WILLS BUILDING

QUEENS COUNTY

LONG ISLAND CITY, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: C241143

Prepared for:

Rockrose Development Corporation
15 East 26th Street, 7th Floor
New York, New York 10010

Prepared by:

CORE Environmental Consultants, Inc.
46-11 54th Ave
Maspeth, New York 11378

Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

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JULY 2015

SITE MANAGEMENT PLAN
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43-01 21st Street
Long Island City, New York 11101
Site No. C241143

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September 25, 2015

PROFESSIONAL ENGINEER CERTIFICATION

I, Sheila Ransbottom, certify that I am currently a New York State Registered Professional Engineer as defined in Title 6 of the New York Codes, Rules and Regulations Part 375 and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

NYS Professional Engineer Number (Stamp)	Date	Signature
	9/25/15	Sheila Ransbottom

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LIST OF ACRONYMS

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
COPC	Constituent of Potential Concern
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
GHG	Green House Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
IC	Institutional Control
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Soil Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSDS	Sub-slab Depressurization System
SVE	Soil Vapor Extraction

LIST OF ACRONYMS
(continued)

SVI	Soil Vapor Intrusion
SVMS	Soil Vapor Mitigation System
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program

EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance, and reporting activities required by this Site Management Plan (SMP):

Site Identification: C241143
Wills Building, 43-01 21st Street, Long Island City, NY

Institutional Controls
1. The property may be used for: restricted residential, commercial, or industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
2. All ECs must be operated and maintained as specified in this SMP;
3. All ECs must be inspected at a frequency and in a manner defined in this SMP;
4. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
5. Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
6. Data and information pertinent to Site management must be reported at the frequency and in a manner as defined in this SMP;
7. All future activities that will disturb residual impacted material must be conducted in accordance with this SMP;
8. Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
9. Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
10. Access to the Site must be provided to agents, employees, or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;
11. The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries, and any potential impacts that are identified must be monitored or mitigated; and
12. Vegetable gardens and farming on the Site are prohibited.
Engineering Controls
1. Cover system
2. Air Sparge/Soil Vapor Extraction System
3. Sub-Slab Depressurization System
4. *In-Situ* Groundwater Treatment

Type	Frequency
Inspections	
1. Site Cover	Annually
2. Air Sparge/Soil Vapor Extraction System	Monthly
3. Sub-slab Depressurization System	Monthly
Monitoring	
1. Air Sparge/Soil Vapor Extraction System	Monthly
2. Sub-slab Depressurization System	Monthly
3. Groundwater Monitoring Wells	Every six months
4. Indoor Air Quality	One sample after AS/SVE start-up, then as needed in connection with any system modifications
Maintenance	
1. Site Cover	As needed
2. Air Sparge/Soil Vapor Extraction System	As needed
3. Sub-slab Depressurization System	As needed
Reporting	
1. Air Sparge/Soil Vapor Extraction System	Monthly
2. Sub-slab Depressurization System	Monthly
3. Groundwater Monitoring Data	Every six months
4. Periodic Review Report	Annually

* Further descriptions of the above requirements are provided in detail in later sections of this SMP.

This SMP details the Site-specific implementation procedures that are required by the Environmental Easement to manage residual impacts at the Site until such time said Environmental Easement can be extinguished. All future activities that will disturb residually impacted materials at the Site must be conducted in accordance with this SMP.

- Subsurface intrusive activities, such as soil boring installation or excavation, are controlled by procedures documented in the Excavation Work Plan (EWP), included as Appendix D of this SMP.
- Procedures for operation and maintenance of the air sparge/soil vapor extraction (AS/SVE) system and sub-slab depressurization system (SSDS) are discussed in Section 5.0.
- Waste management procedures for soil and groundwater generated during on-Site activities are included in Section 4.5.

1.0 INTRODUCTION

1.1 GENERAL

This Site Management Plan (SMP) was prepared by CORE Environmental Consultants, Inc. (CORE) on behalf of 43-01 21st Street LLC as a required element of the remedial program for the Wills Building, located in Long Island City, New York (hereinafter referred to as the "Site"). A Site Location Map is presented as Figure 1. The Site is currently in the New York State Brownfield Cleanup Program (BCP) (Site No. C241143) administered by the New York State Department of Environmental Conservation (NYSDEC). This SMP has been prepared in accordance with NYSDEC's *DER-10/Technical Guidance for Site Investigation and Remediation* (DER-10), dated May 2010, and other guidelines provided by NYSDEC.

The Wills Family Group Limited Partnership entered into a Brownfield Cleanup Agreement (BCA) with NYSDEC on May 6, 2014 to remediate the Site. The BCA was amended to replace The Wills Family Group Limited Partnership with 43-01 21st Street LLC as the BCP Volunteer, effective January 23, 2015. The Site location and Site boundary are presented on Figure 2. The boundaries of the Site are more fully described in the metes and bounds Site description that is part of the Environmental Easement provided in Appendix A.

After completion of the remedial work, some residual impacts remain at the Site, hereafter referred to as "residual impacts". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the Site remedy to control exposure to residual impacts to ensure protection of public health and the environment. An Environmental Easement granted to NYSDEC and recorded with the New York City Register's Office, Queens Borough, and requires compliance with this SMP and all ECs and ICs in place on Site. This SMP addresses the means for implementing the ICs and ECs.

This SMP was prepared to manage residual impacts at the Site until the Environmental Easement is extinguished in accordance with New York State Environmental Conservation Law (ECL) Article 71, Title 36. This Plan has been approved by the NYSDEC, and compliance with this Plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of NYSDEC.

It is important to note that:

- This SMP details the Site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC); and

- Failure to comply with this SMP is also a violation of ECL, Title 6 of the New York Codes, Rules and Regulations, Part 375 (6 NYCRR 375), and the BCA (Index No. C241143-04-14; Site No. C241143) for the Site, and thereby subject to applicable penalties.

All reports associated with the Site can be viewed by contacting NYSDEC or its successor agency managing environmental issues in New York State or by visiting the document repository for the Site, located at:

Queens Public Library
Long Island City Branch
37-44 21st Street
Long Island City, New York 11101
(718) 752-3700

A list of contacts for persons involved with the Site is provided in Appendix B of this SMP.

1.2 REVISIONS

Revisions to this Plan will be proposed in writing to NYSDEC's project manager for the Site. Revisions will be necessary upon, but not limited to, the following occurrences:

- A change in media monitoring requirements;
- Upgrades to, or shut-down of, a remedial system;
- Post-remedial removal of impacted sediment or soil; or
- Other significant change to Site conditions.

In accordance with the Environmental Easement for the Site, NYSDEC will provide a notice of any approved changes to the SMP, and append those notices to the SMP that is retained in its files.

1.3 NOTIFICATIONS

Notifications will be submitted by the property owner to NYSDEC, as needed, in accordance with NYSDEC's DER–10 for the following reasons:

- 60-day advance notice of any proposed changes in Site use that are required under the terms of the BCA, 6 NYCRR 375, and/or ECL;
- 7-day advance notice of any field activity associated with the remedial program;
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan (EWP);

- Notice within 48-hours of any damage or defect to the foundation, structures, or ECs that reduces, or has the potential to reduce, the effectiveness of an EC, and likewise, any action to be taken to mitigate that damage or defect;
- By noon of the following day, verbal notice of any emergency, such as a fire, flood, or earthquake, that reduces, or has the potential to reduce, the effectiveness of ECs in place at the Site, with written confirmation within seven days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public; and/or
- Follow-up status reports submitted to NYSDEC within 45 days on actions taken to respond to any emergency event requiring ongoing responsive action, and describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the Site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, NYSDEC will be notified, in writing, of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the BCA and all approved work plans and reports, including this SMP.

  Within 15 days after the transfer of all or part of the Site, the new owner's name, contact representative, and contact information will be confirmed to NYSDEC in writing.

Currently, the notifications listed above can be made to:

Jonathan Greco
NYSDEC Project Manager
625 Broadway
Albany, New York 12233
(518) 402-9694
Jonathan.Greco@dec.ny.gov

A full list of contacts for persons involved with the Site is provided in Appendix B of this SMP.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 SITE LOCATION AND DESCRIPTION

The Site is located at 43-01 21st Street in Long Island City, Queens County, New York and is identified as Block 441 and Lot 16 by the New York City Department of Finance (see Figure 2). The Site is an approximately 1.11-acre area occupying the entire block length between 21st and 22nd Streets. A Site Map is presented on Figure 2. The boundaries of the Site are more fully described in the metes and bounds survey of the Environmental Easement, provided in Appendix A. The owner of the Site parcel at the time of issuance of this SMP is: 43-01 21st Street LLC.

2.2 PHYSICAL SETTING

2.2.1 Land Use

The Wills Building is currently a mixed-use commercial and manufacturing space. The Site is located in an area designated as zone M1-4 by the New York City Department of City Planning, indicating that it can be used for manufacturing and commercial uses. Site occupants are engaged in commercial and light manufacturing activities, such as woodworking and upholstery.

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include commercial and industrial properties. The property is bound by various commercial and industrial properties to the south – including the taxi management company Queens Medallion Leasing, 21st Street and commercial properties beyond that to the west, 43rd Avenue and the Mason Tenders Training Fund apprenticeship school beyond that to the north, and 22nd Street and commercial properties beyond that to the east. An Area Map is provided as Figure 3.

2.2.2 Geology

Based on observations made during CORE's 2015 Remedial Investigation (RI), overburden materials are composed of brown silty sands and trace amounts of gravel. The top 5 feet of all borings were characterized by fill material composed of sands and silty sands with gravel and fragments of concrete and brick. Bedrock was encountered during previous investigations in the vicinity of the Site between approximately 18 feet below ground surface (bgs) in the area of MW-1D and 25 feet bgs at MW-227B. Site-specific boring logs are provided in Appendix C.

2.2.3 Hydrogeology

Groundwater at the Site occurs in the unconfined overburden as well as in the underlying bedrock units. During the 2015 RI, depths to groundwater in overburden monitoring wells in the vicinity of the Site ranged from 13.58 feet below measuring point (bmp) at MW-219 to 15.61 feet bmp at MW-2S. Overburden groundwater flow direction is south; bedrock groundwater flow direction is west. Groundwater contour maps are presented as Figures 4A through 4D. Groundwater elevation data are provided in Table 1. Groundwater monitoring well construction logs are provided in Appendix C. Additional findings of previous Site investigations are discussed below.

2.3 PREVIOUS SITE INVESTIGATIONS

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8.0.

2.3.1 Remedial Investigation Report, 21-03 44th Avenue Site, Arcadis US (August 2012)

The Arcadis US (Arcadis) investigation, performed under direction of NYSDEC, was oriented at determining the nature and extent of chlorinated volatile organic compounds (VOCs) in soil and groundwater in an area immediately south of the Queens Medallion Building, a nearby property located south of the Site which shares a common alleyway with the Wills Building. Results of this investigation indicated that tetrachloroethylene (PCE) was present in all bedrock and overburden groundwater samples collected on, and in the immediate vicinity of, the Wills Building property. In general, bedrock concentrations were detected at higher levels than those in the overburden. PCE and trichloroethylene (TCE) were not detected in exceedence of Part 375 Unrestricted Use Soil Cleanup Objectives (SCOs) in any soil samples collected on, or in the immediate vicinity of, the Site. Sub-slab vapor and indoor air samples were collected from several locations inside the Wills Building during the investigation that indicated exceedences of PCE levels at which the New York State Department of Health (NYSDOH) 2006 *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (NYSDOH Guidance) recommends mitigation, with the highest values collected beneath the slab in the western portion of the building. Indoor air quality (IAQ) samples in the western portion of the building also contained concentrations of PCE and TCE exceeding those for which the NYSDOH Guidance recommends mitigation.

The combination of analytical data, groundwater flow direction, and isotope analysis of the PCE plume led Arcadis to conclude that a potential source area for PCE was located under both Queens Medallion and the Wills Building.

2.3.2 Remedial Investigation Report, Phase I – Limited Subsurface Investigation, Wills Building, CORE Environmental Consultants, Inc. (September 2013)

CORE advanced a total of seven soil borings, and installed four groundwater monitoring wells in the northern corner of the Site. Low-level concentrations of PCE and associated degradation products were detected in soil samples collected during the investigation, however, no detections were in exceedence of the applicable NYSDEC Part 375 Unrestricted Use SCOs.

All overburden monitoring wells sampled during the Limited Subsurface Investigation (LSI) contained PCE above the Part 703.5 Class GA Groundwater Standard. The highest concentration was detected at monitoring well MW-6BA in the Northern Alleyway (between the Site and Queens Medallion property). All bedrock wells sampled during the investigation also contained exceedences of the Class GA Groundwater Standard for PCE.

Groundwater flow in the overburden in the vicinity of the Site appeared to form a slight depression in the area of the Site. The groundwater pattern was likely the result of erroneous survey or monitoring data. Groundwater flow in the bedrock was generally west, consistent with the previous Arcadis investigation in the area of the Site.

2.4 REMEDIAL INVESTIGATION FINDINGS

CORE's 2015 RI was performed to characterize the nature and extent of impacts to Site media and included the collection of soil, groundwater, sub-slab vapor, and IAQ samples for laboratory analysis. The results of the RI are detailed in Remedial Investigation Report (CORE, 2015). Generally, the conclusions of the RI were that a potential source area for elevated concentrations of PCE in Site media is located beneath the western portion of the Will Building, and that Site groundwater, sub-slab vapor, and indoor air required remedial and mitigative activities. A qualitative human health exposure assessment (HHEA) was performed to evaluate potential exposure pathways. Below is a summary of Site conditions when RI field activities were performed in November and December 2014.

2.4.1 Subsurface Soil

Low-level concentrations of a limited number of VOCs (acetone, methylene chloride, and PCE) were detected in one or more of the subsurface soil samples collected from borings B-2 through B-4, B-6, and B-7 on Site. No VOCs were detected in the samples collected from soil borings B-5, B-8, or B-9. The low levels detected in subsurface soil samples were consistent with the lack of visual and olfactory evidence of subsurface impacts as well as the only slightly elevated photoionization detector (PID) readings encountered above the water table in all soil borings. No VOCS were detected in exceedence of the Unrestricted Use SCOs in any subsurface soil sample collected.

Concentrations of pesticides (4,4'-DDT and/or 4,4'-DDE) were detected above the Unrestricted Use SCOs in the soil samples collected from borings B-4 and B-8. Metals, including chromium, copper, and zinc were detected above the applicable Unrestricted Use SCOs and barium was detected above the Commercial Use SCO in the soil sample collected from boring B-8. Both samples were collected at approximately 9 feet bgs. The types and concentrations of impacts present in soil samples collected are typical of urban fill throughout New York City.

2.4.2 Overburden and Bedrock Groundwater

Overburden Groundwater

VOCs were detected in overburden groundwater samples analyzed during the 2015 RI. PCE concentrations were detected in each monitoring well in exceedence of 6 NYCRR 703.5 Class GA Groundwater Standards during the RI, with the exception of those collected at monitoring wells MW-215D and MW-219. The highest concentration of PCE in overburden groundwater detected during the RI was 90,000 µg/L in sample GW-2, located inside the southwestern portion of the

building. The low-level concentration of PCE in the soil sample collected from the same boring indicates that while a potential source area may exist near the boring and groundwater sample location (based upon overburden groundwater concentrations), that the boring was not installed directly into the source area.

TCE was detected in exceedence of the Class GA Groundwater Standard in grab groundwater sample GW-2 and samples collected from monitoring wells MW-2S, MW-6BA, MW-214D, and MW-218. Other than PCE, elevated concentrations of volatiles are not present in groundwater samples collected in or near the south/east/southeast portions of Site.

Polycyclic aromatic hydrocarbons (PAHs) benzo(a)anthracene and benzo(b)fluoranthene were detected in exceedence of the applicable groundwater standard of 0.002 µg/L in the duplicate grab groundwater sample for GW-9. Other PAHs were detected in groundwater samples GW-2, GW-9, MW-2S, and MW-218; however, none were detected in exceedence of the applicable Part 703.5 Class GA Groundwater Standards. The detection of PAH compounds in Site groundwater is representative of impacts from urban fill underlying the Site and not an on-Site source.

At least one metal was detected in exceedence of the applicable Part 703.5 Class GA Groundwater Standard in every sample for which they were analyzed, with the highest number of exceedences present in groundwater sample GW-2. In addition, GW-2 contained an exceedence of polychlorinated biphenyl (PCB) Aroclor 1016. PCBs were not detected in any other overburden groundwater sample for which they were analyzed. The exceedence in GW-2 is not believed to be indicative of dissolved-phase conditions at the Site. Grab groundwater sample GW-2 was collected from a temporary well installed during the RI, and the elevated metals and PCBs in the sample are likely influenced by sample turbidity.

Bedrock Groundwater

Exceedences of VOCs in groundwater samples taken from wells screened in bedrock are similar in pattern to those detected in overburden groundwater monitoring wells. PCE was detected above the Part 703.5 Class GA Groundwater Standard in three bedrock groundwater samples collected during the RI. The highest concentration of PCE was detected at MW-222B (43,000 µg/L) near the western corner of the property. In addition, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene and TCE were detected in exceedence of groundwater standards in two or more bedrock groundwater samples each. Concentrations of PCE in bedrock groundwater detected during the RI were highest near the western and northern corners of the Site, with the lowest concentrations detected along the north/northeastern Site boundary.

2.4.3 Sub-Slab Vapor and Indoor Air

Sub-Slab Vapor

PCE was detected in sub-slab vapor samples collected during the RI. Concentrations in exceedence of applicable NYSDOH mitigation guidance values were detected in each sample with the exception of SS-8 and SS-10 from beneath the southern portion of the building. Exceedences of TCE were also noted for samples SS-1 and SS-3. The highest concentration of PCE detected was at sample point SS-2 adjacent to the highest concentration of PCE detected in overburden groundwater at sample location GW-2. In general, concentrations of PCE in sub-slab samples tend to decrease toward the south/east/southeast portions of the building.

Indoor Air

PCE and TCE were detected in every IAQ sample collected as part of the RI. The highest concentrations of PCE were detected in IAQ samples IAQ-1 and IAQ-2, with IAQ-2 being located near sub-slab sample SS-2. Elevated concentrations of VOCs in indoor air, in combination with concentrations present in sub-slab vapor samples indicate that mitigative efforts are required to reduce the potential for soil vapor intrusion.

2.4.4 Qualitative Human Health Exposure Assessment

Constituents of potential concern (COPCs) were identified in Site subsurface soil, groundwater, sub-slab vapor, and indoor air during the RI. The primary COPCs associated with Site media are chlorinated VOCs; however, semi-volatile organic compounds (SVOCs), pesticides, PCBs, and metals were detected in exceedence of applicable guidance criteria in at least one medium. The following summarizes the potential human exposure to Site COPCs.

Potential receptors are identified based on current and probable future use of the Site and surrounding areas. Primary on-Site receptors include tenants of the on-Site building and visitors to the Site, including customers of the Delicatessen located in the northern corner of the building. Future receptors will also include occupants and visitors to the property if the Site were redeveloped, and construction workers and the surrounding community during any maintenance or Site redevelopment activities that would remove the current foundation slab and surrounding paved sidewalks during redevelopment. Current and future off-Site receptors may be tenants of nearby buildings in downgradient locations who may be exposed to impacted indoor air and workers who may come into contact with downgradient groundwater during groundwater monitoring and sampling activities.

Dermal absorption and ingestion of groundwater and/or subsurface soil on Site are incomplete exposure pathways with current Site usage. The Site is covered with a structure and concrete-paved sidewalks preventing contact with Site subsurface soil and groundwater under current conditions. Groundwater contact may occur during groundwater monitoring and sampling activities, and would generally be performed by trained professionals. Any maintenance or redevelopment

activities that remove the foundation slab or surrounding sidewalks would expose subsurface soil allowing the potential for a complete exposure pathway for those at the Site and the surrounding community. This potential pathway would be addressed by implementing Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) measures.

Direct inhalation of sub-slab vapor as ambient air conditions would only occur in the event of an excavation beneath the building, or the removal of building sub-slab components for construction or repair purposes. This potential exposure pathway would similarly be addressed by implementing HASP and CAMP measures.

The potential exists for Site occupants and visitors to be exposed to COPCs in sub-slab vapor migrating into indoor air on Site. The primary exposure route of concern for on-Site COPCs is inhalation of impacted indoor air. This exposure route is currently being controlled by a sub-slab depressurization system (SSDS) and soil vapor extraction (SVE) system installed at the Site, as discussed in Sections 2.6 and 2.7. A round of IAQ samples collected following SSDS start-up contained VOCs at concentrations significantly less than those collected prior to system installation.

Environmental Media	Exposure Route	Human Exposure Assessment
Groundwater	Ingestion	Groundwater on Site is not utilized for drinking water, it is supplied municipally.
	Dermal Contact	Dermal contact could occur during pumping operations for non-potable uses or during ground-intrusive work.
Soil	Ingestion	Soil is currently covered by the on-Site building and concrete-paved sidewalks. People could come into contact with soil during ground-intrusive activities.
	Dermal Contact	
Soil Vapor/Indoor Air	Inhalation	Volatilized COPCs from soil and groundwater may enter the on-Site building through cracks in the sub-slab. SSDS is effectively mitigating soil vapor intrusion into the building.

2.5 REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for the Site, also listed in the Decision Document dated July 2015 are as follows:

Groundwater

RAOs for the protection of human health:

- Prevent ingestion of groundwater with impacts exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles from impacted groundwater.

RAOs for protection of the environment:

- Remove the source of groundwater impacts.

Soil

RAOs for the protection of human health:

- Prevent ingestion and/or direct contact with impacted soil.
- Prevent inhalation of, or exposure to, compounds volatilizing from impacted soil.

RAOs for protection of the environment:

- Prevent migration of impacts that would result in a degradation of groundwater or surface water quality.

Soil Vapor

RAOs for the protection of human health:

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into the on-Site building.

2.6 INTERIM REMEDIAL MEASURE

In order to mitigate elevated concentrations of PCE in sub-slab vapor and indoor air as a result of soil vapor intrusion, an IRM was developed for the Site. The IRM included the installation and operation and maintenance (O&M) of an active SSDS to depressurize the entire building slab. The IRM included the following tasks and was performed in accordance with the Site-specific HASP submitted under the Remedial Investigation Work Plan cover:

- Collection of IAQ samples;
- Installation of, and sample collection from, sub-slab vapor monitoring points;
- Pilot testing for SSDS design;
- SSDS design; and
- SSDS installation and O&M.

A pilot test for the SSDS was performed on September 8, 2014. Utilizing data collected during the test, CORE designed an active SSDS and submitted a Design Analysis Report (DAR) for the IRM for NYSDEC approval on October 17, 2014. The final design was approved on October 17, 2014.

Construction of the active SSDS began in November of 2014 and was completed in January 2015. System startup was initiated in January 2015. A Construction Completion Report was submitted to

NYSDEC for approval on January 27, 2015. Monitoring is conducted on a monthly basis to evaluate system efficacy and monitor system discharge in accordance with procedures identified in Section 2.4 of the IRM Construction Completion Report (CORE, 2015a). Concentrations of PCE and TCE in IAQ samples collected after system startup were less than the applicable levels at which NYSDOH Guidance recommends mitigation and were significantly lower than those in samples collected prior to system installation.

2.7 FINAL REMEDY

The remedy included the installation of air sparge and SVE systems to operate in conjunction with the SSDS at the Site. Components of the remedy:

- Cover System
    - The existing Site cover will be maintained.
    - Any Site redevelopment will include a Site cover which consists of structures such as buildings, pavement, sidewalks, or soil where the upper two feet of exposed surface soil will meet the applicable SCO for Restricted Residential Use.
- Air Sparge with Soil Vapor Extraction
    - An air sparge with soil vapor extraction system to address the groundwater plume impacted by VOCs.
    - The goal of the AS/SVE is to achieve a bulk reduction in on-Site groundwater impacts. Should this goal not be attained within a 5-year time frame, this component of the remedy will be reassessed.
- *In-Situ* Groundwater Treatment
    - *In-situ* groundwater treatment to address Site-related impacts in groundwater on the southern/downgradient boundary of the Site.
    - Periodic groundwater monitoring to determine the effectiveness of the treatment and if additional injection events are necessary to meet RAOs. The operation of the components of the remedy shall continue until NYSDEC determines that the goals have been met or continued operation is technically impracticable or not feasible.
- Vapor Mitigation
    - Any on-Site buildings are required to have a SSDS, or a similarly-engineered system, in order to prevent the migration of vapors into the building from soil and groundwater.
- Institutional Control

- The Environmental Easement, included as Appendix A of this SMP, is recorded in the Title records for the Site. The Environmental Easement:
  - requires the Site owner to complete and submit a periodic certification of institutional and engineering controls to NYSDEC in accordance with Part 375-1.8(h)(3);
  - allows the use and development of the Site for restricted residential, commercial and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
  - restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH or New York City DOH; and
  - requires compliance with this NYSDEC-approved SMP.

- Site Management Plan
  - This NYSDEC-approved SMP, which includes:
    - an Institutional and Engineering Control Plan that identifies all use restrictions and ECs for the Site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:
      - ICs: The Environmental Easement provided in Appendix A; and
      - ECs: The Site cover, AS/SVE, *in-situ* groundwater treatment, and vapor mitigation (SSDS).
  - This SMP also includes:
    - an Excavation Work Plan which details the provisions for management of future excavations in areas of residual impacts;
    - a Monitoring Plan to assess the performance and effectiveness of the remedy; and
    - an O&M Plan to ensure continued operation and maintenance of the ECs.

Construction of the air sparge system and addition of the SVE system to the SSDS began in June 2015 with the installation of air sparge and SVE points required for pilot testing. Construction was completed in September 2015. System startup was initiated in October 2015. A draft Final Engineering Report (FER) was submitted to NYSDEC on September 15, 2015. Monitoring is

conducted on a monthly basis to evaluate system efficacy and monitor system discharge in accordance with procedures identified in Section 6.5 of the Remedial Work Plan (CORE, 2015d).

2.8 RESIDUAL IMPACTS

2.8.1 Soil

Residual impacts to soil remain beneath the Site after the remedy completion due to inaccessibility as a result of the on-Site building that covers the entire property. Consequently, ICs and ECs will be required for long-term management to protect human health and the environment. Long-term management of ICs, ECs, and residual impacts will be executed under this Site-specific SMP.

Areas of subsurface soil where COPCs were detected, as discussed in Section 2.4.1, remain in place on Site, at levels that are typical for historic urban fill that is pervasive throughout New York City. Potential source area VOC impacts to soil have not been identified to date but, if present, will be remediated over time via the on-Site SVE system.

Table 2 and Figure 5 summarize the results of soil samples containing exceedences of Commercial, Restricted Residential, or Unrestricted Use SCOs that will remain on Site after completion of the RA.

2.8.2 Groundwater

During the RI, concentrations of COPCs - primarily VOCs - were detected in exceedence of the applicable standards, guidance, and criteria (SCGs) in Site overburden and bedrock groundwater. The highest concentrations of VOCs in overburden groundwater are located beneath the western portion of the Site.

As a result of existing impacts to overburden groundwater that remain beneath the Site at issuance of the FER, ECs and ICs are required to protect human health and the environment. These ECs and ICs are discussed in Section 3.0. Long-term management of ECs, ICs, and residual impacts will be performed under this SMP. ECs include air sparge and SVE systems to reduce residual VOC impacts VOC impacts in Site overburden groundwater. *In-situ* groundwater treatment will be utilized to treat overburden impacts at the downgradient property boundary to mitigate off-Site migration of impacts.

