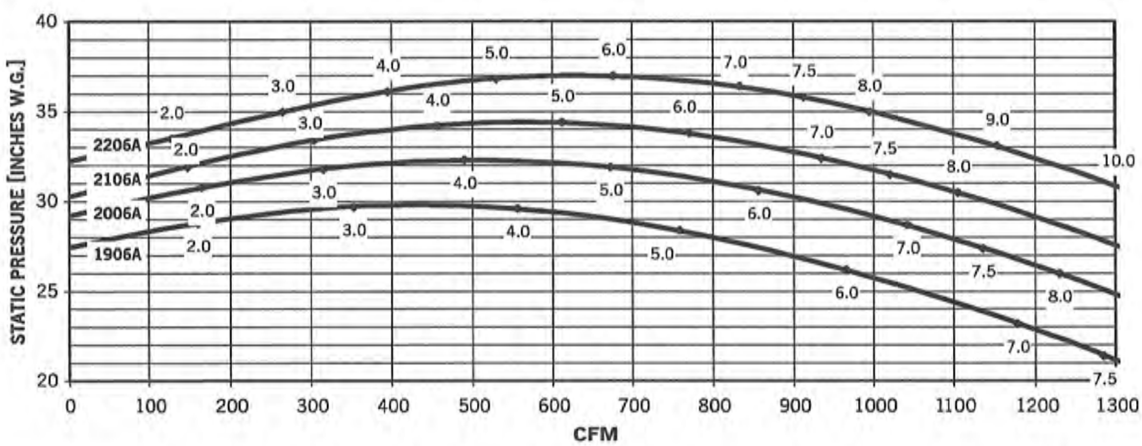
Aluminum Wheel
Pressure Blower

NOTE: Values shown on curves indicate brake horsepower [BHP] required.

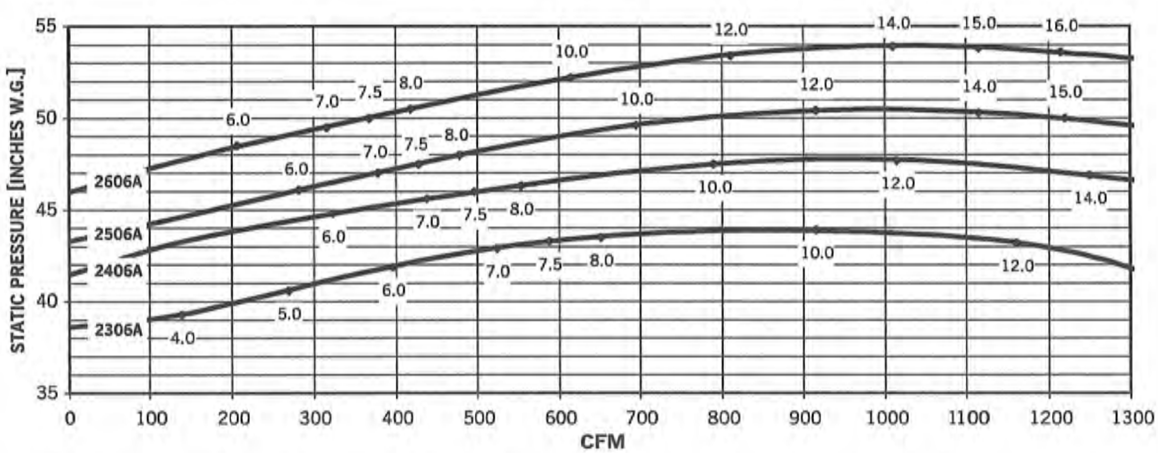
1406A-1806A



1906A-2206A



2306A-2606A



Performance certified is installation Type B: Free inlet, Ducted outlet. Power rating (BHP) does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories).

LOW PRESSURE GAUGES

Type 611.10

WIKA type 6X1.10 low pressure gauges are extremely sensitive and highly accurate. The capsule element pressure system is designed to measure pressure and vacuum of gaseous media from as low as 10" H_2O to 275" H_2O (10 psi). The finely polished nickel-silver pinion gear and shaft of the movement ensure repeatable accuracy.