Tables 3 and 4 and Figures 6A through 6D summarize the results of all samples of groundwater that exceed the SCGs at issuance of the FER.

2.8.3 Sub-Slab Vapor

As a result of existing impacts to sub-slab vapor that remain beneath the Site at issuance of the FER, ECs and ICs are required to protect human health. These ECs and ICs are discussed in Section 3.0. Long-term management of ECs, ICs, and residual impacts will be performed under this

SMP. ECs include a SSDS to address VOC impacts in sub-slab vapor and prevent soil vapor intrusion into the overlying structure.

Table 5 and Figure 7 summarize the results of all samples of sub-slab vapor that exceed the SCGs at issuance of the FER.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 GENERAL

Since residual impacts exist at the Site, ICs and ECs are required to protect human health and the environment. This IC and EC Plan describes the procedures for the implementation and management of all ICs and ECs at the Site. The IC and EC Plan is one component of the SMP and is subject to revision by NYSDEC.

This plan provides:

- A description of all ICs and ECs at the Site;
- The basic implementation and intended role of each IC and EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of ICs and ECs, such as the implementation of the EWP (as provided in Appendix D for the proper handling of residual impacts that may be disturbed during maintenance or redevelopment work on Site; and
- Any other provisions necessary to identify or establish methods for implementing the ICs and ECs required by the Site remedy, as determined by NYSDEC.

3.2 INSTITUTIONAL CONTROLS

A series of ICs is required by the Decision Document to:

- Implement, maintain, and monitor EC systems;
- Prevent future exposure to residual impacts; and
- Limit the use and development of the Site to restricted residential, commercial, or industrial uses only.

Adherence to these ICs on the Site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are consistent with the legal property boundaries, which are shown on Figure 2. These ICs are:

- The property may be used for: restricted residential, commercial, or industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in this SMP.
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
- Groundwater monitoring must be performed as defined in this SMP;
- Data and information pertinent to Site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb residually impacted material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- Access to the Site must be provided to agents, employees, or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries (Refer to Figure 2 for IC boundaries and Figure 8 for the current area of soil vapor intrusion concern), and any potential impacts that are identified must be monitored or mitigated; and
- Vegetable gardens and farming on the Site are prohibited.

3.3 ENGINEERING CONTROLS

3.3.1 Cover System

Exposure to residual impacts at the Site is prevented by a cover system placed over the Site. This cover system is comprised of the existing on-Site structure and sidewalks around the building. Any Site redevelopment will maintain required Site cover, including a building, sidewalks, pavement, or a soil cover in areas where the upper two feet of exposed surface soil will exceed applicable SCOs. If a soil cover is required, it will be a minimum thickness of two feet of soil meeting the SCOs for cover material as set forth in 6 NYCRR 375-6.7(d) for Restricted Residential Use. The soil cover will

be placed over a demarcation layer, with the upper six inches of the soil in areas not covered by a building foundation or pavement of sufficient quality to maintain a vegetation layer. Any fill material brought to the Site will meet the requirements for the identified Site use as set forth in 6 NYCRR 375-6.7(d).

Figure 9A presents the location of the cover system. The EWP provided in Appendix D outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying residually impacted materials are disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in the Site-specific HASP and associated CAMP, provided in Appendix E.

3.3.2 Air Sparge/Soil Vapor Extraction System

Mass removal of PCE and other VOCs from Site groundwater and saturated soil is accomplished by injecting air into the subsurface below the water table via an air sparge system installed following approval of the Remedial Work Plan (RWP). Injected air causes the VOCs to volatilize from the groundwater and/or soil. The VOCs are carried with the injected air into the vadose zone where an SVE system extracts the air via extraction wells via applied vacuum. The SVE system was installed following approval of the RWP and ties directly into the on-Site SSDS, utilizing the same system piping and blower. Impacted vapors are treated via vapor-phase granular activated carbon (VGAC) canisters before being exhausted to the atmosphere. The air sparge/soil vapor extraction (AS/SVE) system equipment is located in the partial basement of the Wills Building and the VGAC canisters are located in the Northern Alleyway.

Procedures for operating and maintaining the AS/SVE system are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP). As-Built drawings, signed and sealed by a Professional Engineer, are included in Appendix F – Operations and Maintenance Manual. Figures 9A and 9B show the location of the ECs for the Site.

3.3.3 Sub-Slab Depressurization System

Exposure to impacted indoor air within the on-Site building is prevented by an active SSDS, installed in the building in 2014 as an IRM to address soil vapor intrusion issues. The system operates by reducing pressure beneath the building slab, preventing soil vapor intrusion. Impacted vapors are treated via VGAC canisters before being exhausted to the atmosphere.

Procedures for operating and maintaining the SSDS are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP). As-Built drawings, signed and sealed by a Professional Engineer, are included in Appendix F – Operations and Maintenance Manual. Figures 9A and 9B show the location of the ECs for the Site.

3.3.4 *In-Situ* Groundwater Treatment

In-situ treatment at the downgradient property boundary will further mitigate off-Site migration of residual VOC impacts to overburden groundwater. *In-situ* groundwater treatment injections will begin approximately 18 months following issuance of the COC, after one year of groundwater data collection, and development of a remedial design approved by NYSDEC.

Procedures for maintaining the injection wells and performing injection events are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP). Figures 9A and 9B show the locations of the ECs for the Site.

3.4 CRITERIA FOR COMPLETION OF REMEDIATION/TERMINATION OF REMEDIAL SYSTEMS

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the RAOs as identified by the Decision Document. The framework for determining when remedial processes are complete is provided in Section 6.4 of DER-10.

3.4.1 Cover System

The cover system consisting of the building slab and concrete sidewalks is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.4.2 Air Sparge/Soil Vapor Extraction System

The AS/SVE system will not be discontinued unless prior written approval is granted by NYSDEC. In the event that monitoring data indicate that the system may no longer be required, the Remedial Party will submit a proposal to discontinue the system. Conditions that may warrant discontinuing the system include concentrations of COPCs in groundwater and/or soil that:

- Reach levels that are consistently below ambient water quality standards or the Site SCGs, as appropriate;
- Have become asymptotic to a low level over an extended period of time, as accepted by NYSDEC; or
- NYSDEC has determined that the AS/SVE system has reached the limit of its effectiveness.

This assessment will be based in part on post-remediation concentrations in groundwater collected from monitoring wells located throughout the Site. The system will remain in place and operational until permission to discontinue use is granted in writing by NYSDEC.

3.4.3 Sub-Slab Depressurization System

The active SSDS will not be discontinued unless prior written approval is granted by NYSDEC and NYSDOH. In the event that monitoring data indicate that the SSDS may no longer be required, the Remedial Party will submit a proposal to discontinue the system to NYSDEC and NYSDOH.

3.4.4 *In-Situ* Groundwater Treatment

In-situ groundwater treatment via injections will not be discontinued unless prior written approval is granted by NYSDEC. In the event that monitoring data indicate that *in-situ* groundwater treatment may no longer be required, the Remedial Party will submit a proposal to discontinue injection events. Conditions that may warrant discontinuation of *in-situ* groundwater treatment injection events include concentrations of COPCs in groundwater that:

- Reach levels that are consistently below ambient water quality standards or the Site SCGs, as appropriate;
- Are no longer migrating off Site;
- Have become asymptotic to a low level over an extended period of time, as accepted by NYSDEC; or
- NYSDEC has determined that the *in-situ* groundwater treatment injection events have reached the limit of their effectiveness.

This assessment will be based in part on concentration of COPCs in post-remediation groundwater collected from monitoring wells located upgradient, on, and immediately downgradient of, the Site. *In-situ* groundwater treatment injection events will continue until permission to discontinue application is granted in writing by the NYSDEC.

4.0 MONITORING AND SAMPLING PLAN

4.1 GENERAL

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of NYSDEC. Details regarding the sampling procedures, data quality usability objectives, and analytical methods, etc. for all samples collected as part of Site management for the Site are included in the Quality Assurance Project Plan (QAPP) provided in Appendix G.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, soil vapor, soils);
- Assessing compliance with applicable NYSDEC SCGs, particularly Class GA Groundwater Standards and Part 375 SCOs for soil; and
- Evaluating Site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Information on all designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 SITE–WIDE INSPECTION

Site-wide inspections will be performed once per year, at a minimum. Modification to the frequency or duration of the inspections will require approval from NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form, provided in Appendix H – Site Management Forms, will be completed. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including Site usage;

- An evaluation of the condition and continued effectiveness of ECs;
- General Site conditions at the time of the inspection;
- The Site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that Site records are up to date.

Inspections of all remedial components installed at the Site will be conducted. A comprehensive Site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- If Site records are complete and up to date.

Reporting requirements are outlined in Section 7.0 of this SMP.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces, or has the potential to reduce, the effectiveness of ECs in place at the site, verbal notice must be given to NYSDEC by noon of the following day. In addition, a Site inspection will be conducted by a qualified environmental professional (QEP), as determined by NYSDEC, within five days of the event to verify the effectiveness of the ICs and ECs implemented at the Site. Written confirmation that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public must be provided to NYSDEC within seven days of the event.

4.3 TREATMENT SYSTEM MONITORING

Monitoring of the AS/SVE system and SSDS will be performed on a routine basis, as identified in Table 4-1 - Remedial System Monitoring Requirements and Schedule (see below). Modification to frequency or sampling requirements will require approval from NYSDEC. A visual inspection of the complete system will be conducted during each monitoring event. Unscheduled inspections and/or sampling may take place when a suspected failure of the AS/SVE system or SSDS has been reported or an emergency occurs that is deemed likely to affect the operation of the system. AS/SVE system and SSDS components to be monitored include, but are not limited to, the components included in Table 4-1 below.

Table 4-1
Remedial System Monitoring Requirements and Schedule

Remedial System Component	Monitoring Parameter	Operating Range	Monitoring Schedule
SSDS/SVE Blower	Flow Rate Vacuum	900-1400 cfm 70-90 inches WC	Monthly
SVE Wells	Flow Rate Vacuum	50-100 cfm 5-50 inches WC	Monthly
SSDS Wells	Flow Rate Vacuum	30-60 cfm 5-50 inches WC	Monthly
Air Sparge Compressor	Flow Rate Pressure	95 scfm 125 psi	Monthly
Air Sparge Wells	Flow Rate Pressure	5-20 cfm 1.3-13.7 psig	Monthly
VGAC Influent/Effluent	Flow Rate Pressure	900-1400 cfm 12/6 inches WC	Monthly

A complete list of components to be inspected is provided in the Inspection Checklist, provided in Appendix H - Site Management Forms. If any equipment readings are not within the specified operation range, any equipment is observed to be malfunctioning, or the system is not performing within specifications; maintenance and repair, as per the Operation and Maintenance Plan, is required immediately.

4.4 POST-REMEDIATION MEDIA MONITORING AND SAMPLING

Samples shall be collected from the AS/SVE system, SSDS, and groundwater monitoring wells on a routine basis. IAQ samples will be collected once after initial AS/SVE start-up, then as needed in connection with any system modifications, e.g., following changes to flow levels in the system. Sampling locations, required analytical parameters, and sample schedule are provided in Table 4-3 – Post Certificate of Completion Sampling Requirements and Schedule, below. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 4-2
Post Certificate of Completion Sampling Requirements and Schedule

Sampling Location	Analytical Parameters			Sampling Schedule
	TCL VOCs (USEPA Method 8260)	**DO** (Meter)	**VOCs** (USEPA Method TO-15)	
VGAC Influent/Effluent			X	Monthly
Air Sparge Wells		X		Monthly
Indoor Air Quality			X	As needed in connection with any system modifications
Groundwater Monitoring Wells	X	X		Quarterly for two years, then every six months

Detailed sample collection and analytical procedures and protocols are provided Appendix G – Quality Assurance Project Plan.

4.4.1 Groundwater Sampling

Groundwater monitoring will be performed on a quarterly basis for one year after full system start-up, quarterly for one year after implementation of *in-situ* groundwater treatment, then once every six months to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The network of monitoring wells includes wells in upgradient, on-Site, and downgradient locations to monitor groundwater conditions at the Site. The network of on- and off-Site wells includes overburden groundwater monitoring wells sampled during the 2015 RI with a newly installed monitoring well (C-MW-3) inside the Wills Building. Groundwater samples will be analyzed for Target Compound List (TCL) VOCs by a NYSDOH Environmental Laboratory Accreditation Program (ELAP)-certified laboratory. All groundwater monitoring data will be validated by a third-party validator. Samples will be collected and analyzed in compliance with the QAPP provided in Appendix G.

Table 4-4 on the following page summarizes the wells, identification number, as well as the purpose, location, depths, diameter and screened intervals of the wells. As part of the groundwater monitoring, four upgradient monitoring wells, two on-Site wells, and four downgradient wells are sampled to evaluate the effectiveness of the remedial system. Post-remediation monitoring well network locations are presented on Figure 10.

Monitoring well construction logs are included in Appendix C of this document.

If biofouling or silt accumulation occurs in the on-Site and/or off-Site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced if an event renders the well unusable.

Repairs to, or replacement of, wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance *CP-43: Groundwater Monitoring Well Decommissioning Procedures* (CP-43). Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by NYSDEC.

Table 4-4
Monitoring Well Construction Details

Well ID	Well Location	Easting	Northing	Well Diameter (inches)	Elevation (ft msl)		Screened Interval (ft bgs)	
					Casing	Surface	Screen Top	Screen Bottom
MW-218	Upgradient	-73.9457	40.7499	2	19.97	20.53	15.0	25.0
MW-219	Upgradient	-73.9451	40.7503	2	18.86	19.17	8.0	18.0
MW-1S	Upgradient	-73.9458	40.7503	2	20.67	20.86	8.0	18.0
MW-2S	Upgradient	-73.9456	40.7505	2	20.82	21.16	12.5	22.5
MW-101S	On-Site	-73.9456	40.7504	2	19.38	19.72	12.5	22.5
C-MW-3	On-Site	-73.9457	40.7502	1	19.38	19.72	10	18
MW-5BA	Downgradient	-73.9460	40.7501	2	20.06	20.32	10	20
MW-6BA	Downgradient	-73.9457	40.7499	2	19.58	19.75	10	20
MW-214D	Downgradient	-73.9458	40.7499	2	19.88	20.20	8	18
MW-215D	Downgradient	-73.9455	40.7498	2	18.62	19.07	8	18

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

4.4.2 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in Appendix H - Site Management Forms. Other observations (e.g., groundwater monitoring well integrity, etc.) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the Site-specific QAPP provided as Appendix G of this document.

4.5 WASTE PROCEDURES

4.5.1 Contained-In Waste Process

Environmental media (i.e. – soil, sediment, groundwater) containing constituents listed as hazardous waste as identified in 6 NYCRR 371 will be handled as hazardous waste unless the media contains hazardous constituents at concentrations at or below media-specific NYSDEC Contained-In Action Levels as indicated in Technical Administrative Guidance Memorandum (TAGM) 3028. This process does not apply to spent carbon generated during operation of the SVE system and SSDS. Media-specific sampling plans detailing the origin of the hazardous waste will be provided to NYSDEC prior to disposal of environmental media generated at the Site.

Soil Characterization

In the event of a future excavation, soils not drummed prior to disposal will be properly staged in approximately 50 yd^3 stockpiles. Each pile will be sampled as follows: two grab samples for TCL VOCs and one composite sample for full Toxicity Characteristic Leaching Procedure (TCLP) analyses.

Drummed soil generated during activities such as boring and monitoring well installation will be sampled as follows: one grab sample analyzed for TCL VOCs will be collected from each drum, and one composite sample compiled from drums originating from similar areas (e.g. on Site, off Site) will be analyzed for full TCLP analyses.

The data from all sampling will be provided to NYSDEC for their determination regarding disposal options. A preliminary goal for soils for such determination shall be: all total analysis for underlying constituents of the hazardous waste (e.g. – PCE, TCE, cis-1,2-dichloroethyelene, and vinyl chloride) must meet the lower of 10-times the Universal Treatment Standard, or the Sediment Action Level values as indicated in TAGM 3028. Soils must also not be a characteristic hazardous waste.

Upon receipt of NYSDEC's determination of "contained-out," soils will be disposed of at a previously identified, approved, permitted, and lined solid waste facility. The disposal facility will receive all waste characterization data as well as NYSDEC's letter determination that the waste has received a "contained-out" determination.

Groundwater Characterization

Purge water generated during groundwater monitoring well development, groundwater monitoring activities, or water vapor generated during operation of the SVE system will be containerized in New York State Department of Transportation (NYSDOT)-approved 55-gallon drums for disposal. Groundwater generated during on-Site activities is anticipated to contain United States Environmental Protection Agency (USEPA) F001/F002 listed wastes as a result of historic on-Site use of use of PCE during degreasing processes. One sample collected from each drum will be analyzed for TCL VOCs. All data will be submitted to NYSDEC and will be compared to NYSDEC's Class GA Groundwater Standards.

NYSDEC will make the determination as to whether the water does or does not contain a listed waste. Following receipt of NYSDEC's determination that the water does not contain a listed waste, the water will be discharged to publicly-owned treatment works (POTW) by sanitary sewer, with approval of the POTW, or transported to a commercial wastewater treatment facility.

Water determined to contain a listed waste will be transported to a disposal facility meeting the requirements of 6 NYCRR 360. Transportation of all hazardous materials will be performed by

licensed transporters with valid 6 NYCRR 364 Waste Transporter Permits. The disposal facility will receive all waste characterization data as well as NYSDEC's letter determination.

In the event of future redevelopment of the Site, water generated during the excavation/dewatering process will be stored in 5,000-gallon frac tanks. Two composite samples will be collected to evaluate the initial concentrations of COPCs. The water will then be passed through granular activated carbon and into a second tank of similar size where two more composite samples will be collected. All data will be submitted to NYSDEC and will be compared to NYSDEC's Class GA Groundwater Standards.

Following receipt of NYSDEC's determination that the treated water no longer contains a listed waste, the treated water will be discharged to POTW by sanitary sewer, with approval of the POTW, or transported to a commercial wastewater treatment facility. The disposal facility will receive all waste characterization data as well as NYSDEC's letter determination that water no longer contains a listed hazardous waste.

4.5.2 Spent Carbon Waste Procedure

The "contained-in" waste process does not apply to spent carbon generated during operation of the SVE system and SSDS. Spent carbon is transported to a reactivation and recycling facility to be refreshed for reuse at another facility.

When breakthrough is detected at the lead canister, the carbon in that canister is changed out for fresh carbon. The canister is taken out of operation utilizing bypass valves (refer to Section 5.3.2). The spent carbon is analyzed for full TCLP characteristics to determine whether it is classified as hazardous. Based on the determination, the carbon is transported to one of two facilities who perform reactivation and recycling of either hazardous or non-hazardous carbon. Fresh carbon is placed into the lead canister, and the canister is put back into operation.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 GENERAL

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

- Includes the procedures necessary to allow individuals unfamiliar with the Site to operate and maintain the AS/SVE system and SSDS; and
- Will be updated periodically to reflect changes in Site conditions or the manner in which the AS/SVE system and SSDS are operated and maintained.

Information on non-mechanical ECs is provided in Section 3.0. Further detail regarding the Operation and Maintenance of the AS/SVE system and SSDS is provided in Appendix F - Operation and Maintenance Manual. A copy of this Operation and Maintenance Plan, along with the complete SMP, is maintained at the Site. This Operation and Maintenance Plan is not to be used as a stand-alone document, but as a component document of this SMP.

5.2 OPERATION AND MAINTENANCE OF AIR SPARGE/SOIL VAPOR EXTRACTION SYSTEM

The following sections provide a description of the operations and maintenance of the air sparge system. Cut-sheets and As-Built drawings for the AS/SVE system are provided in Appendix F - Operations and Maintenance Manual.

5.2.1 System Start-Up and Testing

Start-up testing, lasting approximately one month, was conducted in an effort to optimize operation of the AS/SVE system. The SVE start-up occurred prior to air sparge system start-up. In order to test the functionality of the SVE wells, the expanded SVE system was activated while the air sparge system remained off. During this time, air and groundwater samples were collected to evaluate initial pre-sparging VOCs and dissolved oxygen conditions, as well as key operational parameters such as flow rate and vacuum.

While the SVE system remained on, the air sparge wells were activated one well at a time for analysis. The newly installed groundwater monitoring well, C-MW-3, was utilized during this time to collect groundwater samples for VOC concentrations and dissolved oxygen conditions. Key operational parameters such as flow rate and pressure were recorded during testing. The compressor was adjusted to varying flowrates and pressures during start-up testing to determine an optimal operating point for the system. The air sparge system was not operated without the SVE.

Influent and effluent samples for the SVE system were collected weekly during system start-up to monitor system parameters and determine optimal bleed air percentages required by the system to

maintain an influent total VOCs load of 200,000 µg/m^3 at 1400 cubic feet per minute (cfm). An influent concentration of 200,000 µg/m^3 allows the system to remove larger volumes of VOCs from the subsurface while maintaining a reasonable cost basis for system O&M (i.e. – carbon canister change outs). Weekly samples were collected until four consecutive readings showed that the system is operating within applicable State and federal guidelines. After four consecutive compliant samples were obtained, system start-up testing was considered complete, and the system was put into full-scale operation.

The system testing described above will be conducted if, in the course of the AS/SVE system's lifetime, significant changes are made to the system and the system must be restarted.

5.2.2 System Operation and Maintenance

O&M of AS/SVE components is conducted on a monthly basis to evaluate system efficacy and monitor system discharge in accordance with procedures identified in Section 6.5 of the Remedial Work Plan (CORE, 2015d). During each monthly visit, flowrate at the compressor, pressure and dissolved oxygen at each air sparge well, and temperature at the compressor outlet is monitored.

SVE system monitoring will occur on a monthly basis and include extraction point vacuum measurements, vapor monitoring point vacuum measurements, PID readings, and sampling and analysis of untreated vapor influent (pre-carbon) as well as treated system effluent (post-carbon). Additional samples will be collected between the lead and lag carbon canisters to evaluate potential breakthrough. Influent, effluent, and inter-carbon canister samples will be collected in 3-Liter Tedlar® bags for analysis of VOCs by USEPA Method TO-15.

The SVE system design utilizes two VGAC canisters run in lead-lag configuration. A third, backup canister is utilized when one of the two lead-lag canisters requires service or change out. Bypass piping and valves allow for the maintenance of each canister individually while the remaining two canisters operate. For example, it is anticipated that the lead canister (VGAC-1) will experience breakthrough first. When this occurs valves on either side of the canister can be closed and the flow re-routed through the bypass to VGAC-2 and VGAC-3. The technician will then be able to safely service VGAC-1. In addition if VGAC-2 or VGAC-3 experience breakthrough, it is possible to close the valves on either side of the canisters allowing flow to be redirected through the bypass and to the appropriate VGACs while the technician performs maintenance. The system will not be operated unless two 2000-pound VGAC units are installed, maintained, and are operating in a satisfactory manner. A copy of the O&M manual for the AS/SVE system is included in Appendix F and monthly monitoring forms are included in Appendix H.

5.2.3 System Monitoring Devices and Alarms

Following a successful start-up testing phase, the system was put into full operation. The on-Site EOS Research, Ltd. (EOS) programmable logic controller (PLC) is utilized to remotely monitor the

AS/SVE system via high temperature, flow rate, and pressure alarms. The system does not require an on-Site operator. The PLC sends daily system status reports containing pertinent system information such as total system flow and any system shutdowns or alarms via fax.

The AS/SVE system has warning devices to indicate that the system is not operating properly. In the event that warning device is activated, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the AS/SVE system will be restarted. If shutdown of the SVE portion of the system is required, the air sparge component will also be shut down. At no time will the air sparge system operate while the SSDS and/or SVE system are not functional. Operational problems will be noted in the Periodic Review Report (PRR) to be prepared for that reporting period.

5.3 OPERATION AND MAINTENANCE OF SUB-SLAB DEPRESSURIZATION SYSTEM

The following sections provide a description of the operations and maintenance of the SSDS. Cut-sheets and As-Built drawings for the SSDS are provided in Appendix F - Operations and Maintenance Manual.

5.3.1 System Start-Up and Testing

System start-up and testing for the SSDS was performed prior to system initiation in 2014. If, in the course of the SSDS' lifetime, significant changes are made to the system and the system must be restarted, start-up testing will be performed as described in Section 5.2.1.

5.3.2 System Operation and Maintenance

O&M is conducted on a monthly basis to evaluate system efficacy and monitor system discharge in accordance with procedures identified in Section 2.4 of the IRM Construction Completion Report (CORE, 2015a). O&M is consistent with SVE system monitoring performed as discussed in Section 5.2.2.

5.3.3 System Monitoring Devices and Alarms

The on-Site EOS PLC is utilized to remotely monitor the SSDS via high temperature, flow rate, and vacuum alarms. The system does not require an on-Site operator. The PLC sends daily system status reports containing pertinent system information such as total system flow and any system shutdowns or alarms via fax, which are received and monitored by CORE engineers.

The SSDS has warning devices to indicate that the system is not operating properly. In the event that warning device is activated, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the SSDS will be restarted. Operational problems will be noted in the PRR to be prepared for that reporting period.

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 CLIMATE CHANGE VULNERABILITY ASSESSMENT

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

This section provides a summary of vulnerability assessments that will be conducted for the Site during periodic assessments, and briefly summarizes the vulnerability of the Site and/or ECs to severe storms/weather events and associated flooding. Potential vulnerabilities may include, but are not limited to:

- **Flood Plain:** The Site is not located in a flood plain, low-lying, or low-groundwater recharge area.
- **Site Drainage and Storm Water Management:** The on-Site building contains a partial basement with a sump. Severe weather events may overcome the capabilities of the sump to adequately remove water from the basement if the water table were to rise rapidly.
- **Erosion:** The entirety of the Site is covered with a concrete building slab, concrete sidewalks, and paved alleyway. No portion of the Site is susceptible to erosion.
- **High Wind:** Windows in the on-Site building may be susceptible during high wind events. Exposed portions of the remedial system include the effluent stack and VGAC canisters in the alleyway.
- **Electricity:** Electricity is provided to the Site building via overhead utility lines, which are susceptible during severe weather events. In the event of power surges or power loss, the remedial systems will lose functionality.
- **Spill/Contaminant Release:** The remedial system equipment is located in the partial basement of the Wills Building; however, it is not exposed directly to the elements and is unlikely to be affected by a spill in the building, should one occur.

Because the majority of remedial components are located inside the on-Site structure, there is a low likelihood of severe weather events negatively impacting the remedial systems. As a result, a full-scale vulnerability assessment was not performed.

6.2 GREEN REMEDIATION EVALUATION

NYSDEC's *DER-31/Green Remediation* (DER-31) requires that green remediation concepts and techniques be considered during all stages of the remedial program, including Site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the SMP provides a summary of any green remediation evaluations to be completed for the Site during Site management, and as reported in the PRR. These evaluations may include, but not be limited to:

- **Waste Generation:** Wastes generated during implementation and operation of the remedy include soil from well installation or excavations, purge water collected during groundwater monitoring events, and spent carbon created during operation of the SVE system and SSDS. Environmental media are managed under NYSDEC's "contained-in" criteria, while spent carbon is transported to an appropriate facility to be refreshed for reuse at another site.
- **Energy usage:** Both the AS/SVE system and SSDS utilize building electricity to run.
- **Emissions:** Emissions are generated during operation of the SVE system and SSDS. Effluent from the SVE system and SSDS flows through VGAC canisters prior to discharge to the atmosphere. All system effluent meets NYSDEC DAR-1 Air Guidance Values (AGVs) for the respective compounds at the time of discharge. Vehicle emissions are generated during commute to and from the Site to collect analytical samples and perform system O&M.
- **Water usage:** No water is utilized during O&M of the remedial systems.
- **Land and/or ecosystems:** Given the location of remedial system equipment inside the on-Site building and the urban location of the Site, no ecosystems are disturbed during remedy implementation and operation.

6.2.1 Timing of Green Remediation Evaluations

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

Modifications resulting from green remediation evaluations will be routinely implemented and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR.

6.2.2 Remedial Systems

Remedial systems will be operated properly considering the current Site conditions to conserve materials and resources to the greatest extent possible. Consideration will be given to operating rates and use of reagents and consumables. Spent materials will be sent for recycling, as appropriate – e.g., spent carbon from VGAC canisters utilized to treat SVE system and SSDS effluent prior to atmospheric discharge is transported to a recycling facility where it is refreshed and subsequently reused at another site. In addition, when evaluating compounds for *in-situ* groundwater treatment, consideration will be given to compound effectiveness at present groundwater concentrations, product lifespan, and volume required to achieve remedial goals, allowing for the use of less reagent and consumables.

6.2.3 Building Operations

Structures including buildings and sheds will be operated and maintained to provide for the most efficient operation of the remedy, while minimizing energy, waste generation, and water consumption. The equipment for the AS/SVE system and SSDS are housed in the partial basement of the existing on-Site building. No additional buildings or sheds were constructed for implementation of the RA.

6.2.4 Frequency of System Checks, Sampling and Other Periodic Activities

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

The on-Site remedial systems utilize remote telemetry to provide daily updates on system operations, shut downs, alarms, etc., minimizing the number of trips to the Site required for adequate system monitoring. In addition, system checks for the AS/SVE system and SSDS systems have been coordinated and are performed on the same day, further reducing the number of trips required to perform system monitoring.

6.2.5 Metrics and Reporting

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

6.3 REMEDIAL SYSTEM OPTIMIZATION

A RSO study will be conducted any time that NYSDEC or the Remedial Party requests in writing that an in-depth evaluation of the remedy is needed. A RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;
- The management and operation of the remedial system is exceeding estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- A plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;
- There is an anticipated transfer of Site management to another Remedial Party or agency; and/or
- A new and applicable remedial technology becomes available.

A RSO will provide a critique of a Site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the Site's cleanup goals, gather additional performance or media specific data and information, and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

The RSO study will focus on overall Site cleanup strategy, process optimization and management with the intent of identifying impediments to cleanup, and improvements to Site operations to increase efficiency, cost effectiveness, and remedial time frames. Green remediation technology and principals are to be considered when performing the RSO.

7.0 REPORTING REQUIREMENTS

7.1 SITE MANAGEMENT REPORTS

All Site management inspection, maintenance, and monitoring events will be recorded on the appropriate Site management forms provided in Appendix H. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the Site during the reporting period will be provided in electronic format to NYSDEC in accordance with the requirements of Table 7-1 and summarized in the PRR.

Table 7-1
Schedule of Interim Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Inspection Report	Monthly
Periodic Review Report	Annually, or as otherwise determined by the Department
Groundwater Monitoring Report	Quarterly for two years, then every six months

* The frequency of events will be conducted as specified until otherwise approved by NYSDEC.

All interim monitoring/inspections reports will include, at a minimum:

- Date of monitoring/inspection event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc.);
- Copies of all field forms completed (e.g., well sampling logs, Chain-of-Custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);

- Any observations, conclusions, or recommendations; and
- A determination as to whether the conditions of on-Site media have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of the maintenance event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system(s);
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of non-routine maintenance event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by NYSDEC. Currently, data are to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at the following link http://www.dec.ny.gov/chemical/62440.html.

7.2 PERIODIC REVIEW REPORT

A PRR will be submitted to the Department beginning 16 months after the Certificate of Completion is issued. After submittal of the initial PRR, the next PRR shall be submitted annually to NYSDEC or at another frequency as may be required by NYSDEC. The report will be prepared in accordance with

NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the PRR. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the Site.
- Results of the required annual Site inspections and severe condition inspections, if applicable.
- All applicable Site management forms and other records generated for the Site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedences highlighted. These will include a presentation of past data as part of an evaluation of concentration trends.
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by NYSDEC. Currently, data are supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at the following link: http://www.dec.ny.gov/chemical/62440.html.
- A Site evaluation, which includes the following:
    - The compliance of the remedy with the requirements of the Site-specific Decision Document;
    - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
    - Any new conclusions or observations regarding impacts to Site media based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
    - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan;
    - Trends in COPC concentrations in affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document; and

- The overall performance and effectiveness of the remedy.

- A performance summary for all treatment systems at the Site during the calendar year, including information such as:
  - The number of days the system operated for the reporting period;
  - The average, high, and low flows per day;
  - VOC mass removal;
  - A description of breakdowns and/or repairs along with an explanation for any significant downtime;
  - A description of the resolution of performance problems;
  - Alarm conditions;
  - Trends in equipment failure;
  - A summary of the performance, effluent, and/or effectiveness monitoring; and
  - Comments, conclusions, and recommendations based on data evaluation.

Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a Professional Engineer licensed to practice in New York State will prepare, and include in the PRR, the following certification as per the requirements of NYSDEC DER-10:

"*For each institutional or engineering control identified for the Site, I certify that all of the following statements are true:*

- *The inspection of the Site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by NYSDEC;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any Site management plan for this control;*
- *Access to the Site will continue to be provided to NYSDEC to evaluate the remedy, including access to evaluate the continued maintenance of this control;*

- *Use of the Site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the Site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as Owner's/Remedial Party's Designated Site Representative for the Site."

Every five years the following certification will be added:

- *The assumptions made in the qualitative exposure assessment remain valid.*

The signed certification will be included in the PRR.

The PRR will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the Site is located, and the NYSDOH Bureau of Environmental Exposure Investigation. The PRR may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

7.3 CORRECTIVE MEASURES WORK PLAN

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an IC or EC, a Corrective Measures Work Plan will be submitted to NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by NYSDEC.

7.4 REMEDIAL SYSTEM OPTIMIZATION REPORT

In the event that a RSO is to be performed (see Section 6.3), upon completion, a RSO report must be submitted to NYSDEC for approval. A general outline for the RSO report is provided in Appendix I. The RSO report will document the research/investigation and data gathering conducted, evaluate the results and facts obtained, present a revised Conceptual Site Model, and present recommendations. RSO recommendations are to be implemented upon approval from by NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement

the recommendations based upon the actions that need to be taken. An update to the SMP and FER may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the Site is located, Site Control, and the NYSDOH Bureau of Environmental Exposure Investigation.

8.0 REFERENCES

Arcadis US (Arcadis), 2012. *Remedial Investigation Report, 21-03 44th Avenue Site, Long Island City, New York, Site # 24110.*

CORE Environmental Consultants (CORE), 2013. *Remedial Investigation Report, Phase I, Limited Subsurface Investigation, Wills Building, 43-01 21st Street, Long Island City, New York 11101, State ID #2-41-143.*

CORE, 2014a. *Interim Remedial Measures Work Plan, Wills Building, 43-01 21st Street, Long Island City, New York 11101, State ID #2-41-143.*

CORE, 2014b. *Remedial Investigation Work Plan, Wills Building, 43-01 21st Street, Long Island City, New York 11101, State ID #2-41-143.*

CORE, 2014c. *Design Analysis Report for the Interim Remedial Measure (IRM), Wills Building, 43-01 21st Street, Long Island City, New York 11101, State ID #2-41-143.*

CORE, 2015a. *Interim Remedial Measure Construction Completion Report, Wills Building, 43-01 21st Street, Long Island City, New York 11101, Site No. C241143.*

CORE, 2015b. *DAR-1 Compliance and the Emission Rates of the Sub-Slab Depressurization System (SSDS) Located at The Wills Building, 43-01 21st Street, Long Island City, New York.*

CORE, 2015c. *Remedial Investigation Report, Wills Building, 43-01 21st Street, Long Island City, New York 11101, Site No. C241143.*

CORE, 2015d. *Remedial Work Plan, Wills Building, 43-01 21st Street, Long Island City, New York 11101, Site No. C241143.*

New York State Department of Environmental Conservation (NYSDEC),1992. *Technical Administrative Guidance Memorandum 3028, "Contained-In" Criteria*.

NYSDEC, 1998. *Technical and Operational Guidance Series (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.*

NYSDEC, 2006. *6 NYCRR Part 375, Environmental Remediation Programs. Subpart 375-6 – Remedial Program Soil Cleanup Objectives for Restricted Use*.

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

New York State Department of Health (NYSDOH), 2006. *Guidance for Evaluating Soil Vapor Intrusion in the State of New York.*

TABLES

Table 1
Groundwater Elevation Summary
Wills Building
Long Island City, New York

Well ID	MP Elevation (ft msl)	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Groundwater Elevation (ft msl)	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Groundwater Elevation (ft msl)
		11/10/2014			12/5/2014		
Overburden Monitoring Wells							
MW-1S	20.67		15.45	5.22		15.48	5.19
MW-2S	20.82		15.61	5.21		15.62	5.20
MW-101S	19.38		14.15	5.23		14.18	5.20
MW-1	18.51		14.17	4.34		13.74	4.77
MW-2	17.09		12.79	4.30		12.28	4.81
MW-5	17.12		12.94	4.18		12.33	4.79
MW-10	17.43		13.09	4.34		12.72	4.71
MW-1BA	17.78		13.01	4.77		12.85	4.93
MW-2BA	18.69		13.93	4.76		13.75	4.94
MW-3BA	19.29		14.40	4.89		14.28	5.01
MW-4BA	19.63	13.87	--	NA	14.48	--	NA
MW-5BA	20.06		14.95	5.11		14.94	5.12
MW-6BA	19.58		14.53	5.05		14.49	5.09
MW-8BA	17.65		DRY	NA		12.71	4.94
MW-203S	17.83		13.44	4.39		13.02	4.81
MW-203D	18.07		13.73	4.34		13.28	4.79
MW-204D	18.21		13.87	4.34		13.43	4.78
MW-205S	18.21		13.89	4.32		13.47	4.74
MW-205D	18.24		13.91	4.33		13.48	4.76
MW-206S	18.40		14.08	4.32		13.67	4.73
MW-206D	18.38		14.04	4.34		13.64	4.74
MW-207S	18.42		14.09	4.33		13.70	4.72
MW-207D	18.45		14.10	4.35		13.71	4.74
MW-208D	18.13		13.88	4.25		13.43	4.70
MW-209D	17.93		13.63	4.30		13.25	4.68
MW-210D	18.25		13.55	4.70		13.35	4.90
MW-211S	17.57		12.84	4.73		12.67	4.90
MW-211D	17.46		12.73	4.73		12.56	4.90
MW-212D	17.17		12.49	4.68		12.30	4.87
MW-214D	19.88		14.83	5.05		14.77	5.11
MW-215D	18.62		13.64	4.98		13.60	5.02
MW-217	17.43		NM	NA		NM	NA
MW-218	19.97		14.76	5.21		14.76	5.21
MW-219	18.86		13.58	5.28		13.55	5.31
MW-220	16.73		11.89	4.84		11.74	4.99
Bedrock Monitoring Wells							
MW-1D	20.61		15.39	5.22		15.40	5.21
MW-221B	17.90		13.55	4.35		13.14	4.76
MW-222B	19.62		16.32	3.30		15.92	3.70
MW-223B	17.46		14.28	3.18		13.81	3.65
MW-224B	17.20		13.97	3.23		13.52	3.68
MW-226B	15.89		8.21	7.68		7.75	8.14
MW-227B	20.11		14.91	5.20		14.84	5.27
Hybrid Overburden/Bedrock Monitoring Wells							
MW-225	18.28		15.19	3.09		14.69	3.59

NOTES:

MP = measuring point.
ft msl = feet above mean sea level.
ft bmp = feet below measuring point.
-- = not gauged.
NM = not measured, well was obstructed.
NA = not applicable.

Table 2
Existing Exceedences in Subsurface Soil
Wills Building
Long Island City, New York

Sample ID	Part 375 Soil Cleanup Objectives*			B-4 (9')	B-8 (9')
Sample Date	Unrestricted	Restricted Residential	Commercial	11/8/2014	11/9/2014
Pesticides (mg/kg)					
4,4'-DDT	0.0033	7.9	47	**0.00492**	<0.00169
4,4'-DDE	0.0033	8.9	62	**0.0161**	**0.0107**
Metals (mg/kg)					
Barium	350	400	400	**55.0**	**531**
Chromium	30	180	1500	**13.9**	**39.3**
Copper	50	270	270	**29.3**	**80.9**
Zinc	109	10,000	10,000	**29.6**	**118**

NOTES:

* Soil Cleanup Objectives from New York State Department of Environmental Conservation Part 375 Tables 375-6.8(a) and (b), effective December 14, 2006.

mg/kg = milligrams per kilogram

<# = analyte not detected at concentrations greater than the Reporting Limit shown

= exceeds Part 375 Soil Cleanup Objectives, Unrestricted Use

= exceeds Part 375 Soil Cleanup Objectives, Commercial Use

Table 3
Existing Exceedences in Overburden Groundwater
Wills Building
Long Island City, New York

		Grab Sample Analysis				Groundwater Monitoring Well Sample Analysis						
Sample ID		**GW-2**	**GW-6**	**GW-9**	**GW-9 Duplicate**	**MW-1S**	**MW-2S**	**MW-6BA**	**MW-101S**	**MW-214D**	**MW-218**	**GW-DUP-2**
Sample Date	**Part 703.5***	11/9/2014	11/9/2014	11/9/2014		11/11/2014	11/11/2014	11/12/2014	11/12/2014	11/12/2014	11/11/2014	11/11/2014
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	5	**24 J**	<0.50	<0.50	<0.50	<5.0	<1.0	**1.1**	<0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	1	<0.50	<0.50	<0.50	<0.50	<5.0	<1.0	**6.1**	<0.50	**0.38 J**	**0.78**	**0.73**
1,1-Dichloroethylene	5	**16 J**	<0.50	<0.50	<0.50	<5.0	<1.0	**9.0**	<0.50	**0.20 J**	**2.7**	**2.4**
Acetone	50	<2.0 UJ	<2.0 UJ	<2.0 UJ	**2.0 U**	<20 UJ	<4.0 UJ	<2.0 UJ	**190 J**	**8.4 UJ**	<0.50 UJ	<0.50 UJ
Benzene	1	**2.4 J**	<0.50	<0.50	<0.50	<5.0	<1.0	**0.79**	<0.50	<0.50	<0.50	<0.50
cis-1,2-Dichloroethylene	5	**6.7 J**	<0.50	<0.50	<0.50	<5.0 UJ	**5.3**	**29**	**7.2**	**3.9**	**63**	**58**
Tetrachloroethylene	5	**90,000 J**	**52 J**	**6.0**	**9.0**	**340**	**75**	**7300**	**83**	**250**	**710**	**840**
Trichloroethylene	5	**290 J**	**0.48 J**	<0.50	<0.50	<5.0	**7.0**	**75**	**3.8**	**7.2**	**32**	**31**
Semi-volatile Organic Compounds (µg/L)												
Benzo(a)anthracene	0.002	<0.0500	<0.0500	<0.0541	**0.0842**	<0.0541 UJ	<0.0513 UJ	NS	NS	NS	<0.0513 UJ	<0.0513 UJ
Benzo(b)fluoranthene	0.002	<0.0500	<0.0500	<0.0541	**0.0632**	<0.0541 UJ	<0.0513 UJ	NS	NS	NS	<0.0513 UJ	<0.0513 UJ
Bis(2-ethylhexyl)phthalate	5	<0.500	**1.06**	<0.541	**0.568**	**5.28**	**0.615**	NS	NS	NS	**1.79**	<0.513
Polychlorintated Biphenyls (µg/L)												
Arochlor 1016	0.09	**0.285**	<0.0500	<0.0500	<0.0541	<0.0526	<0.0526	NS	NS	NS	<0.0513	<0.0513
Total Metals (mg/L)												
Chromium	0.05	**0.203**	<0.005	**0.005**	**0.008**	<0.005	<0.005	NS	NS	NS	**0.01**	**0.01**
Iron	0.3	**97.9**	**0.357**	**0.271 J**	**2.55 J**	**0.099**	**0.126**	NS	NS	NS	**0.144**	**0.152**
Lead	0.025	**0.073**	<0.003	**0.003**	**0.01**	<0.003	<0.003	NS	NS	NS	<0.003	<0.003
Manganese	0.3	**5.13**	**0.111**	**0.351**	**0.523**	**1.34**	**5.07**	NS	NS	NS	**0.087**	**0.093**
Nickel	0.1	**0.175**	<0.005	<0.005	**0.007**	**0.007**	<0.005	NS	NS	NS	<0.005	<0.005
Selenium	0.01	**0.017**	**0.012**	**0.010**	<0.01	<0.01	<0.01	NS	NS	NS	<0.01	<0.01
Sodium	20	**322**	**35.3 J**	**213**	**206 J**	**1030 J**	**411 J**	NS	NS	NS	**264 J**	**263 J**
Dissolved Metals (mg/L)												
Manganese	0.3	**0.143**	**0.046**	**0.397**	**0.287**	**1.39**	**5.07**	NS	NS	NS	**0.091**	**0.097**
Selenium	0.01	**0.026 J**	**0.021 J**	**0.015 J**	**0.011 J**	<0.01	<0.01	NS	NS	NS	<0.01	<0.01
Sodium	20	**313**	**36.6**	**210 J**	**217**	**1060 J**	**422 J**	NS	NS	NS	**272 J**	**269 J**

NOTES:

* Guidance values from 6 NYCRR 703.5: Water quality standards for taste-, color-, and odor-producing, toxic and other deleterious substances for Class GA Waters as presented in TOGS 1.1.1 June 1998.

µg/L = micrograms per liter

mg/L = milligrams per liter

NS = not sampled

Shaded value indicates exceedance of TOGS 1.1.1 guidance value

J = estimated value

UJ = not detected above estimated reporting limit shown

<# = analyte not detected at concentrations greater than the Reporting Limit shown

Table 4
Existing Exceedences in Bedrock Groundwater
Wills Building
Long Island City, New York

Sample ID		MW-1D	MW-222B	MW-227B
Sample Date	Part 703.5*	11/11/2014	11/11/2014	11/11/2014
Volatile Organic Compounds (µg/L)				
1,1,1-Trichloroethane	5	**11 J**	**7.2 J**	<0.50
1,1,2-Trichloroethane	1	<0.50	**10 J**	**2.4**
1,1-Dichloroethylene	5	**2.4 J**	**16 J**	**8.3**
cis-1,2-Dichloroethylene	5	**1.3 J**	**11 J**	**7.1**
Tetrachloroethylene	5	**20,000 J**	**43,000 J**	**2500**
Trichloroethylene	5	**62 J**	**230 J**	**82**

NOTES:

* Guidance values from 6 NYCRR 703.5: Water quality standards for taste-, color-, and odor-producing, toxic and other deleterious substances for Class GA Waters as presented in TOGS 1.1.1 June 1998.

µg/L = micrograms per liter.

<# = analyte not detected at concentrations greater than the Reporting Limit shown

J = estimated value

Shaded value indicates exceedance of TOGS 1.1.1 guidance value

Table 5
Existing Exceedences in Indoor Air and Sub-Slab Vapor
Wills Building
Long Island City, New York

Sample ID	NYSDOH Final Guidance for Mitigation[1]	IAQ-1		B-DUP	IAQ-2		IAQ-3		IAQ-4		IAQ-5		IAQ-6		IAQ-7	
Sample Type		Indoor Air			Indoor Air		Indoor Air		Indoor Air		Indoor Air		Indoor Air		Indoor Air	
Sample Date	Indoor Air[2]	10/24/2014	2/15/2015		10/28/2014	2/15/2015	10/24/2014	2/15/2015	10/24/2014	2/15/2015	10/24/2014	2/15/2015	10/24/2014	2/15/2015	10/24/2014	2/15/2015
Volatile Organic Compounds (µg/m^3)																
Methylene Chloride	60	**54 J**	**28**	**30**	**46**	**38**	**51**	**99**	**56**	**88**	**39**	**63**	**48**	**100**	**23**	**1.4**
Tetrachloroethylene	100	**37 J**	**3.6**	**3.4**	**37**	**3.3**	**6.2**	<0.23	**3.6**	<0.17	**11**	<0.23	**0.68 U**	<0.18	**16**	<0.18
Trichloroethylene	5	**0.69**	<0.13	<0.15	**0.39**	<0.17	**0.96**	**0.67**	**0.88**	**0.55**	**0.87**	<0.18	**0.54**	**0.35**	**0.39**	<0.14

Sample ID	NYSDOH Final Guidance for Mitigation[1]	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-9	SS-9-DUP
Sample Type		Sub-Slab	Sub-Slab	Sub-Slab	Sub-Slab	Sub-Slab	Sub-Slab	Sub-Slab	Sub-Slab	
Sample Date	Sub-Slab[3]	10/24/2014	10/24/2014	10/24/2014	10/24/2014	10/24/2014	10/24/2014	10/24/2014	10/24/2014	
Volatile Organic Compounds (µg/m^3)										
Methylene Chloride	NA	**17**	**27**	**790**	**950**	<27	**1400**	<27	**34**	**33**
Tetrachloroethylene	1,000	**190,000**	**4,200,000**	**550,000**	**110,000**	**7300**	**32,000**	**8700**	**2800 J**	**2900 J**
Trichloroethylene	250	**2700**	<20,000	**1600**	**170**	**58**	**83**	**45**	<3.6	<2.4

NOTES:
[1] Mitigation Guidance Values from New York State Department of Health Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, Table 3.1 and Soil Vapor/Indoor Air Matrices 1 and 2, effective October 2006.
[2] Values for mitigation regardless of sub-slab concentration.
[3] Values for mitigation regardless of indoor air concentration.
Shaded cell indicates value exceeds NYSDOH guidance values for mitigation.

µg/m^3 = micrograms per cubic meter
NA = not available
<# = analyte not detected at concentrations greater than the Reporting Limit shown
J = estimated value
U = not detected at or above stated reporting limit

FIGURES

Source: USGS Topographic map Brooklyn 2013

USGS Topographic map Central Park 2013

JOB TITLE AND LOCATION:

WILLS BUILDING
43-01 21st STREET
LONG ISLAND CITY, NEW YORK

WARNING

IT IS A VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON, OTHER THAN THOSE WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

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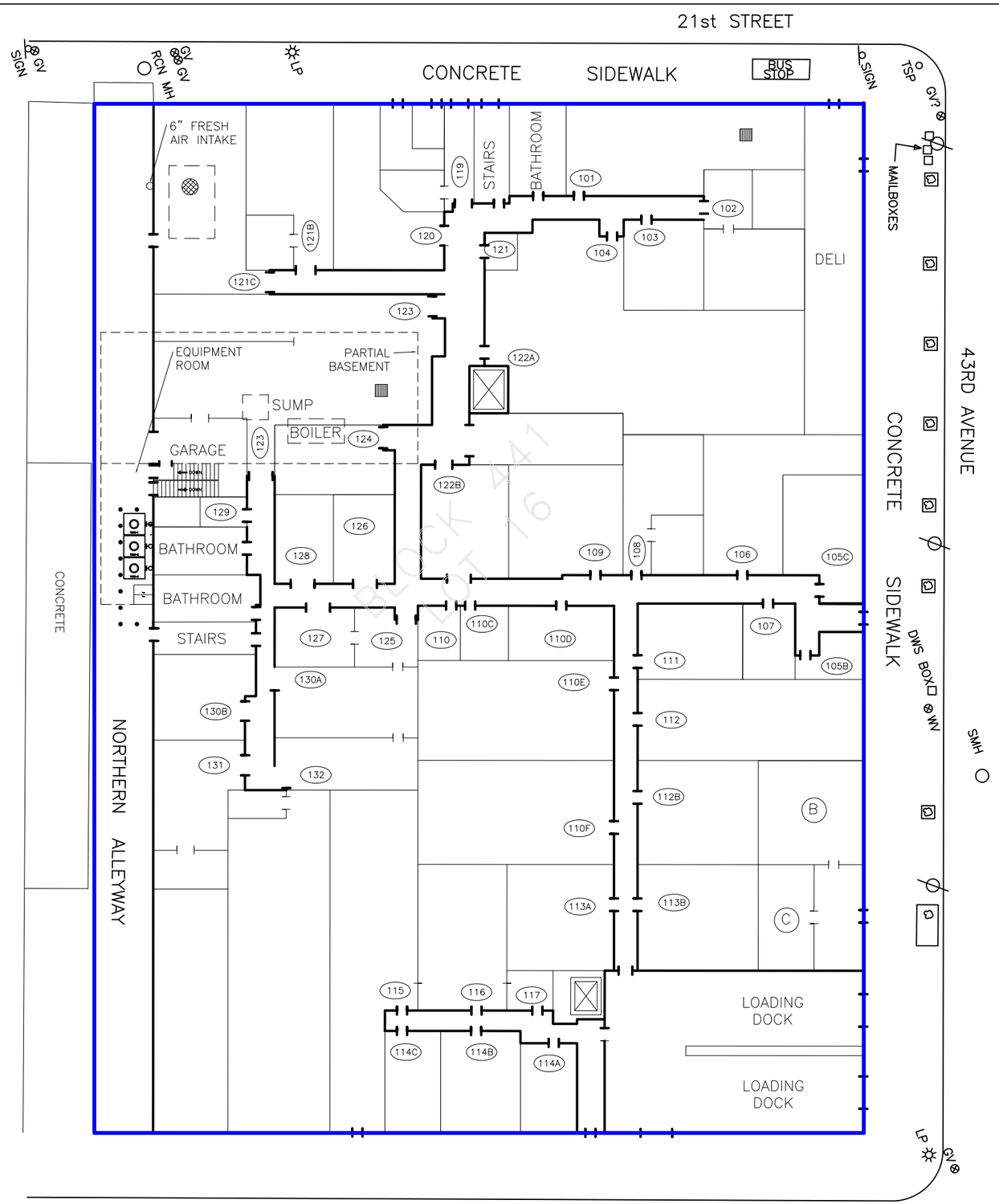
DRAWING TITLE:

SITE LOCATION MAP

DATE: 7/15/2015		JOB NO.:	FIGURE NO.: 1
DESIGNED BY: BDB	CHECKED BY: RPT	SCALE: 1 : 24000	
DRAWN BY: BDB	PROJ ENG.: RPT	SHEET OF	



LEGEND:

- (121C) SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

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PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