Standard Features

Size:	2½"	**Pointer:**	Black aluminum
Case:	Black-painted steel	**Accuracy:**	±1.5% of span
Wetted Parts:	Copper alloy		ASME B40.100 Grade B
Window:	Snap-in acrylic	**Connection:**	Lower or center back mount
Dial:	White aluminum		

Type		611.10	
Size		2½"	
Connection		LM	CBM
Conn. Size		1/4" NPT	
" H_2O	mm H_2O		
30 Vac	760	9852344	9851852
60 Vac	1500	9748321	9748339
100 Vac	2500	9747473	9747465
" H_2O	mm H_2O		
15	380	9851682	9851860
30	760	9851690	9855785
60	1500	9851704	9803432
100	2500	9851810	9851879
200	5000	9851828	9851887
oz./sq. in.	mm H_2O		
10	440	9851771	
15	660	9851780	
20	880	9851798	
30	1320	9851747	9851917
35	1540	9851801	9857273
60	2640	9851755	9803548
oz./sq. in.	" H_2O		
20	34	9851720	9857281
32	55	9851739	9855793
3 psi		9851925	9851836
5 psi		9851933	9851844
10 psi		4204212	4204221
Accessory order codes (installed at factory)			
Front flange, chrome		+FF C	
Front flange, black		+FF B	
Restrictor		+R	

Stock items shown in **blue** print

Available Options

- Rear flange (2½" only)
- Vacuum and overpressure safety
- Instrument or safety glass window
- Cleaned for oxygen service
- Adjustable red min/max pointer on window
- Other connections
- 2" case size
- U-clamp panel mount option
- Restrictor
- Stainless steel case

Applications

- Fluid medium, gaseous or dry, which does not clog connection port or corrode copper alloy

  Example: low pressure pneumatic systems

Abbreviations
CBM - Center back mount
LM - Lower mount
SS - Stainless steel

Capsule Pressure Gauges

Black-Painted Steel Case
Copper Alloy Wetted Parts
Low Pressure Series • Type 611.10

Pressure Gauges

Application
Fluid medium, gaseous or dry, which does not clog connection port or corrode copper alloy.
Example: low pressure pneumatic systems.

Sizes
2½" (63 mm)

Accuracy
± 1.5% of span (± 2.5% for 10" H2O range)

Ranges (All ranges not stocked)
2½": 10 "H2O to 240 "H2O (25 to 600 mbar)
or other equivalent units of pressure or vacuum

Working Range
Steady: Full scale value
Fluctuating: 0.9 x full scale value

Operating Temperature
Ambient: -4°F to 140°F (-20°C to 60°C)
Media: max. 140°F (+60°C)

Temperature Error
Additional error when temperature changes from reference temperature of 68°F (20°C) ±0.4% for every 18°F (10°C) rising or falling. Percentage of span.

Standard Features

Connection
Material: copper alloy
Lower mount (LM)
Center back mount (CBM)
1/8" NPT or 1/4" NPT

Capsule Element
Material: copper alloy

Movement
Copper alloy, nickel-silver pinion gear and shaft. Zero adjustment screw on dial

Dial
White aluminum with black lettering

Pointer
Black aluminum (zero adjust on dial- remove window to access)