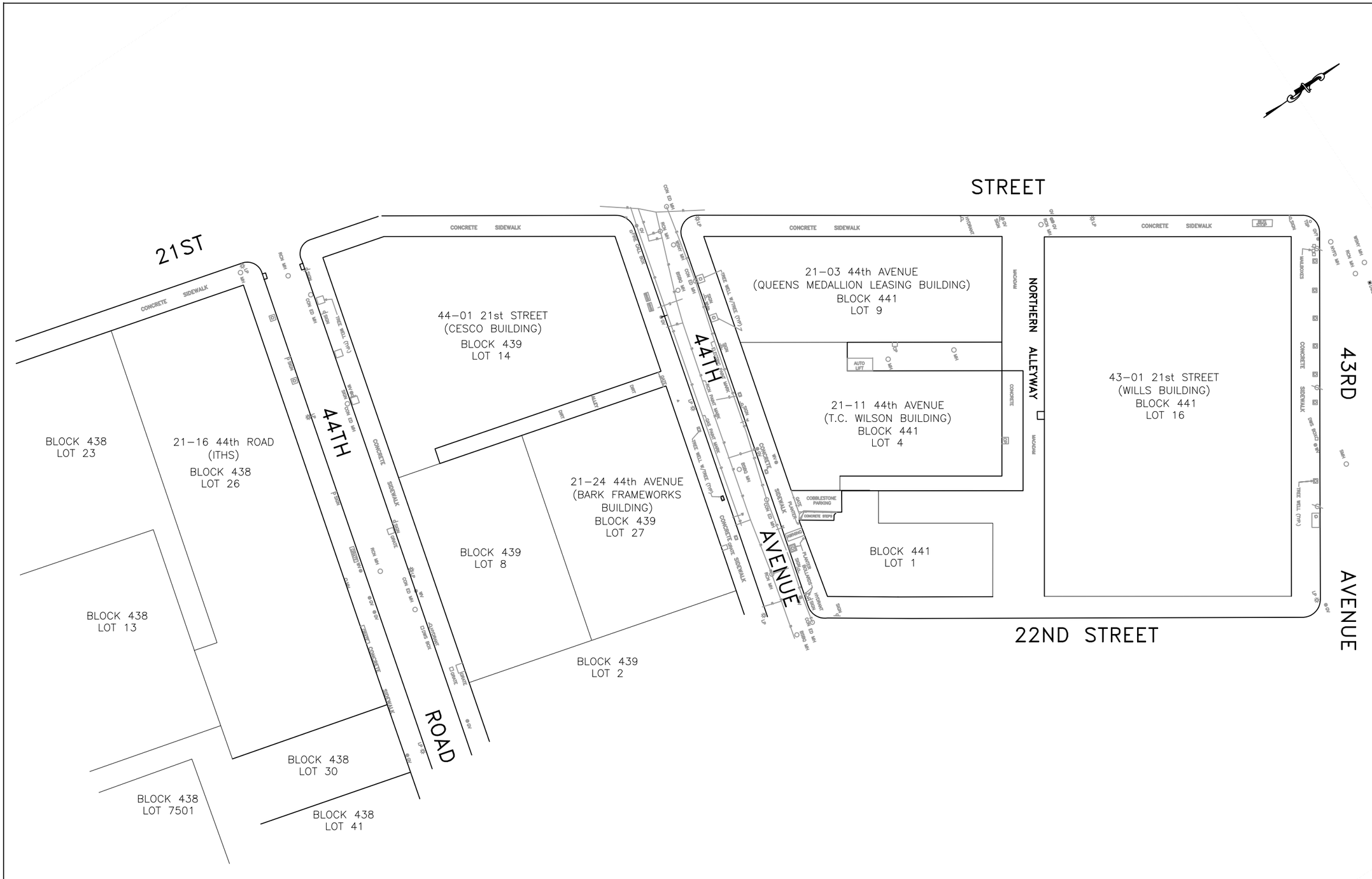
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

SITE MAP

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	2
SCALE: 1" = 30'	SHEET No.:	OF:
	REVISED BY:	–



* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21–03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

35FT 0 35FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

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PROJECT TITLE:

THE WILLS BUILDING
43–01 21ST STREET
LONG ISLAND CITY, NY 11101

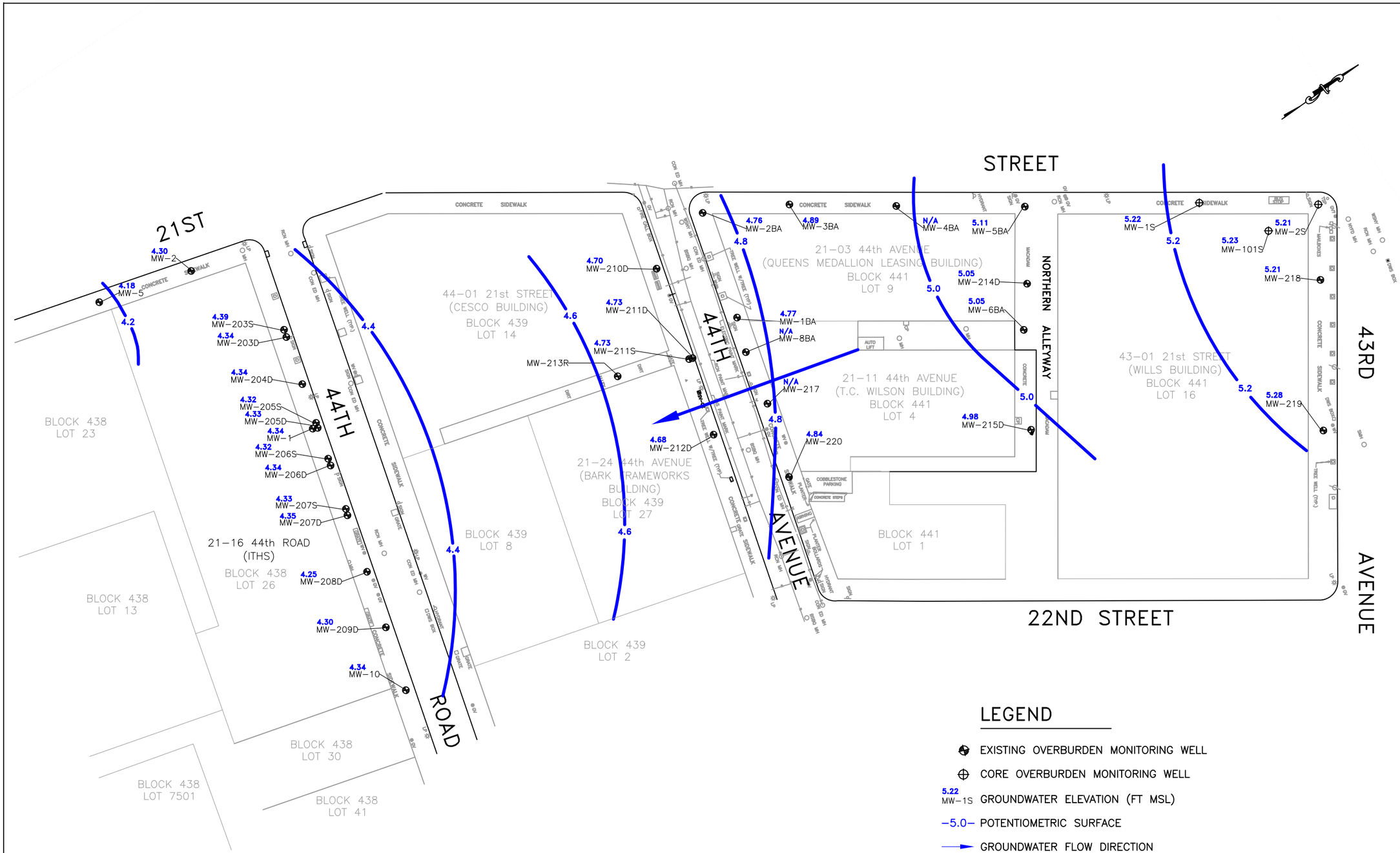
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

AREA MAP

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	3
SCALE: 1" = 70'	SHEET No.:	OF:
	REVISED BY:	–



LEGEND

- EXISTING OVERBURDEN MONITORING WELL
- CORE OVERBURDEN MONITORING WELL
- 5.22 MW-1S — GROUNDWATER ELEVATION (FT MSL)
- –5.0– POTENTIOMETRIC SURFACE
- GROUNDWATER FLOW DIRECTION

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

35FT 0 35FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

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PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

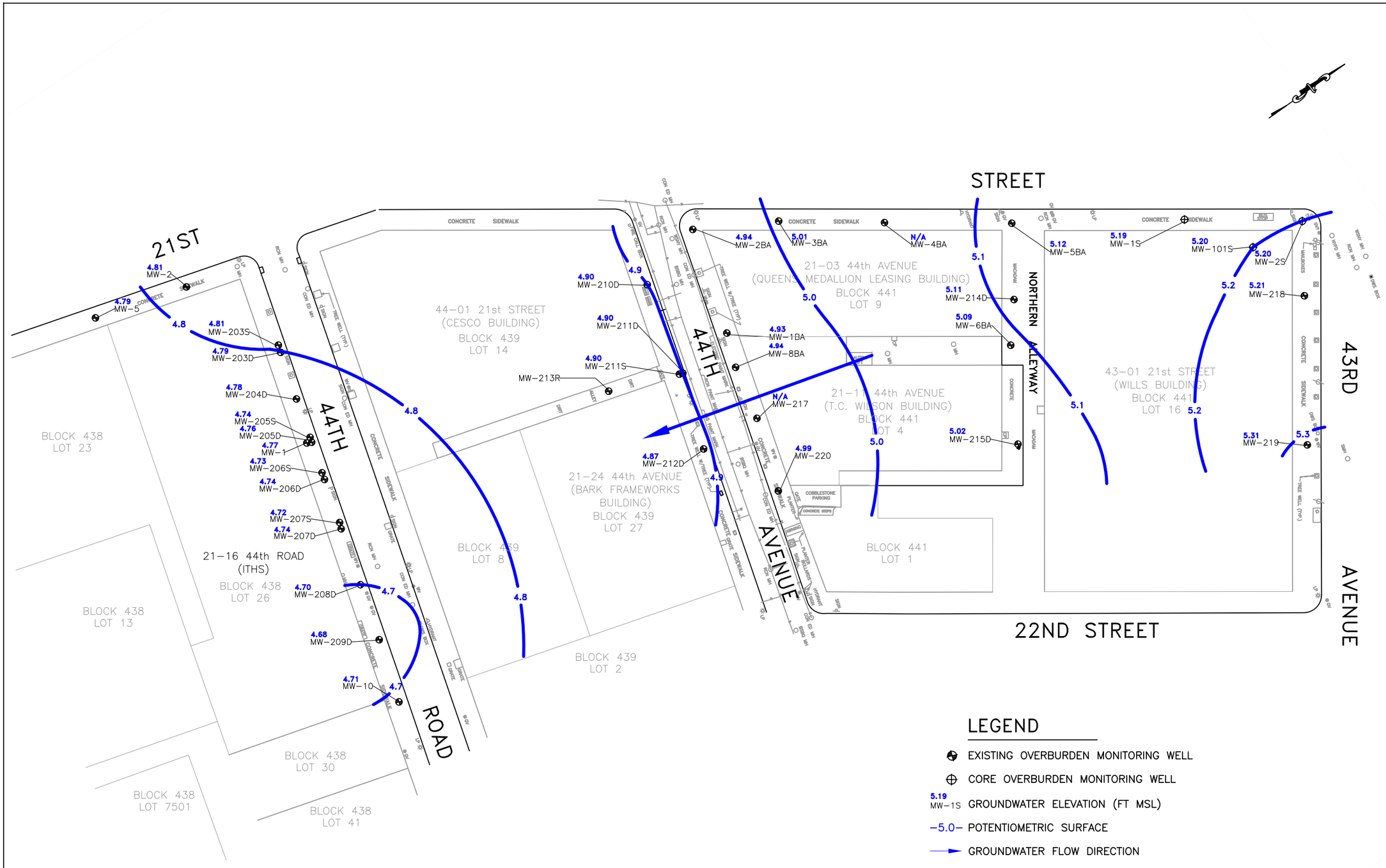
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

OVERBURDEN GROUNDWATER CONTOUR MAP
NOVEMBER 10, 2014

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	4A
SCALE: 1" = 70'	SHEET No.:	OF:
	REVISED BY:	–



LEGEND

- EXISTING OVERBURDEN MONITORING WELL
- CORE OVERBURDEN MONITORING WELL
- 5.19 MW-1S GROUNDWATER ELEVATION (FT MSL)
- –5.0– POTENTIOMETRIC SURFACE
- GROUNDWATER FLOW DIRECTION

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

35FT 0 35FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

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PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

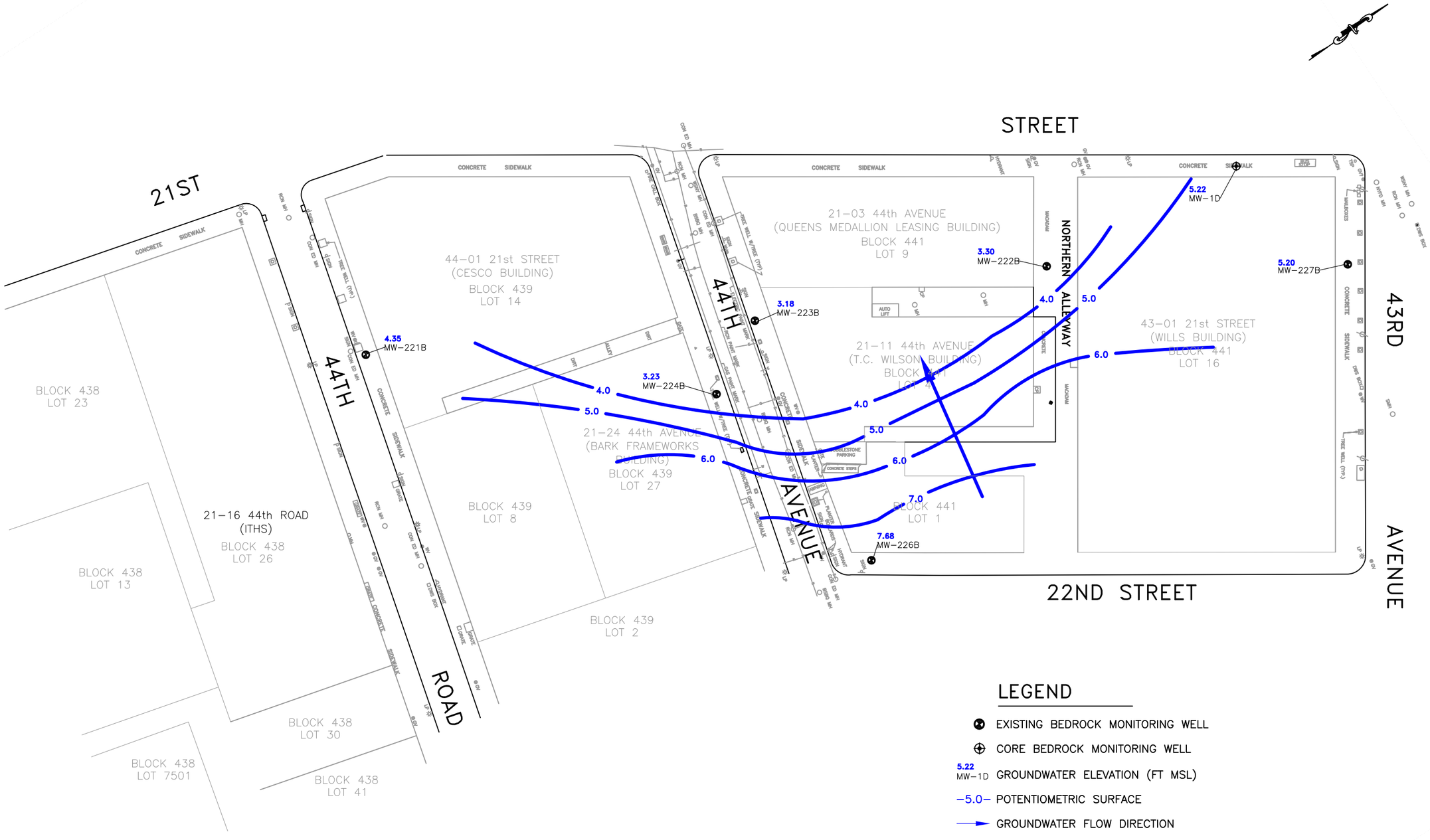
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

OVERBURDEN GROUNDWATER CONTOUR MAP
DECEMBER 5, 2014

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	4B
SCALE: 1" = 70'	SHEET No.:	OF:
	REVISED BY:	–



LEGEND

- EXISTING BEDROCK MONITORING WELL
- CORE BEDROCK MONITORING WELL
- 5.22 MW–1D GROUNDWATER ELEVATION (FT MSL)
- –5.0– POTENTIOMETRIC SURFACE
- GROUNDWATER FLOW DIRECTION

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21–03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

35FT 0 35FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

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PROJECT TITLE:

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43–01 21ST STREET
LONG ISLAND CITY, NY 11101

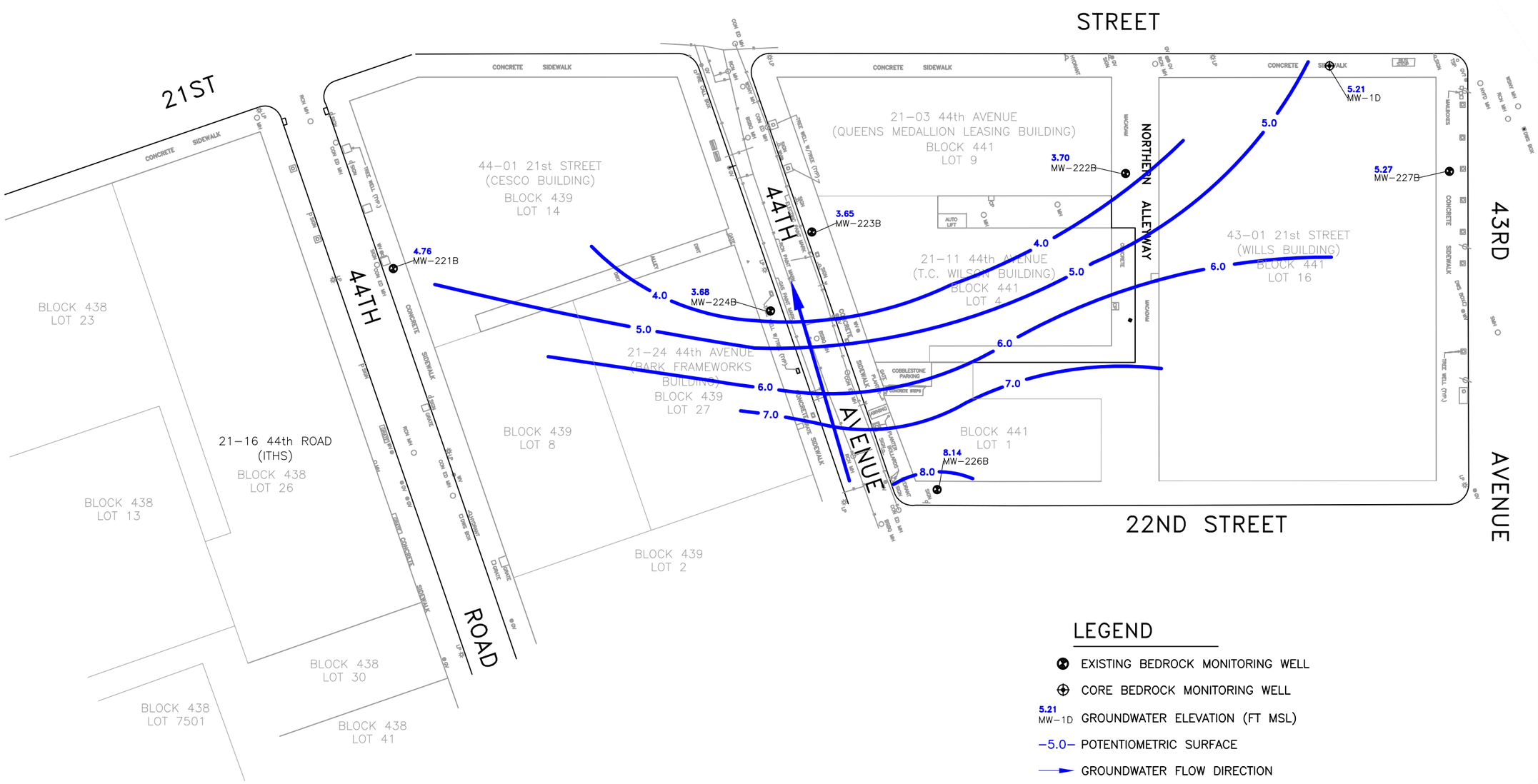
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

BEDROCK GROUNDWATER CONTOUR MAP
NOVEMBER 10, 2014

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	4C
SCALE: 1" = 70'	SHEET No.:	OF:
	REVISED BY:	–



LEGEND

- EXISTING BEDROCK MONITORING WELL
- CORE BEDROCK MONITORING WELL
- 5.21 MW–1D GROUNDWATER ELEVATION (FT MSL)
- –5.0– POTENTIOMETRIC SURFACE
- GROUNDWATER FLOW DIRECTION

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21–03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

35FT 0 35FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

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PROJECT TITLE:

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43–01 21ST STREET
LONG ISLAND CITY, NY 11101

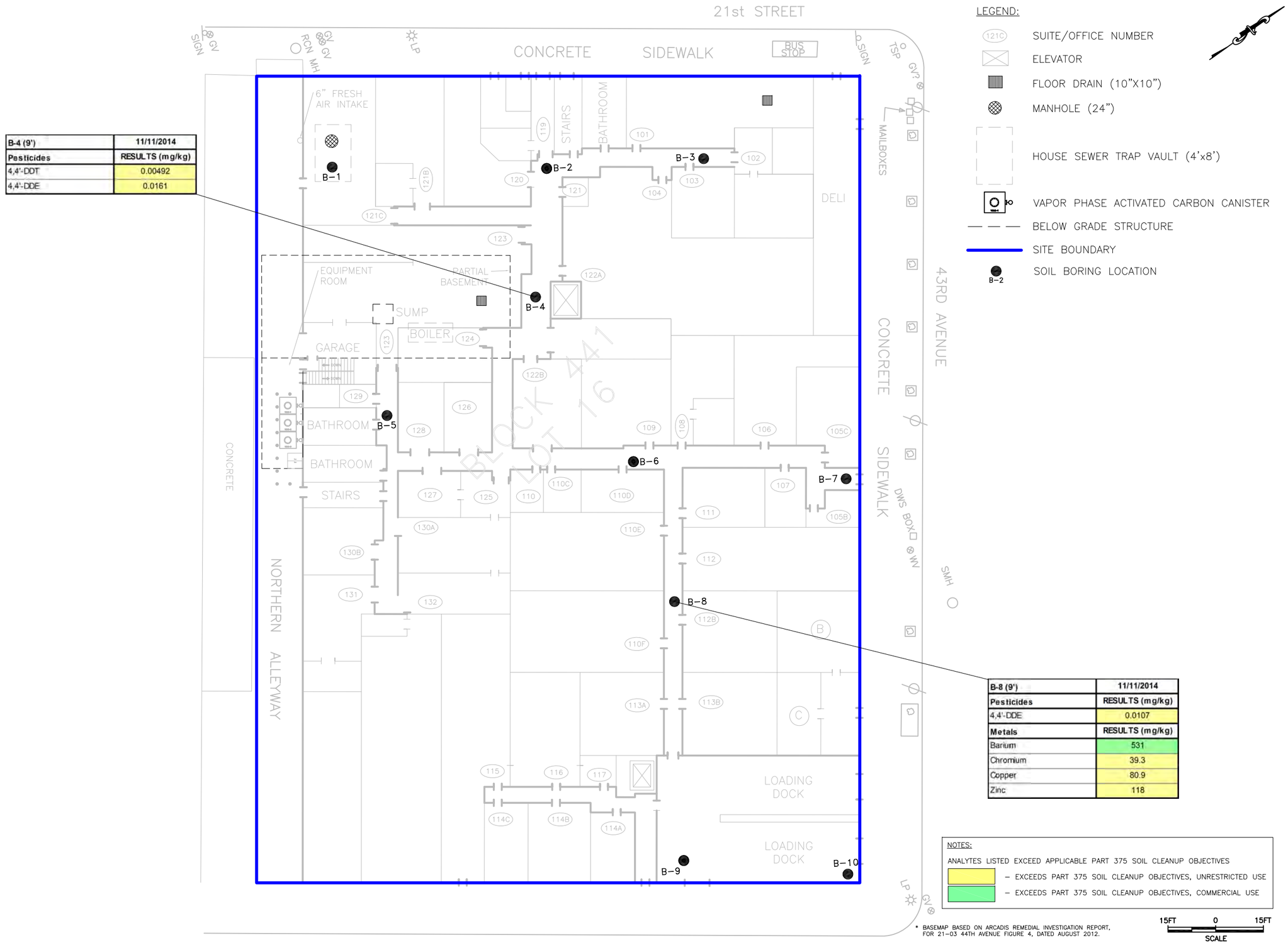
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

BEDROCK GROUNDWATER
CONTOUR MAP
DECMEBER 5, 2014

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	4D
SCALE: 1" = 70'	SHEET No.:	OF:
	REVISED BY:	–



B-4 (9')	11/11/2014
Pesticides	RESULTS (mg/kg)
4,4'-DDT	0.00492
4,4'-DDE	0.0161

B-8 (9')	11/11/2014
Pesticides	RESULTS (mg/kg)
4,4'-DDE	0.0107
Metals	RESULTS (mg/kg)
Barium	531
Chromium	39.3
Copper	80.9
Zinc	118

LEGEND:

- 121C — SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY
- B-2 — SOIL BORING LOCATION

NOTES:

ANALYTES LISTED EXCEED APPLICABLE PART 375 SOIL CLEANUP OBJECTIVES

- — EXCEEDS PART 375 SOIL CLEANUP OBJECTIVES, UNRESTRICTED USE
- — EXCEEDS PART 375 SOIL CLEANUP OBJECTIVES, COMMERCIAL USE

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
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2312 WEHRLE DRIVE
BUFFALO, N.Y. 14221
T: 716-204-8054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

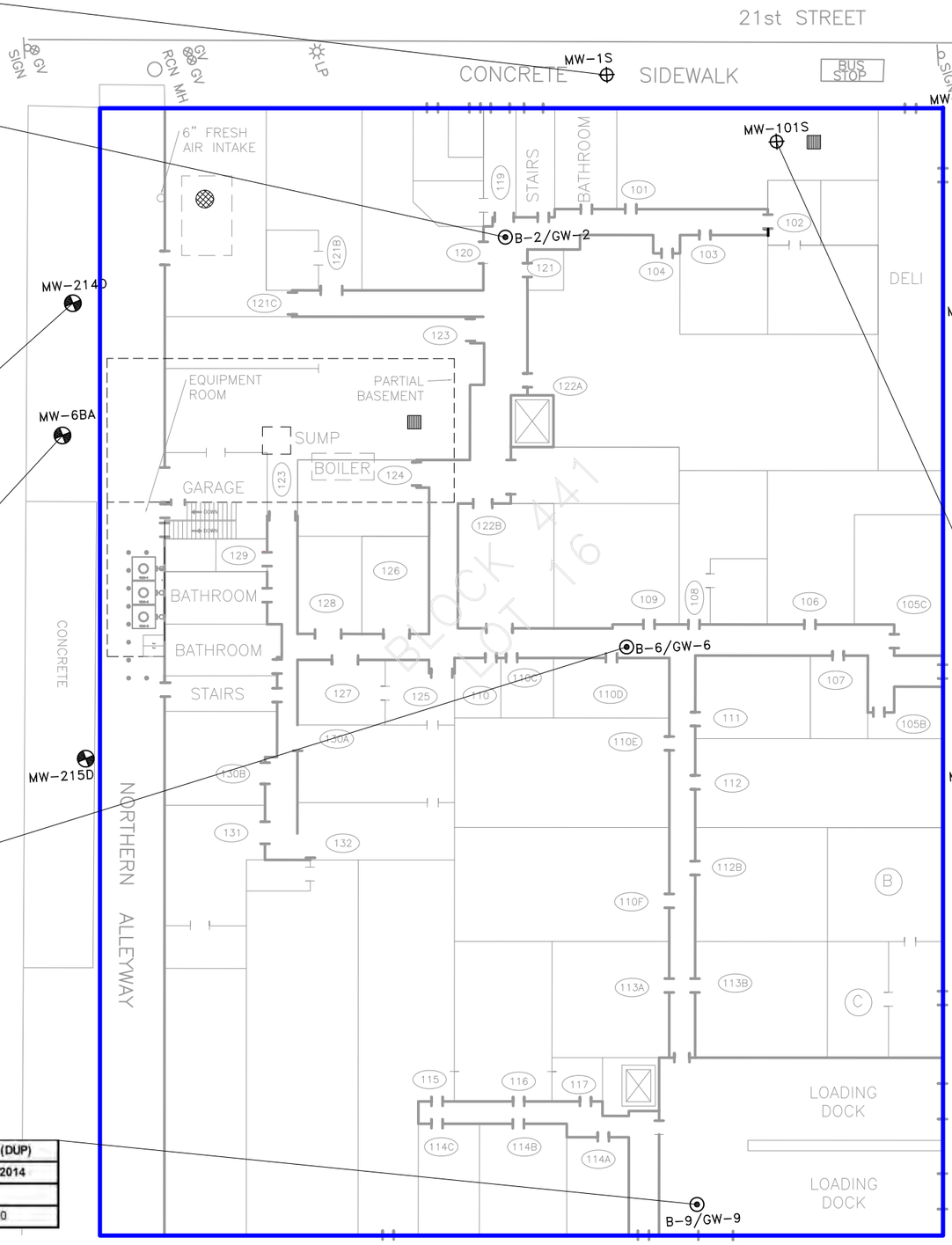
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

EXISTING EXCEEDENCES IN SUBSURFACE SOIL

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	5
SCALE: 1" = 30'	SHEET No.:	OF:
	REVISED BY:	–



MW-1S	11/11/2014
VOCs	RESULTS (µg/L)
Tetrachloroethylene	340

GW-2	11/9/2014
VOCs	RESULTS (µg/L)
1,1,1-Trichloroethane	24 J
1,1-Dichloroethylene	16 J
Benzene	2.4 J
cis-1,2-Dichloroethylene	6.7 J
Tetrachloroethylene	90,000 J
Trichloroethylene	290 J

MW-214D	11/12/2014
VOCs	RESULTS (µg/L)
Tetrachloroethylene	250
Trichloroethylene	7.2

MW-6BA	11/12/2014
VOCs	RESULTS (µg/L)
1,1,2-Trichloroethane	6.1
1,1-Dichloroethylene	9.0
cis-1,2-Dichloroethylene	29
Tetrachloroethylene	7300
Trichloroethylene	75

GW-6	11/9/2014
VOCs	RESULTS (µg/L)
Tetrachloroethylene	52 J

	GW-9	GW-9 (DUP)
	11/9/2014	11/9/2014
VOCs	RESULTS (µg/L)	
Tetrachloroethylene	6.0	9.0

LEGEND:

- (121C) SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY
- MW-214D OVERBURDEN MONITORING WELL (INSTALLED BY OTHERS)
- MW-1S CORE OVERBURDEN MONITORING WELL
- B-2/GW-2 SOIL BORING AND GROUNDWATER SAMPLE LOCATION

MW-2S	11/11/2014
VOCs	RESULTS (µg/L)
cis-1,2-Dichloroethylene	5.3
Tetrachloroethylene	75
Trichloroethylene	7.0

	MW-218	GW-DUP-2
	11/11/2014	11/11/2014
VOCs	RESULTS (µg/L)	
cis-1,2-Dichloroethylene	63	58
Tetrachloroethylene	710	840
Trichloroethylene	32	31

MW-101S	11/12/2014
VOCs	RESULTS (µg/L)
Acetone	190 J
cis-1,2-Dichloroethylene	7.2
Tetrachloroethylene	83

NOTES:

ANALYTES LISTED EXCEED APPLICABLE PART 703.5 CLASS GA GROUNDWATER STANDARDS

J – ESTIMATED VALUE

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
46-11 54TH AVENUE
MASPETH, N.Y. 11378
T: 718-762-0544
F: 718-762-0545
2312 WEHRLE DRIVE
BUFFALO, N.Y. 14221
T: 716-204-8054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

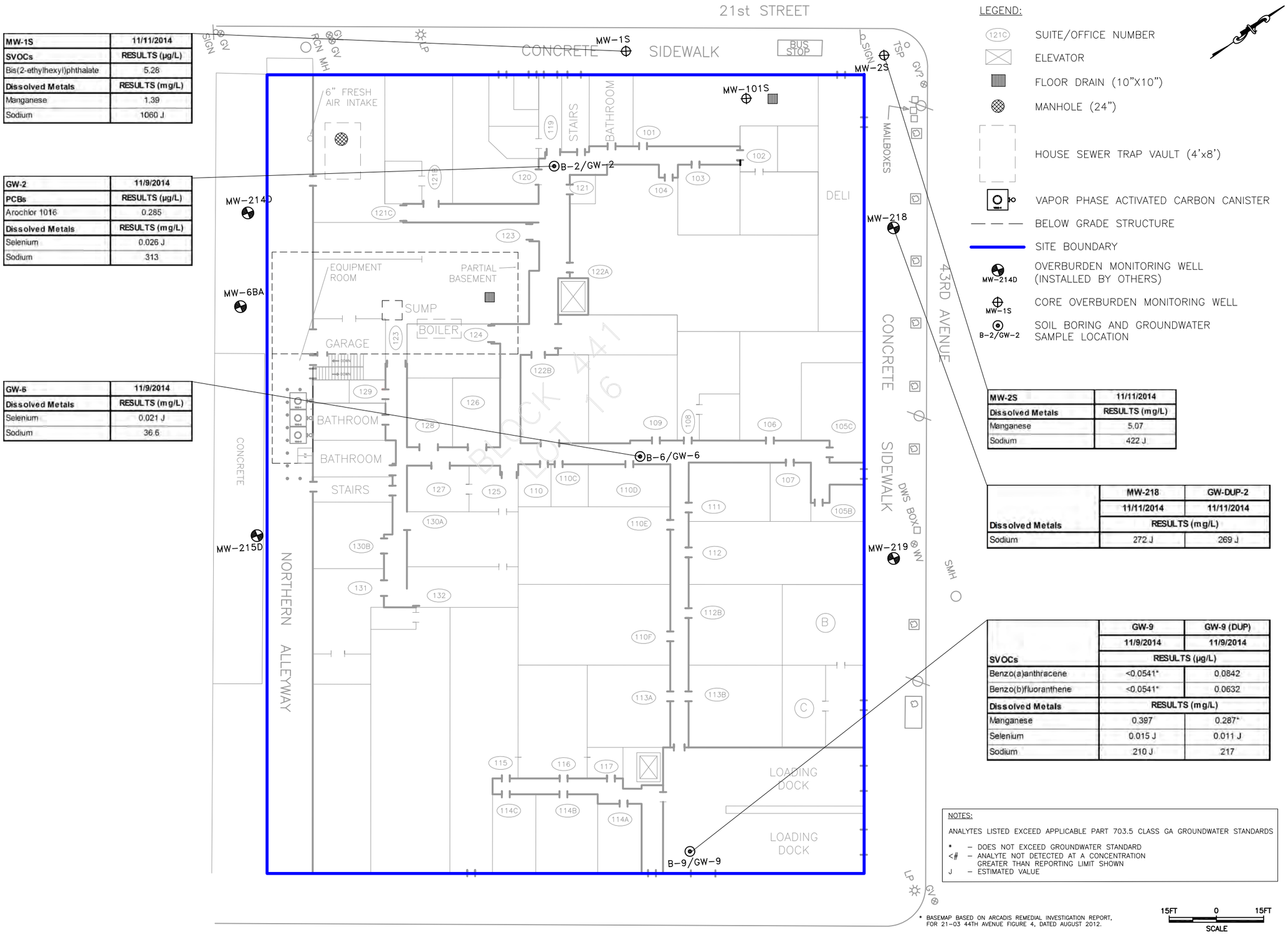
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

EXISTING EXCEEDENCES OF VOCs IN OVERBURDEN GROUNDWATER

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	6A
SCALE: 1" = 30'	SHEET No.:	6A
	REVISED BY:	–



MW-1S	11/11/2014
SVOCs	RESULTS (µg/L)
Bis(2-ethylhexyl)phthalate	5.26
Dissolved Metals	RESULTS (mg/L)
Manganese	1.39
Sodium	1060 J

GW-2	11/9/2014
PCBs	RESULTS (µg/L)
Arochlor 1016	0.285
Dissolved Metals	RESULTS (mg/L)
Selenium	0.026 J
Sodium	313

GW-6	11/9/2014
Dissolved Metals	RESULTS (mg/L)
Selenium	0.021 J
Sodium	36.6

LEGEND:

- 121C — SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY
- MW-214D — OVERBURDEN MONITORING WELL (INSTALLED BY OTHERS)
- MW-1S — CORE OVERBURDEN MONITORING WELL
- B-2/GW-2 — SOIL BORING AND GROUNDWATER SAMPLE LOCATION

MW-2S	11/11/2014
Dissolved Metals	RESULTS (mg/L)
Manganese	5.07
Sodium	422 J

	MW-218	GW-DUP-2
	11/11/2014	11/11/2014
Dissolved Metals	RESULTS (mg/L)	
Sodium	272 J	269 J

	GW-9	GW-9 (DUP)
	11/9/2014	11/9/2014
SVOCs	RESULTS (µg/L)	
Benzo(a)anthracene	<0.0541*	0.0842
Benzo(b)fluoranthene	<0.0541*	0.0632
Dissolved Metals	RESULTS (mg/L)	
Manganese	0.397	0.287*
Selenium	0.015 J	0.011 J
Sodium	210 J	217

NOTES:

ANALYTES LISTED EXCEED APPLICABLE PART 703.5 CLASS GA GROUNDWATER STANDARDS

* – DOES NOT EXCEED GROUNDWATER STANDARD
<# – ANALYTE NOT DETECTED AT A CONCENTRATION GREATER THAN REPORTING LIMIT SHOWN
J – ESTIMATED VALUE

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21–03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
46-11 54TH AVENUE
MASPETH, N.Y. 11378
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2312 WEHRLE DRIVE
BUFFALO, N.Y. 14221
T: 716-204-8054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43–01 21ST STREET
LONG ISLAND CITY, NY 11101

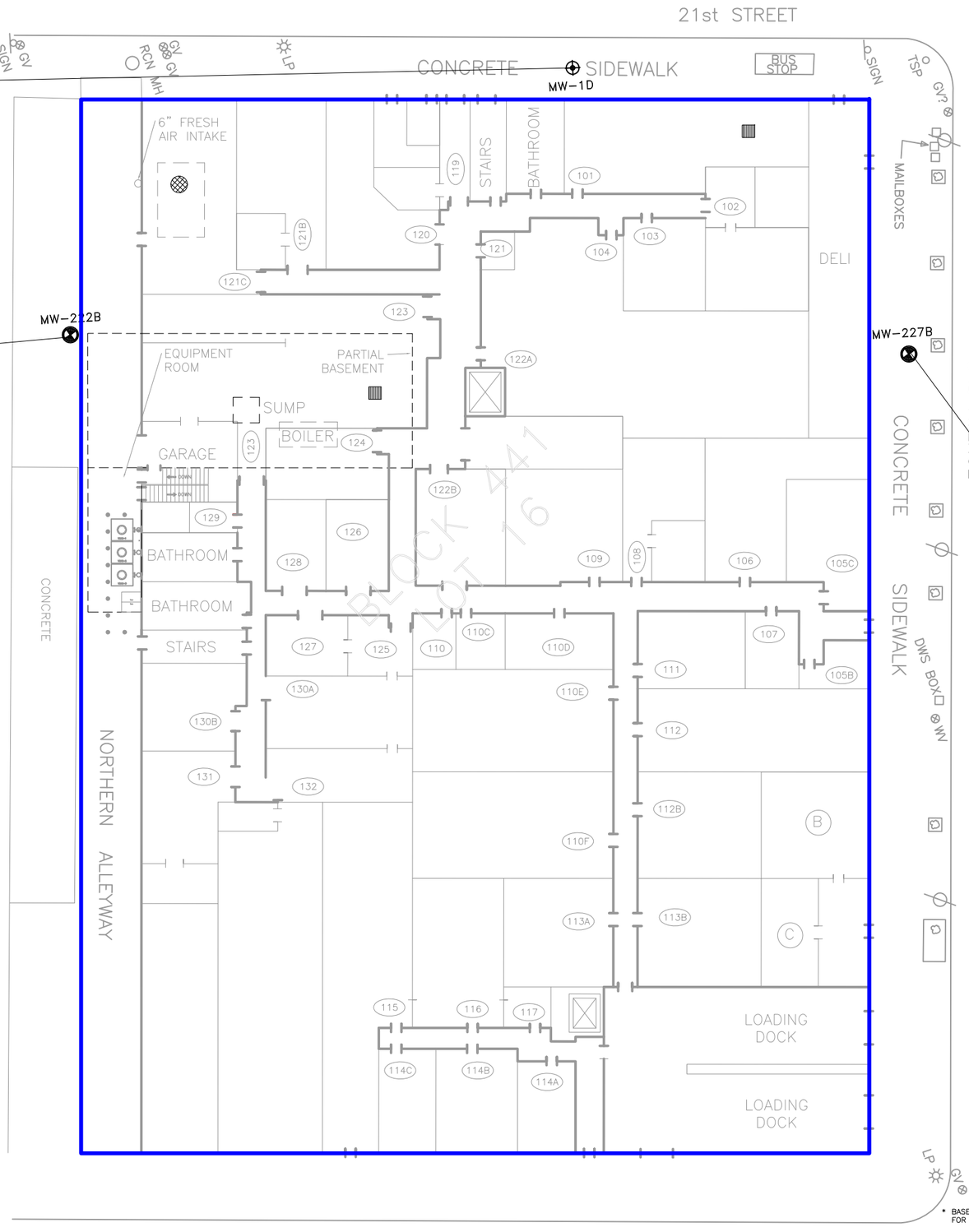
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

EXISTING EXCEEDENCES OF SVOCs, PCBs & METALS IN OVERBURDEN GROUNDWATER

SEAL & SIGNATURE	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	6B
SCALE: 1" = 30'	SHEET No.:	OF:
	REVISED BY:	–



MW-1D	11/11/2014
COMPOUND	RESULTS (µg/L)
1,1,1-Trichloroethane	11 J
Tetrachloroethylene	20,000 J
Trichloroethylene	62 J

MW-222B	11/11/2014
COMPOUND	RESULTS (µg/L)
1,1,1-Trichloroethane	7.2 J
1,1,2-Trichloroethane	10 J
1,1-Dichloroethylene	16 J
cis-1,2-Dichloroethylene	11 J
Tetrachloroethylene	43,000 J
Trichloroethylene	230 J

MW-227B	11/11/2014
COMPOUND	RESULTS (µg/L)
1,1,2-Trichloroethane	2.4
1,1-Dichloroethylene	8.3
cis-1,2-Dichloroethylene	7.1
Tetrachloroethylene	2500
Trichloroethylene	82

LEGEND:

- SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY

NOTES:

ANALYTES LISTED EXCEED APPLICABLE PART 703.5 CLASS GA GROUNDWATER STANDARDS

J – ESTIMATED VALUE

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
46-11 54TH AVENUE
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F: 718-762-0545
2312 WEHRLE DRIVE
BUFFALO, N.Y. 14221
T: 716-204-8054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

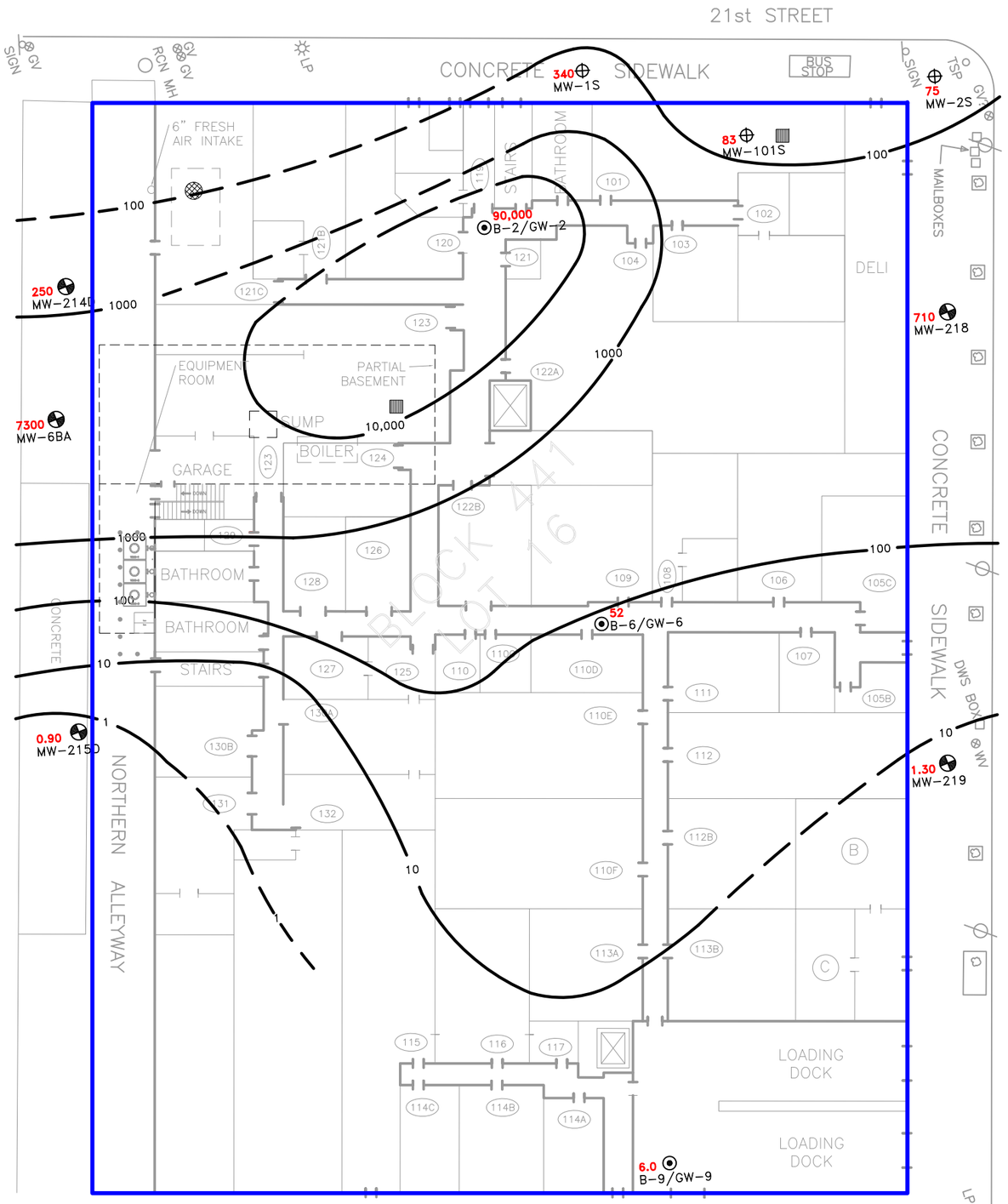
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

EXISTING EXCEEDENCES OF VOCs IN BEDROCK GROUNDWATER

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	6C
SCALE: 1" = 30'	SHEET No.:	OF:
	REVISED BY:	–



LEGEND:

- SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY
- MW-214D — OVERBURDEN MONITORING WELL (INSTALLED BY OTHERS)
- MW-1S — CORE OVERBURDEN MONITORING WELL
- B-2/GW-2 — SOIL BORING AND GROUNDWATER SAMPLE LOCATION
- 340 MW-1S — PCE CONCENTRATION (ppb)
- –10– PCE ISOCONCENTRATION CONTOURS (ppb)
- ---- INFERRED PCE ISOCONCENTRATION CONTOURS

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

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BUFFALO, N.Y. 14221
T: 716-204-8054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

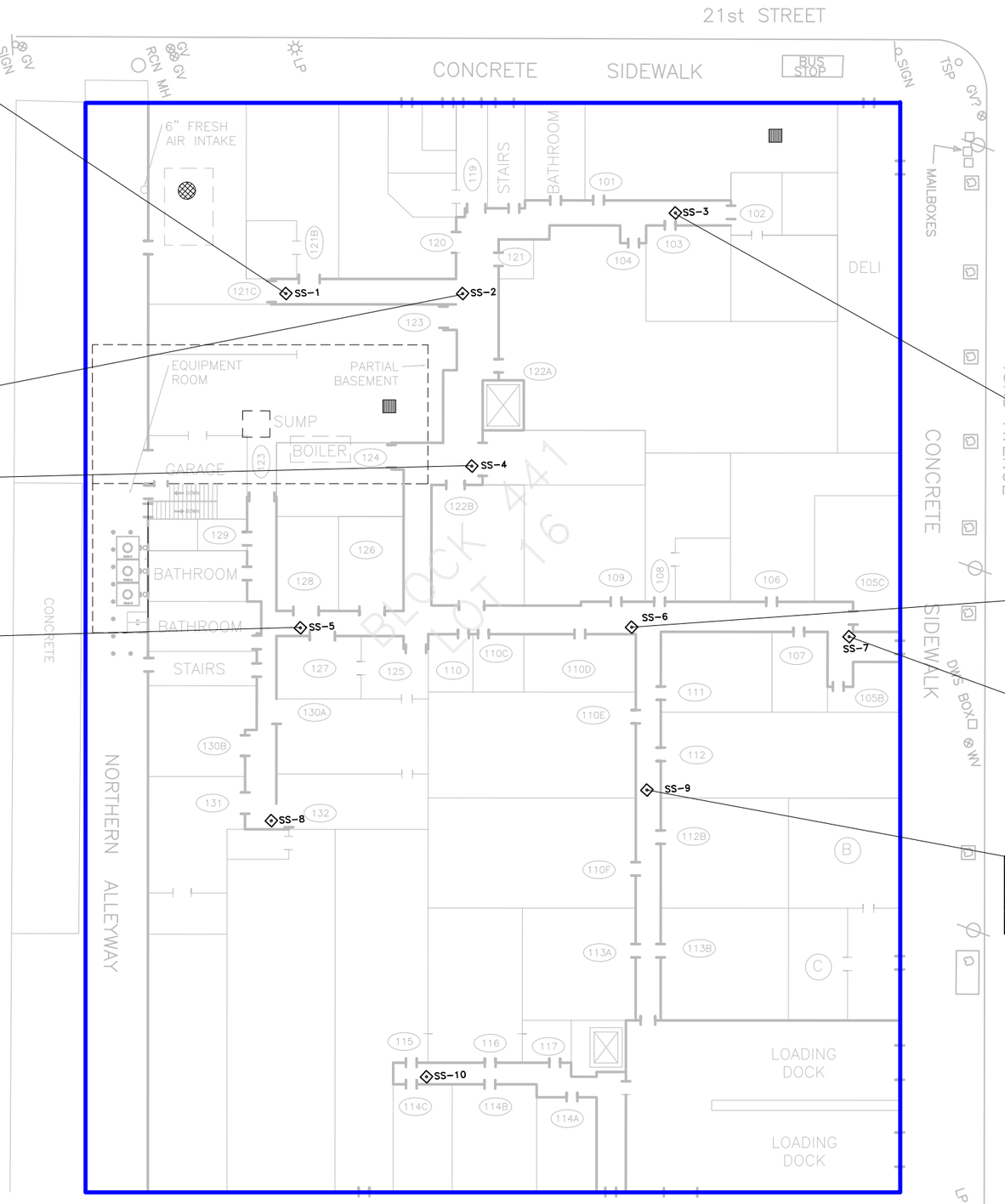
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

EXISTING PCE IN OVERBURDEN GROUNDWATER ISOCONCENTRATION MAP

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	6D
SCALE: 1" = 30'	SHEET No.:	OF:
	REVISED BY:	–



SS-1	10/24/2014
COMPOUND	RESULTS (µg/m³)
Tetrachloroethylene	190,000
Trichloroethylene	2700

SS-2	10/24/2014
COMPOUND	RESULTS (µg/m³)
Tetrachloroethylene	4,200,000

SS-4	10/24/2014
COMPOUND	RESULTS (µg/m³)
Tetrachloroethylene	110,000

SS-5	10/24/2014
COMPOUND	RESULTS (µg/m³)
Tetrachloroethylene	7300

SS-3	10/24/2014
COMPOUND	RESULTS (µg/m³)
Tetrachloroethylene	550,000
Trichloroethylene	1600

SS-6	10/24/2014
COMPOUND	RESULTS (µg/m³)
Tetrachloroethylene	32,000

SS-7	10/24/2014
COMPOUND	RESULTS (µg/m³)
Tetrachloroethylene	8700

	SS-9	SS-9-DUP
	10/24/2014	10/24/2014
COMPOUND	RESULTS (µg/m3)	
Tetrachloroethylene	2800 J	2900 J

LEGEND:

- 121C — SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY
- SS-1 — SUB-SLAB VAPOR SAMPLE LOCATION

NOTES:

ANALYTES LISTED EXCEED APPLICABLE NYSDOH MITIGATION GUIDANCE VALUES

J – ESTIMATED VALUE

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
46-11 54TH AVENUE
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BUFFALO, N.Y. 14221
T: 716-204-8054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

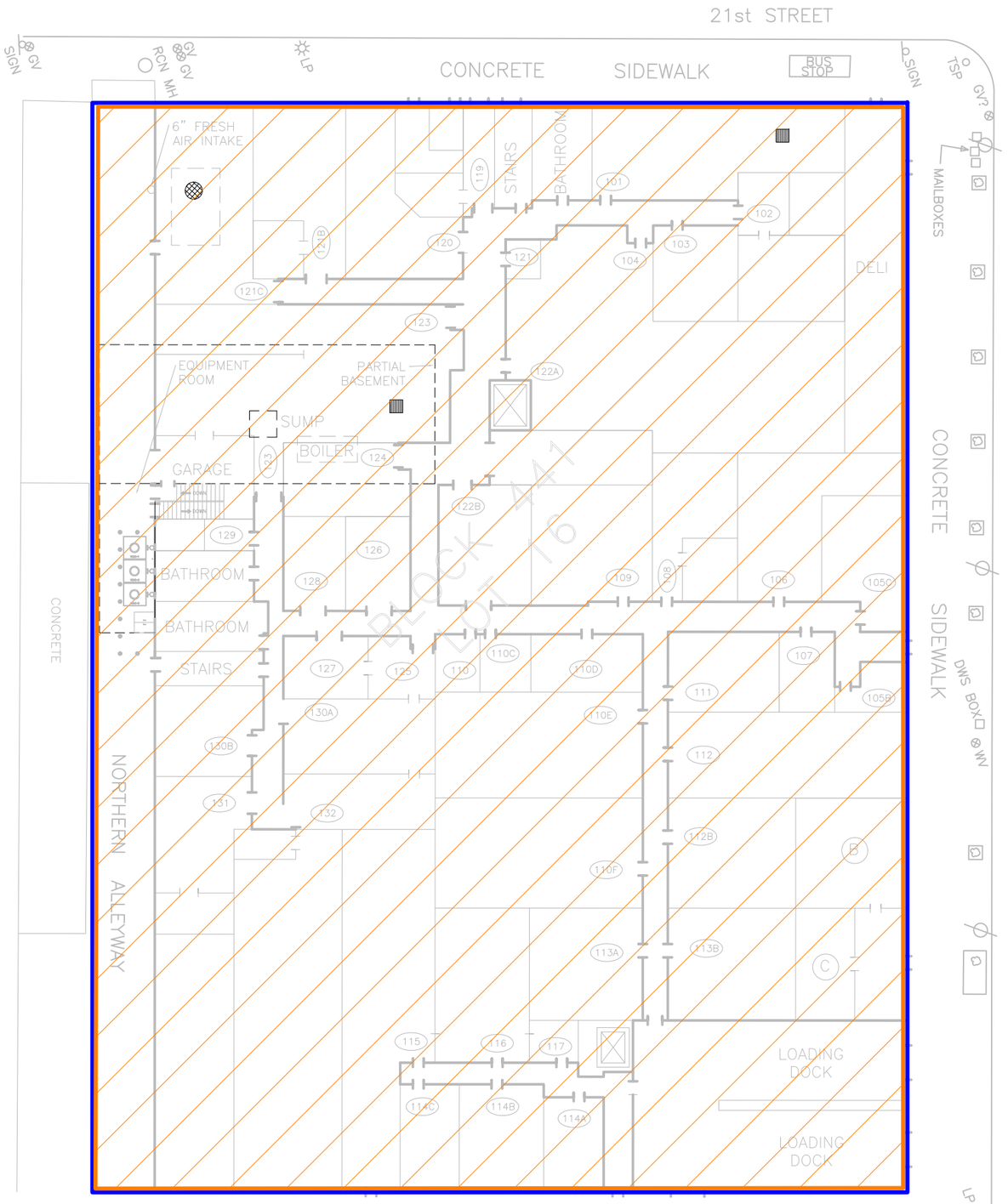
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