Case
Black steel

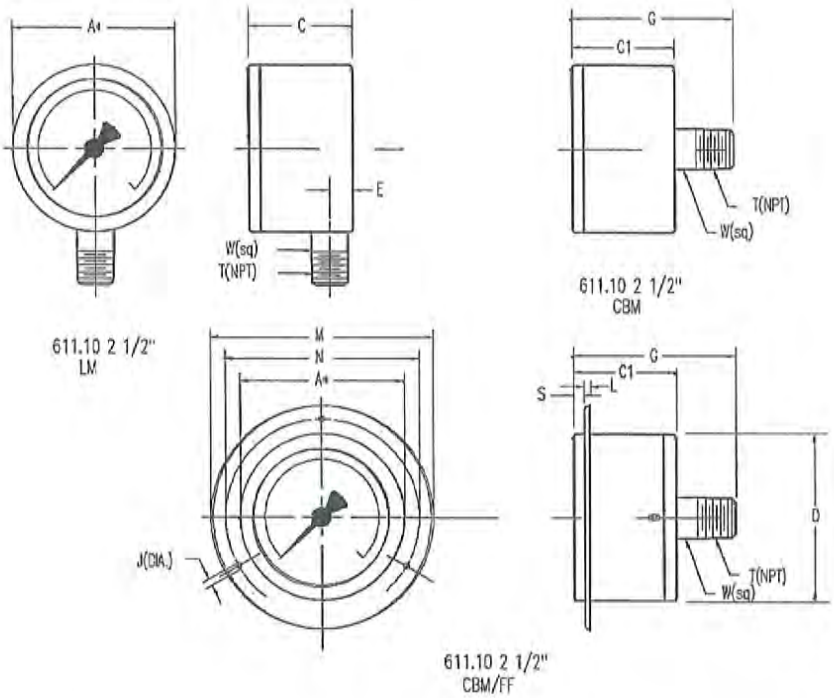
Weather Protection
Dust resistant (NEMA 2 / IP 32)

Standard Scales
in. H2O/mm H2O
oz.-sq. in./mm H2O
oz.-sq. in./in. H2O
PSI

Window
Snap-in acrylic window

Order Options (min. order may apply)
Front or rear flange
Brass threaded restrictor
U-Clamp steel zinc plated with stainless steel polished profile ring
Stainless steel case and ring
Safety glass and instrument glass window
Overpressure and underpressure protection
Cleaned for oxygen service
Medical specification
Special connections limited to wrench flat area
Nickel plated connection
Special case colors
Externally adjustable red mark pointer (set pointer)
Externally adjustable red drag pointer (max. hand)
Custom dial layout
DIN standards
Other pressure scales available

Dimensions:



A* NOMINAL SIZE																	
TYPE	WEIGHT	KEY	A*	B	C	C1	D	E	G	J	L	M	N	S	T	W
611.10		mm	63	52	40	36.5	63	9.5	55.5	3.6	2	85	75	2	–	14
2½"	0.45 lbs.	in	2.5	2.05	1.58	1.44	2.48	0.37	2.19	0.14	0.08	3.35	2.95	0.08	1/4"	0.55

Recommended panel cut-out: D + 1mm

THE MEASURE OF
Total Performance™

Ordering Information:
State computer part number (if available) / type number / size / range / connection size and location / options required.

Specifications given in this price list represent the state of engineering at the time of printing. Modifications may take place and the specified materials may change without prior notice

05/02

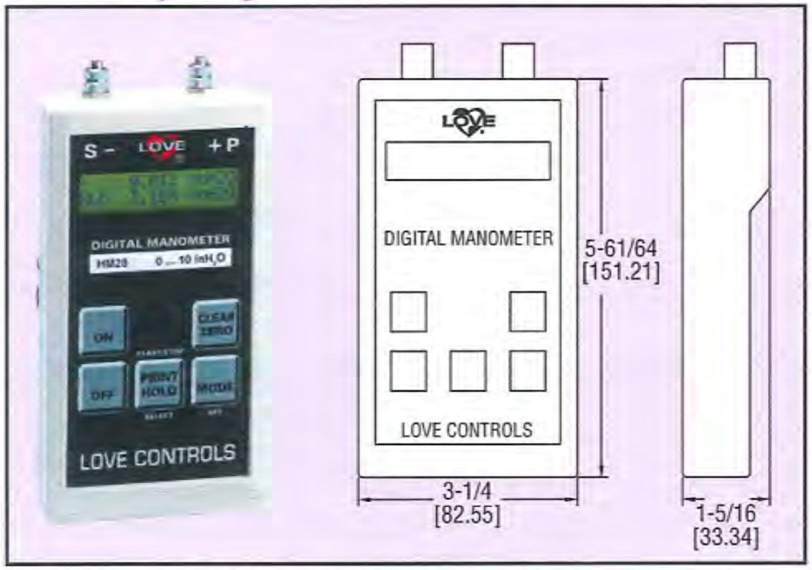
WIKA
WIKA Instrument Corporation
1000 Wiegand Boulevard
Lawrenceville, Georgia 30043-5868
Tel: 770-513-8200 Fax: 770-338-5118
http://www.wika.com e-mail: info@wika.com

Series HM28

Handheld Digital Manometer

High Accuracy (0.2%, 0.1% or 0.05%), Differential, Gage or Absolute

CE



The Series HM28 Digital Hand-Held Manometer is a precision instrument designed to measure a wide range of pressures to a very high accuracy. The unit incorporates a variety of features in an easy to use format that makes it useful in a wide variety of applications. Features include: measurement in all common pressure ranges, display resolution to 0.001, differential or relative measurement, two line liquid crystal display, and adjustable auto power off to conserve battery.

We are so proud of the accuracy of the HM28 that we provide a certificate of calibration with the unit at no additional cost. Depending on your application, the HM28 can be used as a secondary calibration standard for your other pressure instrumentation.

ACCESSORIES

HM28-0, 1/8˝ NPT Adaptor 1 piece
HM28-1, Communication Software & Cable
HM28-2, Universal Power Adaptor

SPECIFICATIONS

Pressure Connection: Hose; 4/6 mm or 1/8˝ NPT.
Accuracy: (Includes linearity, hysteresis, and repeatability): per order code.
±0.20% full scale ±1 digit
±0.10% full scale ±1 digit
±0.05% full scale ±1 digit
Measuring Media: Instrument air or inert gases. For HM28G3XXXXX, any material compatible with 18/8 stainless steel.
Temperature Limits: 23 to 122°F (-5 to 50°C).
Storage Temperature: -4 to 140°F (-20 to 60°C).
Humidity: 30 to 95% rH, non-condensing.
Display: 2 line, 16 character, dot matrix LCD, with switchable display sizes.
Battery: 9V alkaline (included). Can operate from external power supply of 7 to 14 VDC.
Current Consumption: <9 mA.
Memory: 964 measured values. Recording intervals adjustable from manual, 1, 5, 10, 20, 30 seconds, 1, 2, 3, 5, 10, 30, 60 minutes.
Case Protection: IP54.
Case Dimensions: 6 x 3.27 x 1.34 in (152 x 83 x 34 mm).
Weight: 9.5 oz (270 g).
Maximum Measurement Rates: Stand alone: 2-1/2 readings/sec (0.1% and 0.05% ratings), 5 readings/sec (0.2% rating). Output to RS-232: 20 measurements/sec (0.2% rating). 10 measurements/sec (0.1% and 0.05% ratings).
RS-232 Baud Rate: Adjustable, 1200, 2400, 4800, or 9600 baud.
Agency Approvals: CE.