EXISTING EXCEEDENCES OF VOCs IN SUB-SLAB VAPOR

SEAL & SIGNATURE	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	7
SCALE: 1" = 30'	SHEET No.:	OF:
	REVISED BY:	–



LEGEND:

- SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY
- AREA OF SOIL VAPOR INTRUSION CONCERN

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
46-11 54TH AVENUE
MASPETH, N.Y. 11378
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2312 WEHRLE DRIVE
BUFFALO, N.Y. 14221
T: 716-204-8054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

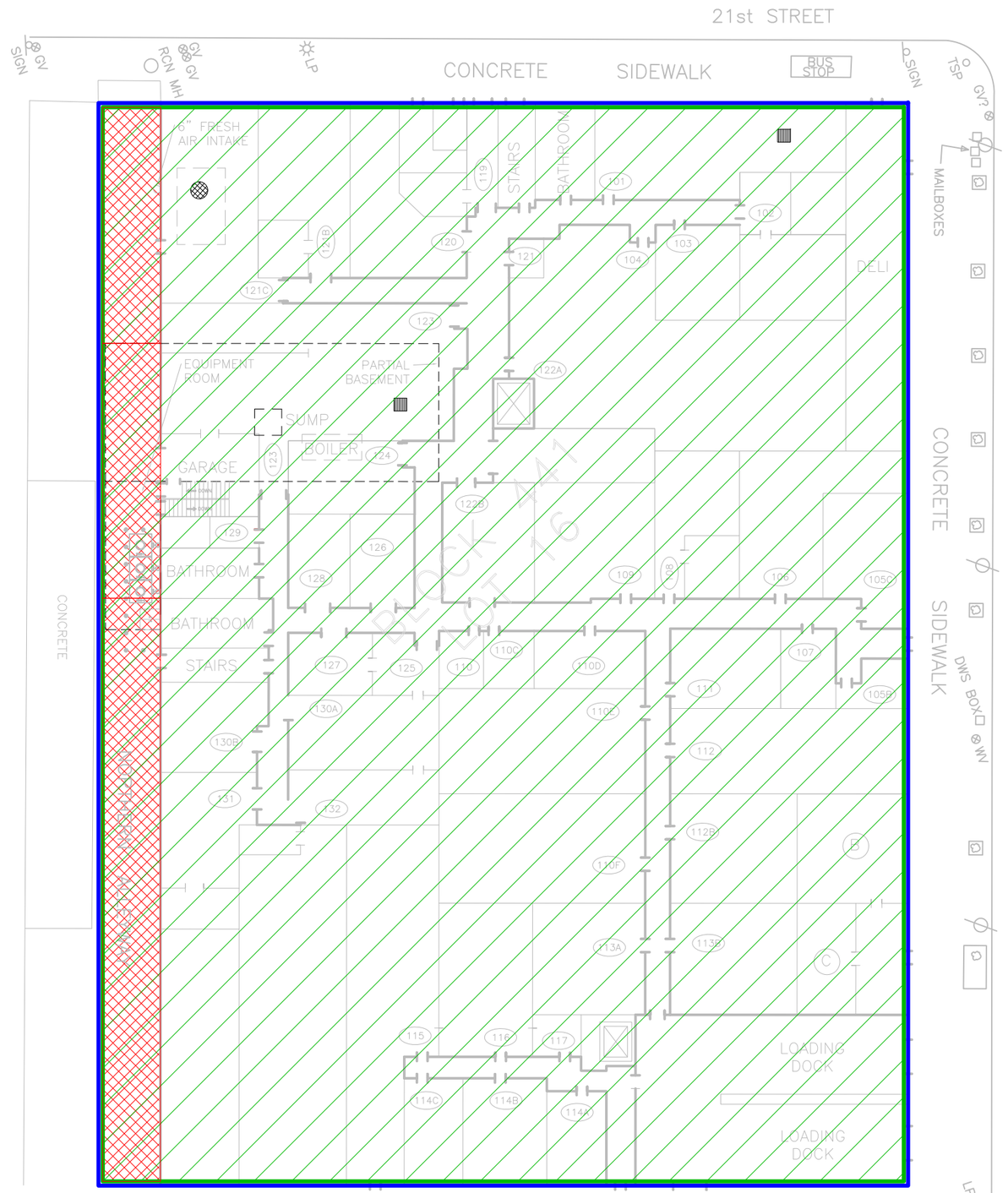
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

AREA OF
SOIL VAPOR INTRUSION
CONCERN

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	8
SCALE: 1" = 30'	SHEET No.:	OF:
	REVISED BY:	–



LEGEND:

- SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY
- EXISTING SITE COVER
- POTENTIAL AREA OF ENHANCED BIOREMEDIATION APPLICATION

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
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2312 WEHRLE DRIVE
BUFFALO, N.Y. 14221
T: 716-204-3054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

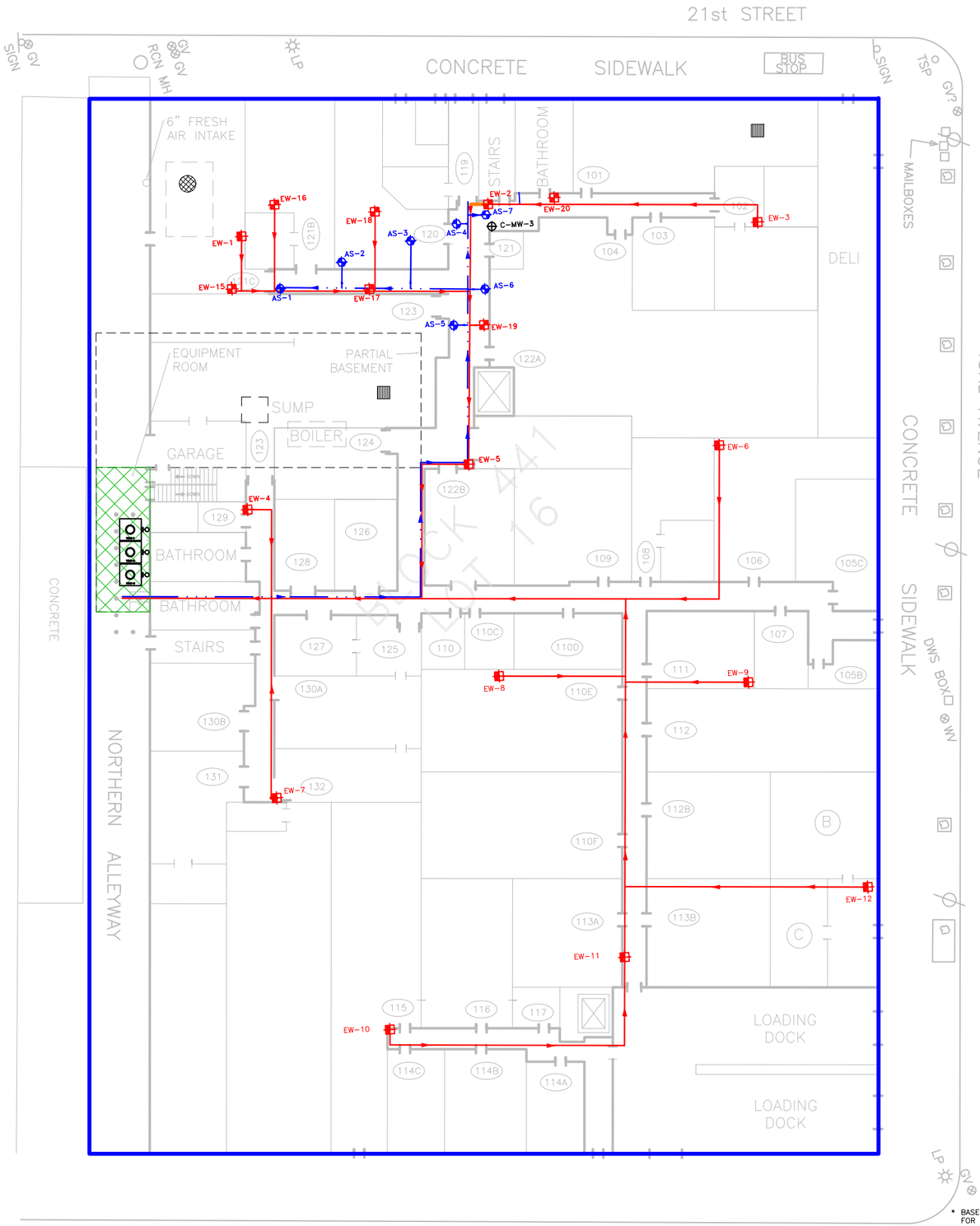
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

LOCATION OF
SITE ENGINEERING CONTROLS

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	9A
SCALE: 1" = 30'	SHEET No.:	OF:
	REVISED BY:	–



LEGEND:

- SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY
- LOCATION OF EQUIPMENT ROOM
- MONITORING WELL LOCATION
- EXTRACTION WELL LOCATION
- AIR SPARGE WELL LOCATION
- SSDS/SVE PROCESS PIPING
- AIR SPARGE PROCESS PIPING

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
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T: 716-204-3054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

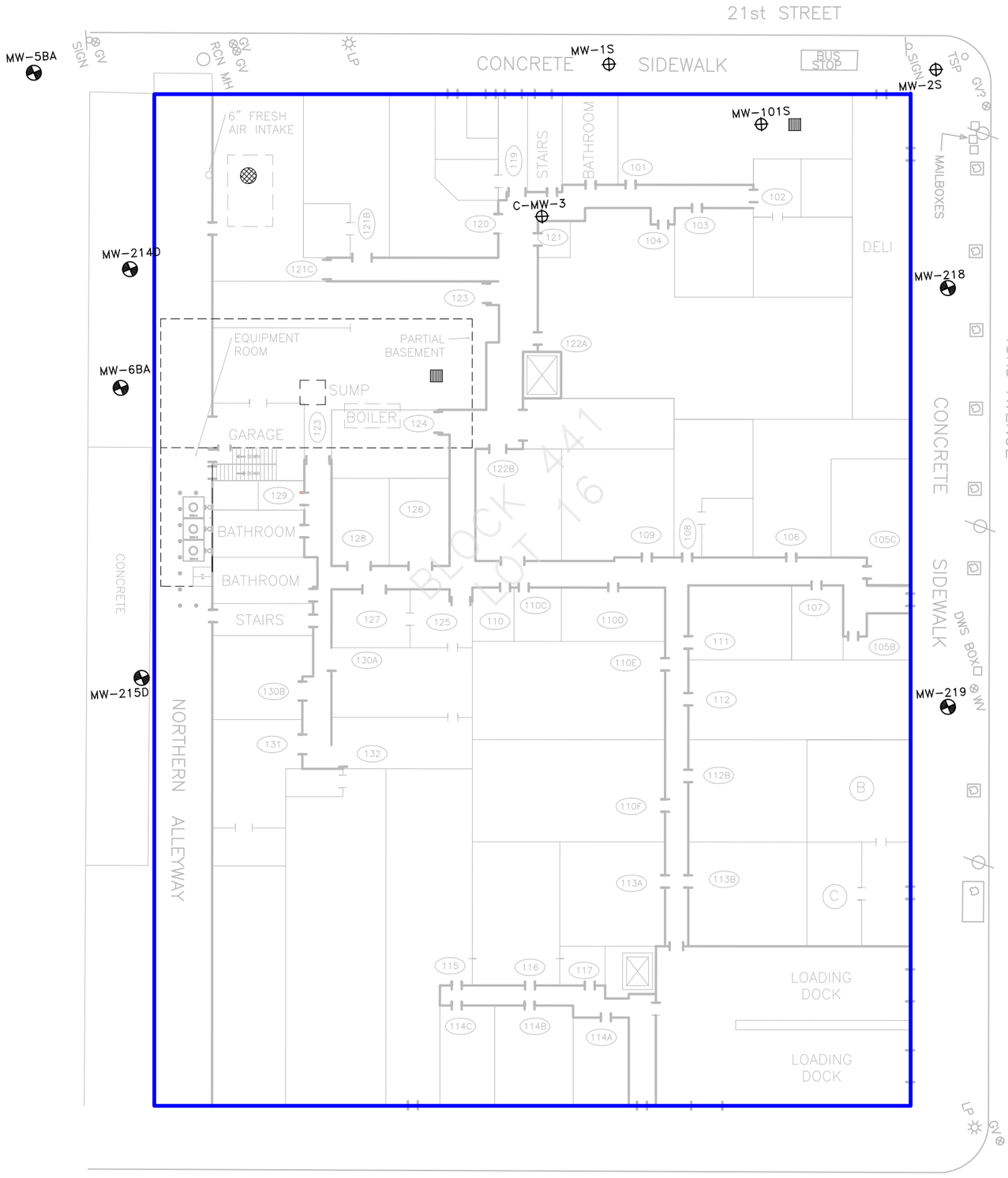
DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

LOCATION OF
SITE ENGINEERING CONTROLS

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	9B
SCALE: 1" = 30'	SHEET No.:	OF:
	REVISED BY:	–



LEGEND:

- 121C — SUITE/OFFICE NUMBER
- ELEVATOR
- FLOOR DRAIN (10"X10")
- MANHOLE (24")
- HOUSE SEWER TRAP VAULT (4'x8')
- VAPOR PHASE ACTIVATED CARBON CANISTER
- BELOW GRADE STRUCTURE
- SITE BOUNDARY
- MW-214D — EXISTING OVERBURDEN MONITORING WELL (INSTALLED BY OTHERS)
- MW-1S — CORE OVERBURDEN MONITORING WELL

* BASEMAP BASED ON ARCADIS REMEDIAL INVESTIGATION REPORT, FOR 21-03 44TH AVENUE FIGURE 4, DATED AUGUST 2012.

15FT 0 15FT
SCALE

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
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2312 WEHRLE DRIVE
BUFFALO, N.Y. 14221
T: 716-204-8054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11101

DESCRIPTION:

SITE MANAGEMENT PLAN

DRAWING TITLE:

POST-REMEDIAL GROUNDWATER MONITORING WELL NETWORK

SEAL & SIGNATURE		
	DATE:	7/15/2015
	PROJECT No.:	-
	DRAWN BY:	BDB
	DESIGNED BY:	AKC
	CHECKED BY:	AKC
	APPROVED BY:	BDB
	FIGURE No.:	10
SCALE: 1" = 30'	SHEET No.:	OF:
	REVISED BY:	-

APPENDICES

CORE ENVIRONMENTAL CONSULTANTS

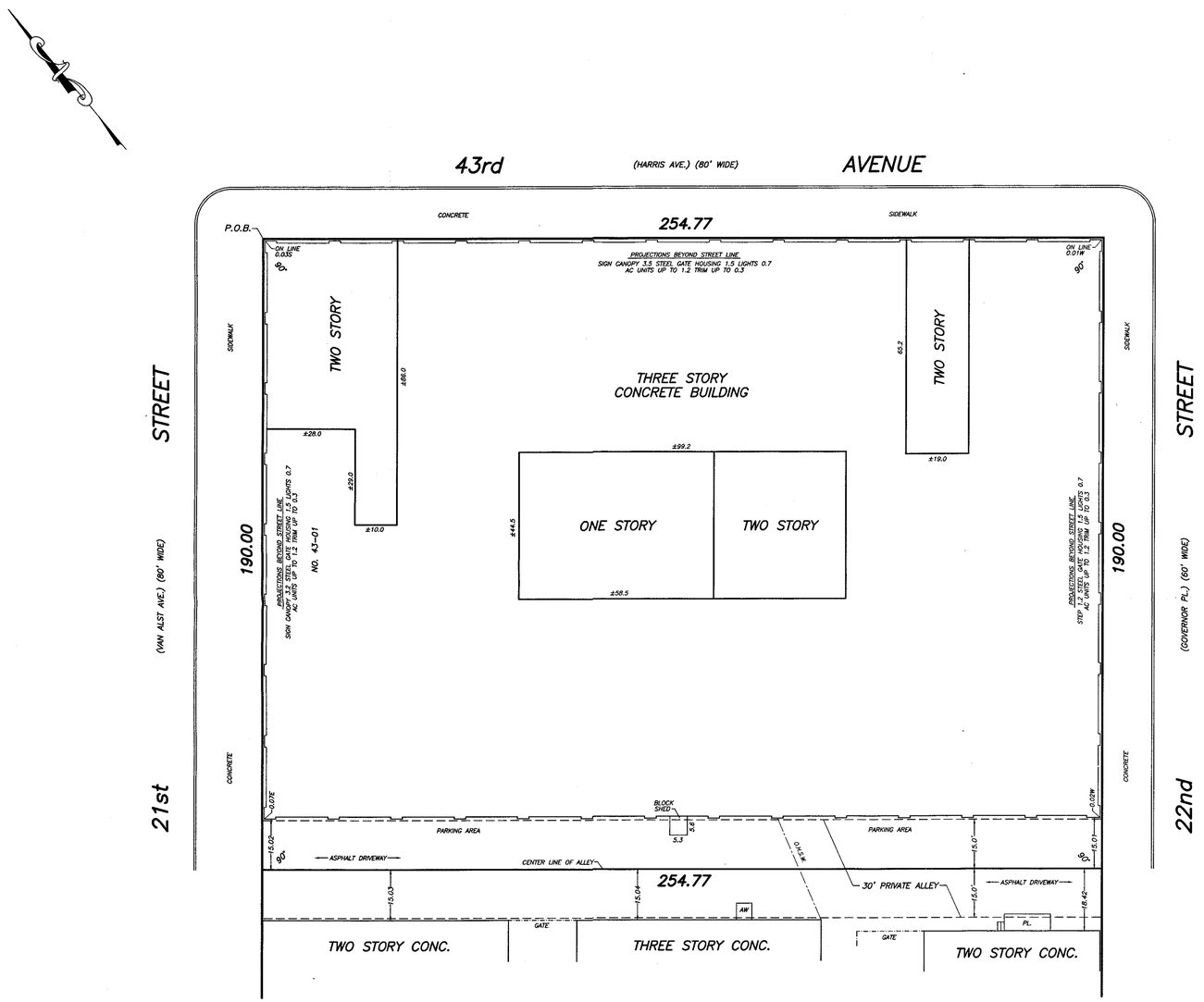
APPENDIX A

Metes and Bounds Survey

CORE ENVIRONMENTAL CONSULTANTS

REF. NO. Q441-16

ENVIRONMENTAL EASEMENTS SURVEY



PROPERTY AND ENVIRONMENTAL EASEMENT LEGAL DESCRIPTION

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND, SITUATE, LYING AND BEING IN THE FIRST WARD OF THE BOROUGH AND COUNTY OF QUEENS, CITY AND STATE OF NEW YORK, KNOWN AND DESIGNATED ON A CERTAIN MAP ENTITLED "MAP OF HUNTER, VAN ALST AND DEBEVOISE FARMS, SITUATE IN THE FIRST, SECOND AND THIRD WARDS OF LONG ISLAND CITY, QUEENS COUNTY, NEW YORK, MADE BY P.G. VAN LAST, C.E. FOR THE TRUSTEES OF UNION COLLEGE PROPRIETORS, DATED JANUARY 1, 1874" AND FILED IN THE OFFICE OF THE CLERK, NOW REGISTER, OF THE COUNTY OF QUEENS ON JUNE 11, 1875, AS AND BY LOTS NUMBERED 13 TO 31, BOTH INCLUSIVE, IN BLOCK NUMBERED 77, AND WHICH LOTS ARE MORE PARTICULARLY BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT THE CORNER FORMED BY THE INTERSECTION OF THE SOUTHERLY SIDE OF 43RD AVENUE, FORMERLY HARRIS AVENUE, WITH THE EASTERLY SIDE OF 21ST STREET, FORMERLY VAN ALST AVENUE;

RUNNING THENCE EASTERLY ALONG THE SOUTHERLY SIDE OF 43RD AVENUE, 254.77 FEET TO THE COMER FORMED BY THE INTERSECTION OF THE SAID SOUTHERLY SIDE OF 43RD AVENUE WITH THE WESTERLY SIDE OF 22ND STREET, FORMERLY GOVERNOR PLACE;

THENCE SOUTHERLY ALONG THE WESTERLY SIDE OF 22ND STREET, 190 FEET;
THENCE WESTERLY AT RIGHT ANGLES TO 22ND STREET, 254.77 FEET TO THE EASTERLY SIDE OF 21ST STREET;

THENCE NORTHERLY ALONG THE SAID EASTERLY SIDE OF 21ST STREET, 190 FEET TO THE POINT OR PLACE OF BEGINNING.

AREA = 48,406.30 SQ.FT.

THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL EASEMENT HELD BY THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION PURSUANT TO TITLE 36 OF ARTICLE 71 OF THE NEW YORK ENVIRONMENTAL CONSERVATION LAW. THE ENGINEERING AND INSTITUTIONAL CONTROLS FOR THIS EASEMENT ARE SET FORTH IN MORE DETAIL IN THE SITE MANAGEMENT PLAN (SMP). A COPY OF THE SMP MUST BE OBTAINED BY ANY PARTY WITH AN INTEREST IN THE PROPERTY. THE SMP CAN BE OBTAINED FROM NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION, DIVISION OF ENVIRONMENTAL REMEDIATION, SITE CONTROL SECTION, 625 BROADWAY, ALBANY, NY 12233 OR AT DERWEB@DEC.NY.GOV".

LEGEND:

AREAWAY	AW
PLATFORM	PL.
SOUTH	S
WEST	W
NORTH	N
EAST	E
POINT OF BEGINNING	P.O.B.

LOTS 13 TO 31 INCL. IN BLOCK 77 ON
"MAP OF HUNTER, VAN ALST AND DEBEVOISE FARMS"
FILED JUNE 11, 1875

6.096 0 6.096 12.192 24.384
GRAPHIC SCALE 1"=6.096 M

20 0 10 20 40 80
GRAPHIC SCALE 1"=20'

NO.	DATE	REVISION

STATE OF NEW YORK FRANK GALLUZZO LICENSED LAND SURVEYOR

LICENSE NO. 050088

SURVEYED AUGUST 20, 2014

MAP OF PROPERTY SITUATED IN
LONG ISLAND CITY
43-01 21 STREET
QUEENS COUNTY, N.Y.
TAX SECT.: 3 TAX BLOCK: 441 TAX LOT(S): 16

Empire State Land Surveyor, P.C.
Frank I. Galluzzo Professional Land Surveyor
Records of Albert A. Bianco
Stephen J. Reid - M. Berry Carman - G. W. Haviland
Vandewater & Lapp - Robert E. Carlin - William J. Daly
1005 Glen Cove Avenue, Glen Head, NY, 11545
(516)-240-6901

Legal Description

ALL that certain plot, piece or parcel of land, situate, lying and being in the First Ward of the Borough and County of Queens, City and State of New York, known and designated on a certain map entitled "Map of Hunter, Van Alst and DeBevoise Farms, situate in the First, Second and Third Wards of Long Island City, Queens County, New York, made by P.G. Van Last, C.E. for the trustees of Union College Proprietors, dated January 1, 1874" and filed in the Office of the Clerk, now Register, of the County of Queens on June 11, 1875, as and by lots numbered 13 to 31, both inclusive, in Block numbered 77, and which lots are more particularly bounded and described as follows:

BEGINNING at the corner formed by the intersection of the southerly side of 43rd Avenue, formerly Harris Avenue, with the easterly side of 21st Street, formerly Van Alst Avenue; running thence easterly along the southerly side of 43rd Avenue, 254.77 feet to the comer formed by the intersection of the said southerly side of 43rd Avenue with the westerly side of 22nd Street, formerly Governor Place; running thence southerly along the westerly side of 22nd Street, 190 feet; thence westerly at right angles to 22nd Street, 254.77 feet to the easterly side of 21st Street; running thence northerly along the said easterly side of 21st Street, 190 feet to the point or place of BEGINNING.

TOGETHER with the benefits of that certain private alleyway as set forth in Deed by N. Frederick Ayer and Ellen B. Ayer, his wife to Belford Realty Company Incorporates dated February 4, 1915 and recorded February 5, 1915 in liber 1990 Cp. 252.

APPENDIX B

Site Contacts

CORE ENVIRONMENTAL CONSULTANTS

SITE CONTACTS

Name	Company/Title	Address	Contact Information
William Grutta	Rockrose Project Executive	15 East 26th Street 7th floor New York, NY 10010	Office: (212) 847-3780 Email: William.Grutta@rockrose.com
Ronald Tramposch	CORE QEP	46-11 54th Avenue Maspeth, NY 11378	Office: (718) 762-0544 Email: RPT@coreenv.com
Jonathan Greco	NYSDEC Project Manager	625 Broadway Albany, NY 12233-7016	Office: (518) 402-9694 Email: Jonathan.Greco@dec.ny.gov

APPENDIX C

Soil Boring and Monitoring Well Construction Logs

CORE ENVIRONMENTAL CONSULTANTS

CORE ENVIRONMENTAL CONSULTANTS

BORING NO. B-2

PROJECT: The Wills Building	SHEET: 1 of 1
CLIENT: Wills Group Family Limited Partnership	JOB NO:
BORING CONTRACTOR: Aquifer Drilling & Testing, Inc.	BORING LOCATION: West central portion of building

GROUNDWATER					CAS	SAMPLER	CORE	TUBE	GROUND ELEVATION:
DATE	TIME	LEVEL		TYPE	Geoprobe 6610DT Macro Core				DATE STARTED: 11/08/14
11/08/14	15:35	14.46		DIA		2"			DATE FINISHED: 11/09/14
				WT					DRILLER: R. Allegrezza
				Length		5'			GEOLOGIST: M. Gelband
				*POCKET PENETROMETER READING					REVIEWED BY: A Cruikshank

		SAMPLE			DESCRIPTION				REMARKS	
DEPTH	STRATA	NO.	TYPE	RECOVERY (inches)	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	CLASS USCS	PID (ppm)	MOISTURE
							5 inches of Concrete			
5		1	MC	36/57.5	Brown		Poorly graded fine sand, little subrounded gravel, little silt, pieces of concrete (fill)	SP	0.4	Moist
10		2	MC	46/57.5	Brown/ Light Gray		Silty sand, little subangular gravel	SM/ GP	1.5	Moist
							11-inch lens of poorly graded subangular gravel, some sand, trace silt			
15		3	MC	57.5/57.5	Brown/ Light Gray		Silty sand, trace fine gravel	SM/ GP	1.0	Wet
							13-inch lens of poorly graded coarse angular gravel			
20		4	MC	57.5/57.5	Brown		Silty sand, little fine to coarse subrounded gravel	SM	379	Wet
							EOB			

COMMENTS: Soil sample collected for TCL VOCs analysis at 13 feet.
Temporary well installed, screened 9.5 to 19.5 feet bgs. Groundwater sample collected for TCL VOCs analysis.

BORING NO: B-2

CORE ENVIRONMENTAL CONSULTANTS

CORE ENVIRONMENTAL CONSULTANTS

BORING NO. B-3

PROJECT: The Wills Building	SHEET: 1 of 1
CLIENT: Wills Group Family Limited Partnership	JOB NO:
BORING CONTRACTOR: Aquifer Drilling & Testing, Inc.	BORING LOCATION: Northwest corner of building
GROUNDWATER	GROUND ELEVATION:
DATE / TIME / LEVEL	DATE STARTED: 11/08/14
TYPE: Geoprobe 6610DT Macro Core	DATE FINISHED: 11/08/14
DIA: 2"	DRILLER: B. Allegrezza
WT:	GEOLOGIST: M. Gelband
Length: 5'	REVIEWED BY: A Cruikshank
*POCKET PENETROMETER READING	

DEPTH	STRATA	SAMPLE NO.	SAMPLE TYPE	RECOVERY (inches)	COLOR	CONSISTENCY HARDNESS	DESCRIPTION: MATERIAL DESCRIPTION	CLASS USCS	REMARKS: PID (ppm)	REMARKS: MOISTURE
							1 inch of Concrete			
5		1	MC	55/57.5	Dark Brown		Silty sand, trace rounded gravel (fill)	SM	4.5	Moist
10		2	MC	50/57.5	Dark Brown		Silty sand, trace subrounded gravel	SM	0.7	Moist
							Refusal met at 12 feet EOB			

COMMENTS: Initial advancement was stopped at 10 feet. Subsequently converted rig to advance air hammer.
Refusal was met at 12 feet with air hammer.
Soil sample collected for full TCL/TAL list analyses at 9 feet.

BORING NO: B-3

CORE ENVIRONMENTAL CONSULTANTS

CORE ENVIRONMENTAL CONSULTANTS

BORING NO. B-4

PROJECT: The Wills Building	SHEET: 1 of 1
CLIENT: Wills Group Family Limited Partnership	JOB NO:
BORING CONTRACTOR: Aquifer Drilling & Testing, Inc.	BORING LOCATION: Central portion of building
GROUNDWATER	GROUND ELEVATION:
DATE / TIME / LEVEL	DATE STARTED: 11/08/14
	DATE FINISHED: 11/08/14
	DRILLER: R. Allegrezza
	GEOLOGIST: M. Gelband
	REVIEWED BY: A Cruikshank

		CAS	SAMPLER	CORE	TUBE
TYPE		Geoprobe 6610DT Macro Core			
DIA			2"		
WT					
Length			5'		

*POCKET PENETROMETER READING

DEPTH	STRATA	SAMPLE NO.	SAMPLE TYPE	RECOVERY (inches)	COLOR	CONSISTENCY HARDNESS	DESCRIPTION: MATERIAL DESCRIPTION	CLASS USCS	REMARKS: PID (ppm)	REMARKS: MOISTURE
							3 inches of Concrete			
5		1	MC		Brown		Silty sand, trace subangular gravel (fill)	SM	2.7	Moist
10		2	MC		Brown		Silty sand, trace subrounded gravel Piece of erractic observed in sampler tip at 9 feet	SM	0.8	Moist
							Refusal met at 9 feet EOB			

COMMENTS: Soil sample collected for full TCL/TAL analyses at 9 feet.

Additional analysis for the matrix spike/matrix spike duplicate collected from 9 foot sample.

BORING NO: B-4

CORE ENVIRONMENTAL CONSULTANTS

CORE ENVIRONMENTAL CONSULTANTS

BORING NO. B-5

PROJECT: The Wills Building	SHEET: 1 of 1
CLIENT: Wills Group Family Limited Partnership	JOB NO:
BORING CONTRACTOR: Aquifer Drilling & Testing, Inc.	BORING LOCATION: South corner of building
GROUNDWATER	GROUND ELEVATION:
DATE / TIME / LEVEL	DATE STARTED: 11/08/14
	DATE FINISHED: 11/08/14
	DRILLER: R. Allegrezza
	GEOLOGIST: M. Gelband
	REVIEWED BY: A Cruikshank

		CAS	SAMPLER	CORE	TUBE
TYPE		Geoprobe 6610DT Macro Core			
DIA			2"		
WT					
Length			5'		

*POCKET PENETROMETER READING

DEPTH	STRATA	SAMPLE NO.	SAMPLE TYPE	RECOVERY (inches)	COLOR	CONSISTENCY HARDNESS	DESCRIPTION: MATERIAL DESCRIPTION	CLASS USCS	REMARKS: PID (ppm)	REMARKS: MOISTURE
							4 inches of Concrete			
5		1	MC	29/57.5	Brown		Silty sand, little subrounded gravel (fill)	SM	0.1	Moist
10		2	MC	45/57.5	Brown		Same as above	SM	0.1	Moist
15		3	MC	28/57.5	Brown		Silty sand, little subangular gravel	SM	0.2	Moist
							Refusal met at 14.5 feet EOB			

COMMENTS: Soil sample collected for full TCL/TAL analyses at 14 feet.

Duplicate sample collected from 14 feet.

BORING NO: B-5

CORE ENVIRONMENTAL CONSULTANTS

CORE ENVIRONMENTAL CONSULTANTS

BORING NO. B-6

PROJECT: The Wills Building	SHEET: 1 of 1
CLIENT: Wills Group Family Limited Partnership	JOB NO:
BORING CONTRACTOR: Aquifer Drilling & Testing, Inc.	BORING LOCATION: Central portion of building

GROUNDWATER					CAS	SAMPLER	CORE	TUBE	GROUND ELEVATION:
DATE	TIME	LEVEL		TYPE	Geoprobe 6610DT Macro Core				DATE STARTED: 11/09/14
11/09/14	9:18	14.37		DIA		2"			DATE FINISHED: 11/09/14
				WT					DRILLER: R. Alllegrezza
				Length		5'			GEOLOGIST: M. Gelband
				*POCKET PENETROMETER READING					REVIEWED BY: A Cruikshank

		SAMPLE					DESCRIPTION		REMARKS	
DEPTH	STRATA	NO.	TYPE	RECOVERY (inches)	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	CLASS USCS	PID (ppm)	MOISTURE
							6 inches of Concrete			
5		1	MC	22/57.5	Brown		Silty sand, sand is fine to medium grained	SM	2.8	Moist
10		2	MC	30/57.5	Brown/ Gray		Silty sand, sand is fine* to medium grained, little angular gravel 4-inch lens of well graded gravel, some silt, little sand, subangular gravel	SM/ GW	3.0	Moist
15		3	MC	44/57.5	Brown		Poorly graded sand, some silt, trace subangular gravel 10-inch lens of well graded gravel, fine* to coarse subrounded gravel	SP/ GW	3.4	Wet
20		4	MC	45/57.5	Dark Brown		Poorly graded sand, trace rounded gravel, trace silt	SP	3.8	Wet
							EOB			

COMMENTS: Soil sample collected for TCL VOCs analysis at 14 feet.

Temporary well installed, screened 8 to 18 feet bgs. Groundwater sampled collected for TCL VOCs analysis.

*Predominant grain size indicated with an asterisk.

BORING NO: B-6

CORE ENVIRONMENTAL CONSULTANTS

CORE ENVIRONMENTAL CONSULTANTS

BORING NO. B-7

PROJECT: The Wills Building								SHEET: 1 of 1
CLIENT: Wills Group Family Limited Partnership								JOB NO:
BORING CONTRACTOR: Aquifer Drilling & Testing, Inc.								BORING LOCATION: North central portion of building
GROUNDWATER					CAS	SAMPLER	CORE	TUBE	GROUND ELEVATION:
DATE	TIME	LEVEL		TYPE	Geoprobe 6610DT Macro Core				DATE STARTED: 11/09/14
11/09/14	11:45	Dry at 14.3		DIA		2"			DATE FINISHED: 11/09/14
				WT					DRILLER: R. Allegrezza
				Length		5'			GEOLOGIST: M. Gelband
				*POCKET PENETROMETER READING					REVIEWED BY: A Cruikshank

		SAMPLE			DESCRIPTION				REMARKS	
DEPTH	STRATA	NO.	TYPE	RECOVERY (inches)	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	CLASS USCS	PID (ppm)	MOISTURE
5		1	MC	38/57.5	Light Brown		4 inches of Concrete 2 inches of brick beneath concrete Silty sand, trace fine subangular gravel (fill)	SM	2.7	Moist
10		2	MC	42/57.5	Brown/ Gray		Silty sand, some angular mica schist 4-inch lens of well graded gravel, some sand Same as 6 to 8 feet bgs	SM/ GW	3.6	Moist
15		3	MC	44/60	Brown		Silty sand, trace angular coarse gravel	SM	4.5	Wet
20		4	MC	6/57.5	Light Brown		Well graded angular gravel, gravel is fine to coarse, some sand, trace silt	GW	2.3	Moist
							EOB			

COMMENTS: Soil sample collected for TCL VOCs analysis at 14 feet.

BORING NO: B-7

CORE ENVIRONMENTAL CONSULTANTS

CORE ENVIRONMENTAL CONSULTANTS

BORING NO. B-8

PROJECT: The Wills Building	SHEET: 1 of 1
CLIENT: Wills Group Family Limited Partnership	JOB NO:
BORING CONTRACTOR: Aquifer Drilling & Testing, Inc.	BORING LOCATION: Northeast portion of interior
GROUNDWATER	GROUND ELEVATION:
DATE / TIME / LEVEL	DATE STARTED: 11/09/14
	DATE FINISHED: 11/09/14
	DRILLER: R. Allegrezza
	GEOLOGIST: M. Gelband
	REVIEWED BY: A Cruikshank

	CAS	SAMPLER	CORE	TUBE
TYPE	Geoprobe 6610DT Macro Core			
DIA		2"		
WT				
Length		5'		

*POCKET PENETROMETER READING

DEPTH	STRATA	SAMPLE NO.	SAMPLE TYPE	RECOVERY (inches)	COLOR	CONSISTENCY HARDNESS	DESCRIPTION: MATERIAL DESCRIPTION	CLASS USCS	REMARKS: PID (ppm)	REMARKS: MOISTURE
							4 inches of Concrete			
5		1	MC	34/57.5	Dark Brown		Well graded gravel, brick fragments present(fill)	GW	0.3	Moist
10		2	MC	34/57.5	Light Brown		Poorly graded sand, fine grained, trace coarse-fine gravel, trace silt	SP	2.2	Moist
							Refusal at 9 feet EOB			

COMMENTS: Soil sample collected for TCL/TAL analyses at 9 feet.

BORING NO: B-8

CORE ENVIRONMENTAL CONSULTANTS

BORING NO. B-9

PROJECT: The Wills Wills Building	SHEET: 1 of 1
CLIENT: Wills Group Family Limited Partnership	JOB NO:
BORING CONTRACTOR: Aquifer Drilling & Testing, Inc.	BORING LOCATION: East central portion of building

GROUNDWATER					CAS	SAMPLER	CORE	TUBE	GROUND ELEVATION:
DATE	TIME	LEVEL		TYPE	Geoprobe 6610DT Macro Core				DATE STARTED: 11/09/14
11/09/14	14:52	8.81		DIA		2"			DATE FINISHED: 11/09/14
				WT					DRILLER: R. Allegrezza
				Length		5'			GEOLOGIST: M. Gelband
				*POCKET PENETROMETER READING					REVIEWED BY: A Cruikshank

		SAMPLE			DESCRIPTION				REMARKS	
DEPTH	STRATA	NO.	TYPE	RECOVERY (inches)	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	CLASS USCS	PID (ppm)	MOISTURE
							4 inches of Concrete			
5		1	MC	46/57.5	Light Brown		Silty sand, sand is fine grained, trace subrounded gravel (fill)	SM	0.3	Moist
10		2	MC	47/57.5	Brown		Silty sand, trace coarse subangular gravel, micaceous	SM	2.0	Moist
15		3	MC	29/57.5	Brown		Well graded fine to course subrounded gravel, some fine sand	GW	2.2	Wet
							Refusal at 13 feet EOB			

COMMENTS: Soil sample collected for TCL VOCs analysis at 10 feet.
Temporary well installed, screened 3 to 13 feet bgs. Groundwater sample collected for TCL VOCs analysis.

BORING NO: B-9

CORE ENVIRONMENTAL CONSULTANTS

DRILLING SUMMARY

Geologist:
Ronald Tramposch

Drilling Company:
Aquifer Drilling & Testing

Drillers:
Shawn Miller

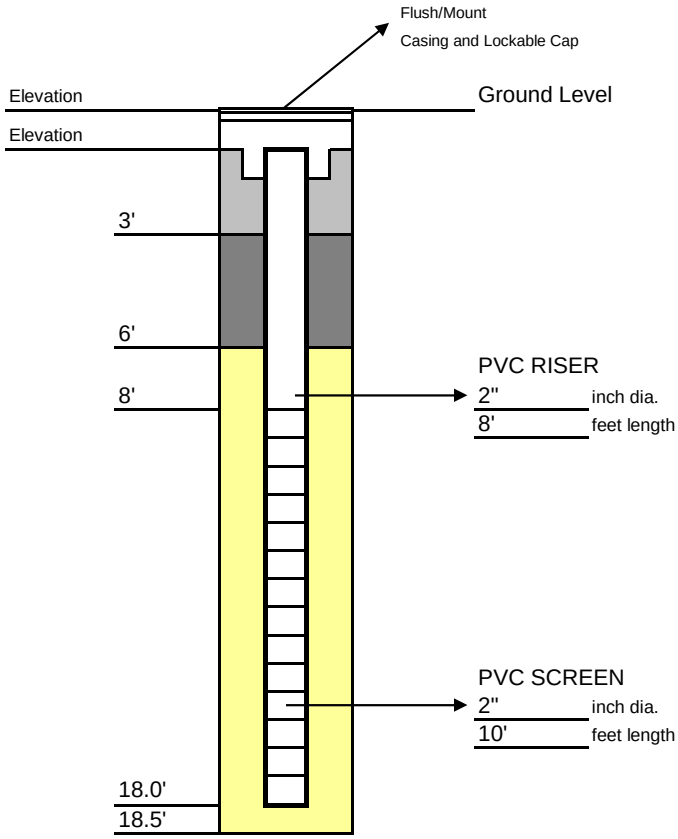
Rig Make/Model:
CME-55

Date:
8/15/2013

GEOLOGIC LOG

depth(ft.)	lithology
0'-10'	See Boring Log
10'-18'	
18'-21'	

DEPTH



WELL DESIGN

CASING MATERIAL		*SCREEN MATERIAL*		*FILTER MATERIAL*
Surface:	Steel flush mount	Type:	Schedule 40	Type: #2 Sand Setting:
Monitor:	2" diameter PVC	Slot Size:	20	SEAL MATERIAL Type: Medium Bentonite Chips Setting:

COMMENTS:

LEGEND

- Cement/Bentonite Grout
- Bentonite Seal
- Silica Sandpack

CORE ENVIRONMENTAL CONSULTANTS

MONITORING WELL CONSTRUCTION DETAILS

Project No.:

Well Number: MW-1S

DRILLING SUMMARY

Geologist:
Ronald Tramposch

Drilling Company:
Aquifer Drilling & Testing

Drillers:
Christopher Stratton

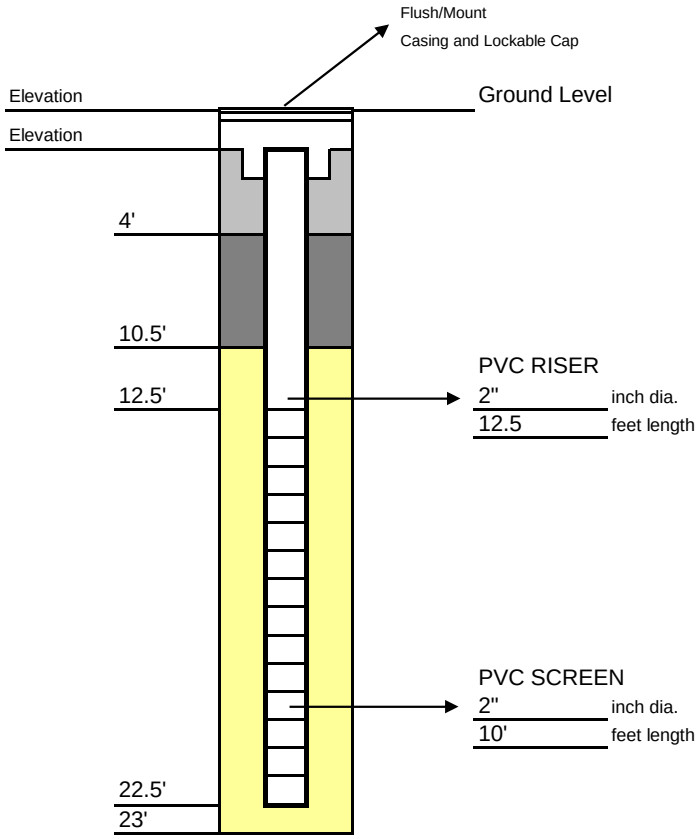
Rig Make/Model:
CME-55

Date:
8/15/2013

GEOLOGIC LOG

D
E
P
T
H

depth(ft.)	lithology
0'-10'	See Boring Log
10'-18'	
18'-21'	



WELL DESIGN

CASING MATERIAL		*SCREEN MATERIAL*		*FILTER MATERIAL*
Surface:	Steel flush mount	Type:	Schedule 40	Type: #2 Sand Setting:
Monitor:	2" diameter PVC	Slot Size:	20	SEAL MATERIAL Type: Medium Setting: Bentonite Chips

COMMENTS:

LEGEND

- Cement/Bentonite Grout
- Bentonite Seal
- Silica Sandpack

CORE ENVIRONMENTAL CONSULTANTS

MONITORING WELL CONSTRUCTION DETAILS

Project No.:

Well Number: **MW-2S**

DRILLING SUMMARY

Geologist:
Ronald Tramposch

Drilling Company:
Aquifer Drilling & Testing

Drillers:
Christopher Iodice

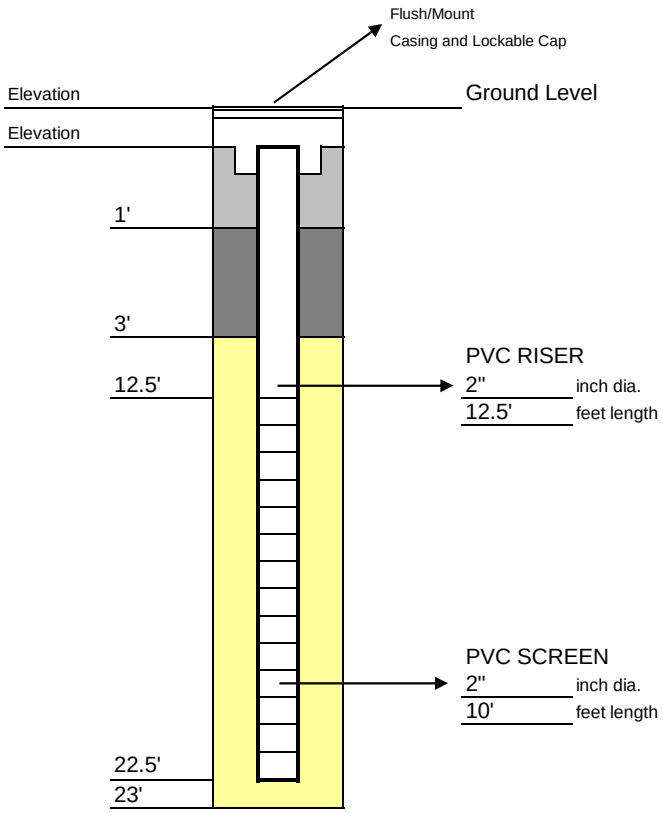
Rig Make/Model:
Geoprobe 6610DT

Date:
1/25/2012

GEOLOGIC LOG

DEPTH

depth(ft.)	lithology
0'-7'	See Boring Log
7'-19'	
19'-21'	



WELL DESIGN

CASING MATERIAL		*SCREEN MATERIAL*		*FILTER MATERIAL*
Surface:	Steel flush mount	Type:	Schedule 40	Type: #2 Sand Setting:
Monitor:	2" diameter PVC	Slot Size:	20	SEAL MATERIAL Type: Medium Bentonite Chips Setting:

COMMENTS:

LEGEND

- Cement/Bentonite Grout
- Bentonite Seal
- Silica Sandpack

CORE ENVIRONMENTAL CONSULTANTS

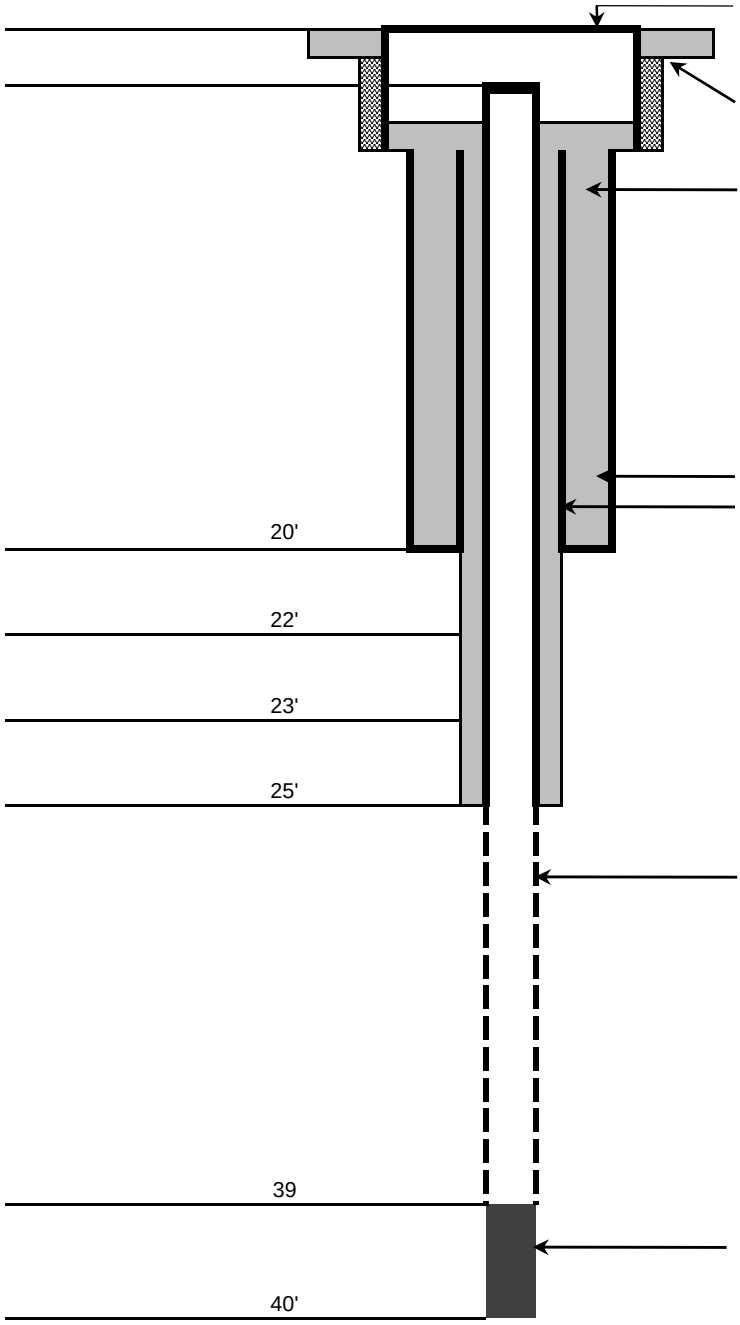
MONITORING WELL CONSTRUCTION DETAILS

Project No.:

Well Number: **MW-101S**

CORE ENVIRONMENTAL CONSULTANTS		BEDROCK WELL/PIEZOMETER
Project: Wills Building	Project No.:	
Client: Wills Group Familty LP	Date:	Subcontractor: Auqifer Drilling & Testiing
Drilling Method: Hollow Stem Augers / Air Rotary		Measuring Point:
Development Method:		Type:
Construction Dates: 8/15/13 to 8/17/13		Elevation (ft):

Item	Depth, Below Measuring Point (ft)	Elevation (ft)
Grade		
Riser Pipe		
Top of Screen	20'	
Top of Bedrock	22'	
Top of Hard Bedrock	23'	
Bottom of Casing	25'	
Base of Screen	39	
Total Depth	40'	



Flushmount Diameter:	
Surface Seal Type:	
Grout Type:	
Borehole Diameter:	11"
Casing Type:	SS
Casing ID:	5
Well Screen:	2"
Length of Well Screen:	30'
Backfill/Grout:	

Notes: Borehole was drilled to 25' with 6 1/4" Hollow stem augers. A 5" casing was grouted into place from 0 - 25 feet. Hole was completed to 40' with air. 2" PVC Screen was intalled in the open rock hole. Sand from 25' to 39'. Screen was required to keep hole open

DRILLING SUMMARY

Geologist:
David Duhamel

Drilling Company:
CORE Environmental

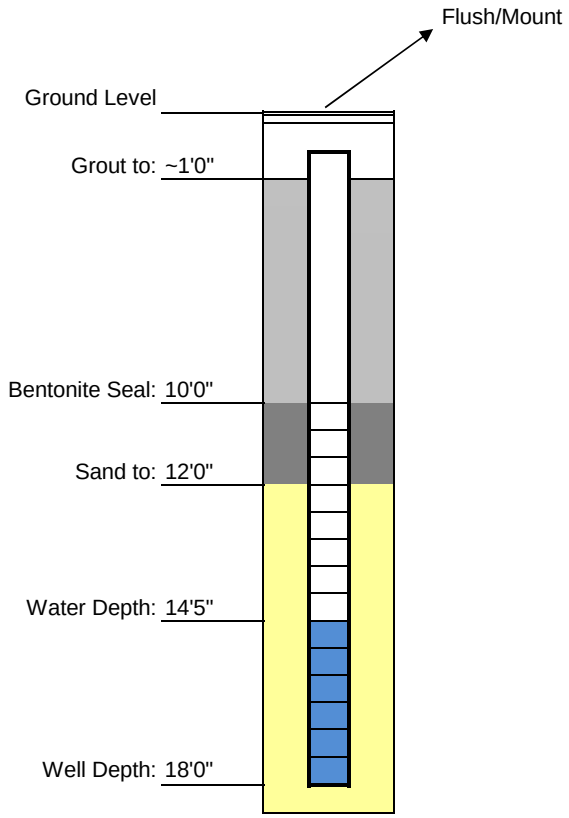
Drillers:
Ronald Tramposch

Rig Make/Model:
Simco Earthprobe 200

Date:
7/13/2015

GEOLOGIC LOG

depth(ft.)	lithology
0 to ~9	Brown, gravelly silty sand with cobbles, fill, moist.
~9 to ~19.5	Brown, poorly graded sand with silt, moist to wet.