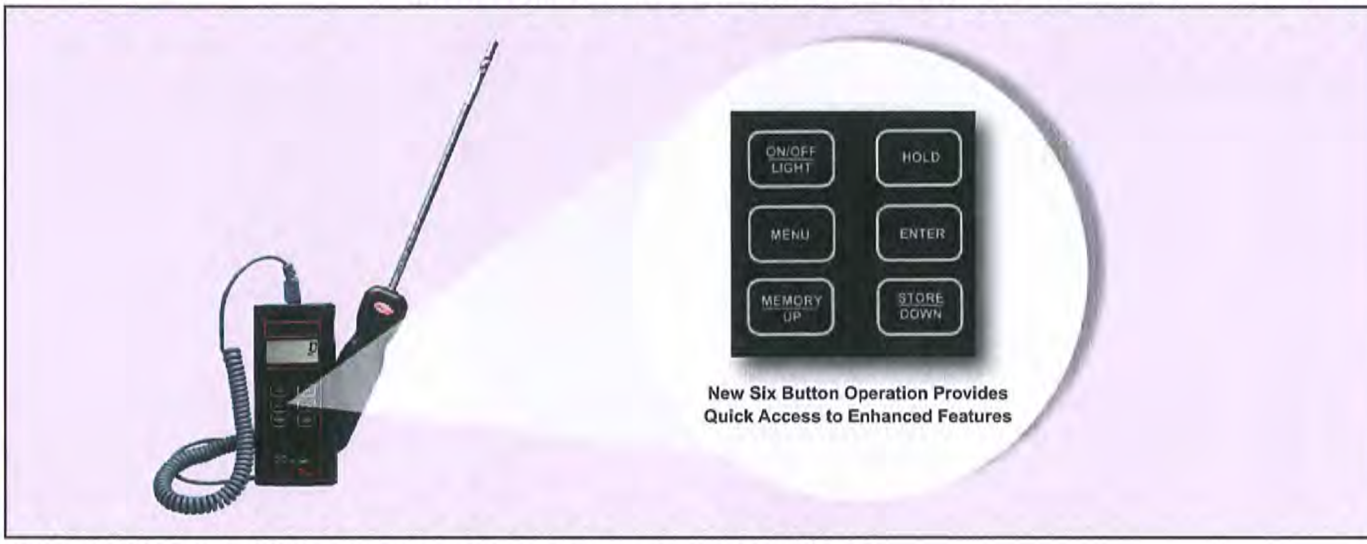
Part Number	Features
Error limit 0.2% F.S. for gage, underpressure and differential pressure	
HM28D3B10000	0-10 in w.c. (2.5 kPa)
HM28D3C10000	0-28 in w.c. (7 kPa)
HM28D3F10000	0-120 in w.c. (30 kPa)
Error limit 0.05% F.S. for gage, underpressure and differential pressure	
HM28D3C30000	0-28 in w.c. (7 kPa)
HM28D3F30000	0-120 in w.c. (30 kPa)
HM28D3K30000	0-100 psi (700 kPa)
For Absolute pressure	
HM28A3I10000	0-15.9 psia (0.2% F.S. (110 kPa abs)

Consult factory for 0.10% models.

Model 471B

Thermo-Anemometer Test Instrument

Measures Air Velocity or Air Volume and Temperature Simultaneously



New Six Button Operation Provides Quick Access to Enhanced Features

TEST EQUIPMENT

Thermo-Anemometers

The Model 471B Digital Thermo Anemometers are versatile dual function instruments that quickly and easily measure air velocity or volumetric flow plus air temperature in imperial or metric units. High contrast LCD display shows both selected readings simultaneously. Convenient backlight provides perfect visibility in low light conditions. Light automatically shuts off after 2-1/2 minutes to prolong battery life. Low battery warning is included. Stainless steel probe with comfortable hand grip is etched with insertion depth marks from 0 to 8 inches and 0 to 20 cm. Extruded aluminum housing fully protects electronics, yet is lightweight and comfortable to hold even when taking multiple readings as part of duct traverses. Up to 99 readings may be stored for later retrieval. An integral sliding cover protects sensors when not in use. Items included with the 471B are 9 volt alkaline battery, sensing probe, wrist strap and custom carrying case.

Model 471B-1, Digital Thermo Anemometer includes 9V battery, sensing probe, wrist strap, soft carrying case and instructions

ADDITIONAL PARTS

AP1, Thermo anemometer air velocity & temperature probe with coiled cable

UHH-C1, Soft carrying case

SPECIFICATIONS

Service: Air velocity and temperature of clean, dry air.

Temperature Limits:

Process Air Velocity: -20 to 212°F (-29 to 100°C);

Process Temperature: -40 to 212°F (-40 to 100°C);

Ambient: 5 to 125°F (-15 to 51°C).

Display: 4.5 digit LCD.

Resolution: 0.1%, 0.1 °F/°C.

Range Air Velocity: 0 to 6000 FPM (0 to 30 m/s).

Accuracy Air Velocity: ±3% FS within temperature range of 40 to 90°F (4 to 32°C).

Range Volumetric Air Flow: 19,999 in selected flow units.

Range Temperature: -40 to 212°F (-40 to 100°C).

Accuracy Temperature: ±0.5°F (±0.28°C) from 32 to 122°F (0 to 50°C); ±1.5°F (±0.83°C) from -40 to 32°F (-40 to 0°C) & 122 to 212°F (50 to 100°C).

Probe Length: 8" (203 mm) insertion.

Cable Length: 28" (71 cm) retracted, 6 ft (183 cm) extended.

Power Requirements: 9 V alkaline battery, included, user replaceable.

Weight: 16 oz (454 g).

Agency Approvals: CE, RoHS.

Replaceable Probe with Secure 6 Pin Adapter

Soft Carrying Case Included with Every Unit

Ball Valve – Chemcock® PVC Schedule 80
A45CC-V

enlarge

The Chemtrol® Chemcock® bi-directional ball valve is injection molded PVC construction and is ideal for laboratories, monitoring systems, sampling, and a variety of other applications as original equipment.
>>> more

Resources

Spec Sheet
Price Sheet PDF
Price Sheet Excel
Warranty
MSDS

Add To Submittal

- Valve pressure rating 150 psi at 73°F water non-shock full-port
- Maximum service temperature 140°F
- Full port
- Replaceable FKM O-rings
- Hose x male NPT threaded connections
- Do not use or test with compressed air or other gases
- ASTM F1970
- NSF/ANSI Standard 14
- NSF/ANSI Standard 61, Annex G
- Size ¼"

SKU

Size	Description	UPC	NIBCO #
1/4	A45CC-V 1/4 MXH CHEMCOCK	039923736963	MA507A4

Chemcock® is a registered trademark of NIBCO INC. Chemtrol® is a registered trademark of NIBCO INC.

GATE VALVE TECHNICAL DATA

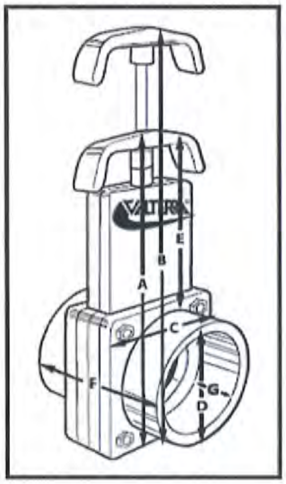
MATERIAL & GENERAL SPECIFICATIONS

	1½" (50mm)	2" (63mm or 75/90mm)	3" (90mm)	4" (110mm)	6"/8" (160/200mm)	10" / 12"
Color	White or Black (Gray)	White or Black (Gray)	White or Black (Gray)	White (Gray)	White (Gray)	White
Hubs	PVC or ABS (PVC)	PVC or ABS (PVC)	PVC or ABS (PVC)	PVC (PVC)	PVC	PVC
Body	PVC or ABS (PVC)	PVC or ABS (PVC)	PVC or ABS (PVC)	PVC (PVC)	ABS	ABS
Shaft	304SS	304SS	304SS	304SS	304SS	304SS
Paddle	Polypro	Polypro or 304SS	Polypro or 304SS	304SS	304SS	304SS
Handle	Plastic or Die Cast Al	Plastic or Die Cast Al	Plastic or Die Cast Al	Die Cast Al	304SS	304SS
Seals	Sarlink	Sarlink	Sarlink	Sarlink	Sarlink	Sarlink
PSI	45	40	30	20	10	10
Mid-Flow Max Closing Pressure	6 psi	1 psi (PP) 15 psi (SS)	.5 psi (PP) 9 psi (SS)	8 psi	2.5 psi	2.5 psi
Air Cylinder	Reinforced Nylon	SS or Reinforced Nylon	SS or Reinforced Nylon	SS	SS	SS

Notes:
Vacuum Applications: 1½" to 4" tested to 26 Hq in.
Metric Valves are Gray PVC

MANUAL VALVE DIMENSIONS (Inches)(mm)

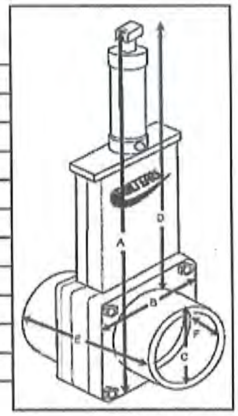
Size	A	B	C	D	E	F	G
1.5 ABS	6.5	8.625	2.875	2.375	3.9375	2.875	0.7
1.5 PVC	6.5	8.625	2.875	2.375	3.9375	3.375	1.25
50mm	168	222	76	64	98	98	35
2 ABS	7.5	10.25	3.37	2.6875	4.5	3.125	0.75
2 PVC	7.5	10.25	3.37	2.75	4.5	3.5	1.125
63mm	191	260	86	73	111	105	37
75/90mm	238	324	111	89	130	133	48
3 ABS	9.25	13	4.375	3.9375	5.1875	4.5	1.6
3 PVC	9.25	13	4.375	3.9375	5.1875	4.5	1.8
90mm	238	324	111	105	130	133	48
4 PVC	13.25	18	6.625	5	7.4375	5.1875	1.75
110mm	330	454	168	127	181	130	44
6 PVC	22.75	31.125	11	7.25	13.25	11.125	4.375
160mm	572	800	279	181	343	279	111
8 PVC	22.75	31.125	11	9.3125	12.1875	13.75	5.67
200mm	572	797	279	216	327	276	108
10 PVC	35	48.5	18	11.5	16.99	13.75	5
12 PVC	35	48.5	18	13.5	18	15.375	6



"B" Dimension is height of valve in fully open position

PNEUMATIC VALVE - ALUMINUM/STAINLESS STEEL AIR CYLINDER DIMENSIONS (Inches)(mm)

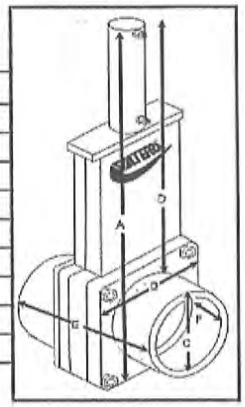
Size	A	B	C	D	E	Air Tubing Size	Recomm. Operating Pressure	Cylinder Air Volume
2	12.5	3.5	2.75	8.5	3	1/8"	55-70 psi	1.209 in³
63mm	318	86	73	216	105	1/8"	55-70 psi	1.209 in³
3	15.5	4.5	4	11.25	4.5	1/8"	55-70 psi	1.662 in³
90mm	394	111	105	286	133	1/8"	55-70 psi	1.662 in³
4	19.5	6.5	5	13.25	5	1/8"	55-70 psi	1.742 in³
110mm	489	168	127	337	130	1/8"	55-70 psi	1.742 in³
6	In Development							
160mm	In Development							
8	In Development							
200mm	In Development							
10	In Development							
12	In Development							



Note: Aluminum/SS Air Cylinders assembled with Air Restrictor - removal of restrictor voids warranty

PNEUMATIC VALVE - REINFORCED NYLON PLASTIC AIR CYLINDER DIMENSIONS (Inches)(mm)

Size	A	B	C	D	E	Air Tubing Size	Recomm. Operating Pressure	Cylinder Air Volume
1.5	10	2.875	1.875	7.375	2.875	I.D. 4 mm x O.D. 6 mm	60-75 psi	1.196 in³
50mm	254	76	64	187	98	I.D. 4 mm x O.D. 6 mm	60-75 psi	1.196 in³
2	11	3.5	2.75	8	3	I.D. 4 mm x O.D. 6 mm	60-75 psi	1.196 in³
63mm	279	86	73	203	105	I.D. 4 mm x O.D. 6 mm	60-75 psi	1.196 in³
3	13	4.5	4	8.5	4.5	I.D. 4 mm x O.D. 6 mm	60-75 psi	1.196 in³
90mm	330	111	105	216	133	I.D. 4 mm x O.D. 6 mm	60-75 psi	1.196 in³



CEMENT

VALVE FITTING	PIPE	SIZE	CEMENT
ABS	PVC	1.5-6"	Use IPS #794 or equivalent
ABS	ABS	1.5-3"	Use IPS #771 or equivalent
PVC	ABS	1.5-6"	Use IPS #794 or equivalent
PVC	PVC	1.5-12"	Use IPS #717 or equivalent

STATIC HEAD PRESSURE

Feet Head	PSI
1	0.43
3	1.03
6	2.6
9	3.9
12	5.2
15	6.51
20	8.66
30	12.99
40	17.32
50	21.65

- Feet Head to PSI, multiply by 0.434
- PSI to Feet Head, multiply by 2.3

WORKING TEMPERATURE

Material	Suggested Maximum Working Temperature	
ABS	205° F	96° C
PVC	167° F	75° C
PC	280° F	137° C