(Diagram not to scale)

WELL DESIGN

CASING MATERIAL	*SCREEN MATERIAL*	*FILTER MATERIAL*
Surface:	**Type:** Pre-packed	**Type:** **Setting:**
Monitor:	**Slot Size:**	**SEAL MATERIAL**
		Type: Medium **Setting:**

COMMENTS:
No sampling conducted; lithology classification based on soil shavings from augers.

LEGEND

- Cement/Bentonite Grout
- Bentonite Seal
- Silica Sandpack

CORE ENVIRONMENTAL CONSULTANTS

Wills Building, Rockrose Development

Site No: C241143

MONITORING WELL CONSTRUCTION DETAILS

Well Number: C-MW-3

ARCADIS
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TEST BORING LOG

BORING No.MW-218

PROJECT	**21-03 44th Avenue**	LOCATION **Long Island City, NY**	SHEET **1** OF **1**
CLIENT	**New York State Department of Environmental Conservation**		PROJECT No. **00266391.0000**
DRILLING CONTRACTOR	**SGS**		MEAS. PT. ELEV. **19.96**
PURPOSE	**Remedial Investigation**		GROUND ELEV. **20.5**
WELL MATERIAL	**2" PVC**		DATUM **NAVD 88**
DRILLING METHOD(S)	**HSA**	SAMPLE / CORE / CASING	DATE STARTED **10/10/11**
DRILL RIG TYPE	**B-61**	TYPE: CASING **PVC**	DATE FINISHED **10/12/11**
GROUND WATER DEPTH	**'**	DIA.: SAMPLE **"** / CASING **2"**	DRILLER **L.Lynch**
MEASURING POINT	**TOC**	WEIGHT: SAMPLE **#**	PIRNIE STAFF **D. Grzesik**
DATE OF MEASUREMENT		FALL: SAMPLE **"**	

DEPTH FT.	SAMPLE TYPE, RECOVERY, NUMBER	BLOWS ON SAMPLE SPOON PER 6"	PID	GRAPHIC LOG	GEOLOGIC DESCRIPTION KEY - Color, Major, Minor Moisture, Etc.	ELEV. / DEPTH	WELL Constr.	REMARKS
2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24					Yellow-Brown medium SAND, Some Silt, moist.	3.5 / 17.0	11.0 13.0 15.0 25.0	

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TEST BORING LOG

BORING No.MW-219

PROJECT	**21-03 44th Avenue**	LOCATION	**Long Island City, NY**	SHEET	**1** OF **1**
CLIENT	**New York State Department of Environmental Conservation**			PROJECT No.	**00266391.0000**
DRILLING CONTRACTOR	**SGS**			MEAS. PT. ELEV.	**18.85**
PURPOSE	**Remedial Investigation**			GROUND ELEV.	**19.2**
WELL MATERIAL	**2" PVC**			DATUM	**NAVD 88**
DRILLING METHOD(S)	**HSA**	SAMPLE	CORE / CASING	DATE STARTED	**10/13/11**
DRILL RIG TYPE	**B-61**	TYPE	**PVC**	DATE FINISHED	**10/13/11**
GROUND WATER DEPTH	**'**	DIA.	**"** / **2"**	DRILLER	**L. Lynch**
MEASURING POINT	**TOC**	WEIGHT	**#**	PIRNIE STAFF	**S. Bagnato**
DATE OF MEASUREMENT		FALL	**"**		

DEPTH FT.	SAMPLE TYPE, RECOVERY, NUMBER	BLOWS ON SAMPLE SPOON PER 6"	PID	GRAPHIC LOG	GEOLOGIC DESCRIPTION KEY - Color, Major, Minor Moisture, Etc.	ELEV. / DEPTH	WELL Constr.	REMARKS
2								
4							4.0	
6							6.0	
8							8.0	
10								
12								
14								
16								
18					Pieces of rock (biotite/quartz gneiss) in lead auger.		18.0	

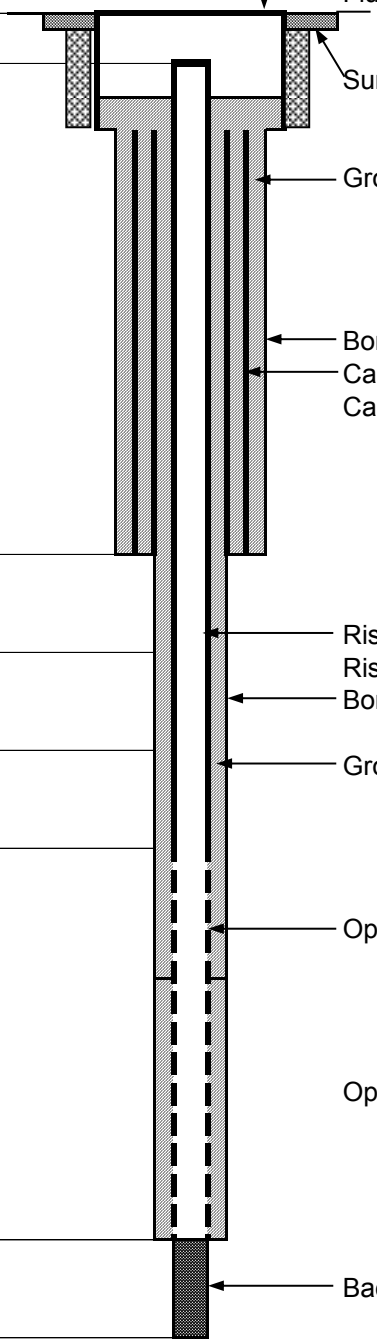
ARCADIS Infrastructure · Water · Environment · Buildings	TEST BORING LOG	BORING No.MW-222

PROJECT	**21-03 44th Avenue**	LOCATION	**Long Island City, NY**		SHEET	**1** OF **1**
CLIENT	**New York State Department of Environmental Conservation**				PROJECT No.	**00266391.0000**
DRILLING CONTRACTOR	**SGS**				MEAS. PT. ELEV.	**19.62**
PURPOSE	**Remedial Investigation**				GROUND ELEV.	**20.0**
WELL MATERIAL	**4" Steel/Open Bedrock**				DATUM	**NAVD 88**
DRILLING METHOD(S)	**Mud Rotary**		SAMPLE	CORE	CASING	DATE STARTED **10/20/11**
DRILL RIG TYPE	**B-61**	TYPE			**Steel**	DATE FINISHED **10/21/11**
GROUND WATER DEPTH	**'**	DIA.	**"**		**4"**	DRILLER **L. Lynch**
MEASURING POINT	**TOC**	WEIGHT	**#**			PIRNIE STAFF **D. Grzesik**
DATE OF MEASUREMENT		FALL	**"**			

DEPTH FT.	SAMPLE TYPE, RECOVERY, NUMBER	BLOWS ON SAMPLE SPOON PER 6"	PID	GRAPHIC LOG	GEOLOGIC DESCRIPTION KEY - Color, Major, Minor Moisture, Etc.	ELEV. / DEPTH	WELL Constr.	REMARKS
2					Overburden.			
4								
6								
8								
10								
12								
14								
16								
18								
20								
22								
24						-4.0 24.0		25.0
26					Bedrock.			
28	93%				RQD: 99%			
30								
32	94%				RQD: 94%			Open bedrock section
34								
36								
38	100%				RQD: 98%			
40						-20.0 40.0		40.0

ARCADIS			BEDROCK WELL/PIEZOMETER MW-227B
Project: 44th Ave		**Job Number:** 00266391.0000	
Client: NYSDEC		**Date:** 4/17/2012	**Subcontractor:** LAWES
Drilling Method:	Hollow Stem Auger		**Measuring Point**
Development Method:	Pump & Surge		**Type:** GROUND SURFACE
Construction Dates:	3/29/2012 to 4/2/2012		**Elevation (ft):** xxx

Item	Depth, below Measuring Point (ft)	Elevation (ft)	Description
Grade	0.0		Flushmount Diameter: 5 (in.)
Riser Pipe	0.3		Surface Seal Type: Concrete
			Grout Type: Cement-bentonite
			Borehole Diameter: 6 5/8 (in.)
			Casing Type: Sch-40 PVC
			Casing ID: 4 (in.)
Base of Casing	25.0		
Top of Bedrock	25.0		Riser Pipe Type: Sch-40 PVC
			Riser Pipe ID: 1.5 (in.)
			Borehole Diameter: 2 (in.)
Top of Hard Bedrock	30.5		Grout Type: Cement-bentonite
Top of Open Hole	25.0		
			Open Hole Diameter: 2 (in.)
			Open Hole Length: 20 (ft)
Base of Open Hole	46.0		
			Backfill/Grout: NA
Total Depth	46.0		



Notes:

APPENDIX D

Excavation Work Plan

CORE ENVIRONMENTAL CONSULTANTS

This Excavation Work Plan (EWP) contains procedures for potential future soil disturbances at the Site, including renovation, below-grade utility line repair, and new construction.

D.1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter residual impacts, the Site owner or their representative will notify the NYSDEC. Currently, this notification will be made to:

Jonathan Greco
NYSDEC Project Manager
625 Broadway
Albany, New York 12233
(518) 402-9694
Jonathan.Greco@dec.ny.gov

This notification will include:

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

D.2 SITE SECURITY

Site Security will be utilized to prevent access to the Site and vandalism or destruction of construction equipment, and to minimize health and safety concerns for surrounding properties.

Currently the Site is covered by a building. Any excavations within the building are generally subject to reduced potential for vandalism and unwanted access.

If excavations are performed outside the on-Site building or in the event of a building demolition, the area of excavation will be surrounded with an 8-foot security fence with a minimum of one gate that can be locked at the end of each working day. The fence will encompass the excavation, equipment, and soil storage areas, if any.

D.3 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional (QEP) during all excavations into known or potentially impacted material (residual impacts). Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the Certificate of Completion (COC).

Soils will be segregated based on previous environmental data and screening results into material that requires off-Site disposal and material that requires testing to determine if it can be reused on-Site as soil beneath a cover. Further discussion of off-Site disposal of materials and on-Site reuse is provided in Sections D.7 and D.8 of this Appendix.

D.4 SOIL STAGING METHODS

Any soils disturbed while the on-Site building is intact are anticipated to be in small volumes and will be containerized in New York State Department of Transportation (NYSDOT)-approved 55-gallon drums and stored in an on-Site staging area for later off-Site disposal.

In the event of a building demolition, larger amounts of soil will be generated. Excavated soils will be stockpiled in an on-Site staging area. Soil will be segregated into stockpiles based on screening performed as discussed in Section D.3 of this Appendix. Stockpiled soil will be characterized per NYSDEC “contained-in” procedures as discussed in Section 4.5 of the SMP. Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters, and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced. Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook maintained at the Site and will be made available for inspection by NYSDEC upon request.

D.5 MATERIALS EXCAVATION AND LOAD-OUT

A QEP or person under their supervision will oversee all invasive work and excavation and load-out of all excavated material. The owner of the property and its contractors are responsible for safe execution of all invasive and other work performed under this EWP.

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

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

A truck wash will be operated on-Site, as appropriate. The QEP will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the Site until the activities performed under this section are complete. Truck wash waters will be collected and disposed of off-Site in an appropriate manner.

Locations where vehicles enter or exit the Site shall be inspected daily for evidence of off-Site soil tracking. The QEP will be responsible for ensuring that all egress points for truck and equipment transport from the Site are clean of dirt and other materials derived from the Site during intrusive excavation activities. Adjacent streets will be cleaned as needed in order to maintain a clean condition with respect to Site-derived materials.

D.6 MATERIALS TRANSPORT OFF-SITE

All materials transport will be performed by licensed haulers in accordance with appropriate federal, state, and local regulations, including Title 6 of the New York Codes, Rules and Regulations Part 364 (6 NYCRR Part 364). Haulers will be appropriately licensed and trucks properly placarded.

Material not contained in 55-gallon drums will be transported by trucks equipped with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Truck transport routes are as follows: from the Northern Alleyway, trucks will turn left onto 21st Street, right onto Jackson Avenue, right onto 51st Avenue, left onto Vernon Boulevard, left onto Borden Avenue, and left onto Route 495 (Long Island Expressway). All trucks loaded with Site materials will exit the vicinity of the Site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of New York City-mapped truck routes; (c) prohibiting off-Site queuing of trucks entering the Site; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project Site. Off-Site queuing will be prohibited.

D.7 MATERIALS DISPOSAL OFF-SITE

All material excavated and removed from the Site will be treated as contaminated and regulated material and will be transported and disposed of in accordance with all federal, state (including 6 NYCRR 360), and local regulations. If disposal of material from this Site is proposed for unregulated off-Site disposal (i.e. clean soil removed for development purposes), a formal request, with an associated plan, will be made to NYSDEC. Unregulated off-Site management of materials from this Site will not occur without formal NYSDEC approval.

Off-Site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown of disposal facility by class, if appropriate - i.e., hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, construction/demolition (C/D) recycling facility, etc. Actual disposal quantities and associated documentation will be reported to NYSDEC in the Periodic Review Report (PRR). This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading, and facility receipts.

Non-hazardous historic fill and impacted soils taken off-Site will be handled, at minimum, as a Municipal Solid Waste per 6 NYCRR 360-1.2. Material that does not meet Part 375 Unrestricted Use SCOs is prohibited from being taken to a New York State recycling facility (6 NYCRR 360-16 Registration Facility).

D.8 MATERIALS REUSE ON-SITE

Excavated soils will be considered appropriate for reuse as on-Site backfill above residual impacts if concentrations are less than those set forth in 6 NYCRR 375-6.8(b) for Restricted Residential Use and the Standards, Criteria, and Guidance (SCGs) set forth in Table 5.4(e)4 of *DER Technical Guidance for Site Investigation and Remediation* (DER-10), included at the end of this Section. Soil will be stockpiled in accordance with Sections D.3 and D.4 of this EWP.

The QEP will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-Site. Impacted on-Site material, including historic fill and impacted soil, that is acceptable for reuse on-Site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse on-Site will be sampled for asbestos and the results will be reported to NYSDEC for acceptance. Concrete crushing or processing on-Site will not be performed without prior NYSDEC approval. No organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing is anticipated to be generated during Site

redevelopment and/or remedial work as the entire property is covered with a building, concrete sidewalks, and a paved alleyway.

Table 5.4(e)4
Reuse of Soil

Soil on the Site Meets:	Reuse on the Site:	Off-site Export & Reuse:
Unrestricted Soil SCGs	Without restrictions	Without restrictions
Meets the Applicable Use-based and Groundwater Protection SCG and where Appropriate Protection of Ecological Resources Soil SCGs for a Site w/ an IC & SMP.	In the soil cover/cap or as backfill within the area of the site subject to the IC.	Not Allowed, unless going to a site with IC subject to a 6 NYCRR Part 360 Beneficial Use Determination (BUD).
Meets Site-Specific Background Soil Levels.	Without restrictions. (Does not apply to sites in the BCP.)	Not Allowed, unless going to a site with IC subject to a 6 NYCRR Part 360 BUD.
Site-specific cleanup goals for subsurface soil	Placement below the soil cover/cap within the area of the site subject to the IC.	Not Allowed, unless going to a site with IC subject to a 6 NYCRR Part 360 BUD.

D.9 FLUIDS MANAGEMENT

All liquids to be removed from the Site including, but not limited to, excavation dewatering, decontamination waters, and groundwater monitoring well purge and development waters, will be handled, transported, and disposed of in accordance with applicable federal, state, and local regulations. Dewatering, purge, and development fluids will not be recharged back to the land surface or subsurface of the Site and will be managed off-Site unless prior approval is obtained from NYSDEC.

Impacted water originating from equipment decontamination, excavation dewatering, and monitoring well purging, will be pumped into storage tanks for off-Site disposal. A licensed liquid waste hauler will remove, transport, and dispose of the liquid in compliance with all applicable regulations.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river), if any, will be performed under a SPDES permit.

D.10 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the Decision Document. The existing cover system is comprised of concrete covered sidewalks, pavement, and a concrete building slab. A demarcation layer will be placed to provide a visual reference to the top of the zone of residual impacts, the zone that requires adherence to special conditions for disturbance of remaining impacted soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (e.g., the building slab is replaced by soil cover), this will constitute a modification of the cover element of

the remedy and the upper surface of the residual impacts. A figure showing the modified surface will be included in the subsequent PRR and in an updated SMP.

D.11 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the Site will be approved by the QEP and will be in compliance with provisions in the SMP prior to receipt at the Site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC Project Manager, allowing a minimum of five business days for review.

Material from industrial sites, spill sites or other environmental remediation sites, or potentially impacted sites will not be imported to the Site.

All imported soils will meet the backfill and cover soil quality standards established in 6 NYCRR 375-6.7(d). Approval will also be based on an evaluation of the land use, protection of groundwater, and protection of ecological resources criteria. Soils that meet 'exempt' fill requirements under 6 NYCRR 360, but do not meet backfill or cover soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Solid waste will not be imported onto the Site.

Imported materials will be tested at a rate consistent with Table 5.4(e)10 of DER-10, included at the end of this Section. Samples will analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), TCL pesticides, TCL Aroclors, and Target Analyte List (TAL) metals. Sample collection will be performed in accordance with the Quality Assurance Project Plan (QAPP), included as Appendix G of the SMP.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

Table 5.4(e)10
Recommended Number of Soil Samples for Soil Imported To or Exported From a Site

Contaminant	VOCs	SVOCs, Inorganics & PCBs/Pesticides	
Soil Quantity (cubic yards)	**Discrete Samples**	**Composite**	**Discrete Samples/Composite**
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
> 1000	Add an additional 2 VOC and 1 composite for each additional 1000 Cubic yards or consult with DER		

D.12 STORMWATER POLLUTION PREVENTION

Smaller soil disturbances, such as those required for utility maintenance or slab repairs, conducted after issuance of the COC, will not require coverage under the State Pollution Discharge Elimination System (SPDES) permit system or the preparation of a Stormwater Pollution Prevention Plan (SWPPP) due to the likelihood that they will be performed within the on-Site building, and will not be exposed to precipitation or other weather-related events. If performed within the alleyway, best management practices will be implemented.

For larger disturbances, such as in the event of a building demolition, a SWPPP will be required as well as applicable inspections to maintain compliance with the SPDES permit system. Silt fencing or hay bales will be installed around the entire perimeter of the construction area. Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook maintained at the Site and will be made available for inspection by NYSDEC upon request. All necessary repairs shall be made immediate. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

D.13 CONTINGENCY PLAN

If underground storage tanks (USTs) or other previously unidentified sources for impacts to subsurface media are found during post-remedial subsurface excavations or development-related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Analyses will be performed consistent with the "contained-in" process discussed in Section 4.5 of the SMP unless the Site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytical parameters will be proposed to NYSDEC for approval prior to sampling.

The NYSDEC Project Manager will be promptly notified in the event that unknown or unexpected impacted media is identified by screening during invasive Site work. Reportable quantities of

petroleum product will also be reported to the NYSDEC Spills Hotline. These findings will be also included in the PRR in compliance with the SMP.

D.14 COMMUNITY AIR MONITORING

A Site-specific Community Air Monitoring Plan (CAMP) is contained in the Health and Safety Plan (HASP), included as Appendix E to the SMP. CAMP procedures will be implemented for all excavations on Site, regardless of size.

D.15 OTHER NUISANCES

A plan for rodent control will be developed and utilized by the contractor for all large excavation work that may be performed.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

APPENDIX E

Health and Safety Plan

CORE ENVIRONMENTAL CONSULTANTS

HEALTH AND SAFETY PLAN
Wills Building
43-01 21st Street
Long Island City, New York 11101
Site No. C241143

Prepared for:

Rockrose Development Corporation
15 East 26th Street, 7th Floor
New York, New York 10010

Prepared by:

46-11 54th Ave
Maspeth, New York 11378

July 7, 2015

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TABLES

FORMS

ATTACHMENTS

1.0 INTRODUCTION

Rockrose Development Corporation (Rockrose) retained CORE Environmental Consultants, Inc. (CORE) to provide environmental consulting services related to the Wills Building Site located at 43-01 21st Street, Long Island City, New York. This Site-specific Health and Safety Plan (HASP) is an update of the 2014 New York State Department of Environmental Conservation (NYSDEC)-approved HASP to include information and data gathered during the 2014 Remedial Investigation (RI) and Interim Remedial Measure (IRM).

1.1 PROJECT DESCRIPTION

The purpose of this HASP is to set forth appropriate health and safety procedures to be followed by CORE personnel and contractors during on-Site remedial activities, including intrusive activities, and soil, groundwater, and sub-slab vapor sampling.

This document will serve not only to explain the chemical and physical hazards associated with working on Site, but will also outline approved measures for dealing with such hazards. The project Health and Safety Officer (HSO) will be responsible for the development and implementation of project Health and Safety protocols. In addition, the contractor(s) will be required to designate a Site HSO for their personnel and to follow, at a minimum, the requirements of this HASP. All personnel who will be involved with sampling on Site must have completed the appropriate Hazardous Waste Operations (HAZWOPER) Site Worker Training - i.e., 24 hour or 40 hour, as required by the Occupational Safety and Health Administration (OSHA) in Title 29 of the Code of Federal Regulations (29 CFR), Part 1910.120(e)(2), 1910.120(e)(3), and 1910.120(e)(8), as applicable, and the required medical surveillance as required by 29 CFR 1910.120(f).

The remedial work efforts will include:

Air Sparge and Soil Vapor Extraction

Remedial activities primarily include air sparge and soil vapor extraction (SVE) for removal of volatile organic compounds (VOCs) from Site groundwater. Installation of the overall remedial system will include drilling for well installation, potential soil sample collection for VOCs analysis, and system construction.

Groundwater Monitoring Program

The groundwater monitoring program will involve the collection of groundwater samples from monitoring wells location on Site, as well as from sparge wells, to evaluate system efficacy.

Soil/Sub-Slab Vapor and Indoor Air Quality Monitoring Program

The soil vapor and indoor air quality (IAQ) monitoring program will involve the installation of SVE points, and soil vapor and indoor air quality (IAQ) sample collection for analysis. Samples will be

analyzed to verify air sparge system operation and continued effectiveness of the existing on-Site sub-slab depressurization system (SSDS) in mitigating impacts to indoor air as a result of soil vapor intrusion.

Sample Analysis

Select soil and groundwater samples collected for analysis will be analyzed for Target Compound List (TCL) VOCs. Analysis of soil vapor and IAQ samples will be via United States Environmental Protection Agency (USEPA) Method TO-15. Soil vapor samples will be collected in individually certified clean 6-liter SUMMA® canisters.

Community Air Monitoring

VOCs and particulates are not anticipated to be a concern to building tenants during intrusive activities based on the non-detection of both in the breathing zone during previous subsurface intrusive activities performed within the building structure. Exhaust generated by drilling activities will be vented via pipe to the exterior of the building. Community air monitoring will be performed in accordance with New York State Department of Health (NYSDOH) guidance to guarantee the safety of both workers and building tenants. Generic NYSDOH Community Air Monitoring requirements are included in Attachment A.

1.2 SITE DESCRIPTION

The Site is located at 43-01 21st Street in Long Island City, Queens, New York. The Wills Building is currently a mixed-use commercial and manufacturing space. The Site is located in an area zoned M1-4 by the New York City Department of City Planning, indicating that it can be used for manufacturing and commercial uses. The Site is presently owned by 43-01 21st Street LLC, and is bound by various commercial and industrial properties to the south, 21st Street to the west, 43rd Avenue to the north, and 22nd Street to the east. The East River is located approximately one-half mile northwest of the Site.

The Site is comprised of a large parcel occupying the entire block length between 21st and 22nd Streets. The parcel is approximately 261 feet along 43rd Avenue by 190 feet along the 21st Street frontage, and is identified as Block 441, Lot 16 by the New York City Department of Finance. The Site is currently occupied by one 124,000 square foot, three-story building originally constructed in approximately 1926. The property is relatively flat, with an approximate ground elevation 19 feet above mean sea level (msl). General topography in the area of the Site slopes slightly to the west. A Site Location Map is presented as Figure 1 and a Site Plan is included as Figure 2.

2.0 KEY PERSONNEL

Personnel responsible for implementation of this Health and Safety Plan are:

Name	Company/Title	Address	Contact Information
Ronald Tramposch	CORE Site HSO	46-11 54th Avenue Maspeth, NY 11378	Office: (718) 762-0544 Mobile: (917) 804-8717 Email: RPT@coreenv.com
Fred Smith, CIH, CSP	Project HSO	46-11 54th Avenue Maspeth, NY 11378	Office: (718) 762-0544 Email: flsmithjr@usa.net
William Grutta	Rockrose Project Executive	15 East 26th Street 7th Floor New York, NY 10010	Office: (212) 847-3780 Email: William.Grutta@rockrose.com

2.1 SITE HEALTH AND SAFETY OFFICER

The responsibilities of the Site HSO are as follows:

- Implement this HASP on Site;
- Enforce day-to-day health and safety protocols on Site;
- Require that all personnel entering the Site understand the provisions of this HASP;
- Conduct periodic training sessions on use/maintenance of personal protective equipment (PPE) and safety practices;
- Conduct daily health and safety meetings each morning;
- Direct and advise CORE's Site personnel, visitors, and contractor(s) on the specific hazards associated with the Site as well as any changes related to health and safety requirements at the Site;
- Conduct necessary health and safety monitoring;
- Oversee air monitoring program, including monitoring logs;
- Monitor Site conditions and determine if changes in PPE levels are required;
- Execute work stoppages, if required; and
- Report changes in Site conditions and changes in PPE requirements to the Project HSO.

3.0 MEDICAL SURVEILLANCE REQUIREMENTS

All personnel who engage in waste Site activities for 30 days or more per year will participate in a Medical Surveillance Program. All project personnel involved in on-Site activities in impacted areas will be required to undergo annual medical examinations. This examination must take place not more than one year prior to and one year after the completion of Site work and must be conducted by a physician who is board-certified in occupational medicine. The physician should be familiar with the job-related duties of each worker examined. The physician must certify whether the individual is fit to conduct work on hazardous waste Sites using personal protection, or whether he or she must work within certain restrictions.

Any person exposed to high levels of hazardous substances will be required to undergo a repeat medical exam at, or before, the conclusion of the project to determine possible health impacts. Any person suffering a lost-time injury or illness must receive medical approval prior to returning to work. When employment is terminated for any reason, the employee must receive an exit medical examination.

All medical records will be held by the employer for the period of employment plus at least 30 years, in accordance with OSHA regulations on confidentiality and any other applicable regulations and will be made available to OSHA upon request. The components of Medical Surveillance include:

- Medical and occupational history;
- Physical examination, with particular attention to the cardiopulmonary system, general physical fitness, skin, blood-forming, hepatic, renal, and nervous systems;
- Blood and urine analyses;
- Pulmonary function testing; and
- Additional tests as appropriate, such as x-ray, stress tests, etc.

4.0 SITE HAZARD/RISK ANALYSIS

Physical hazards include the dangers of tripping and falling on uneven ground, operation of heavy equipment such as drill rigs, vehicular traffic, and utilities either above-ground or buried. The following are physical hazards which may be encountered during remedial activities

4.1 HAZARD ANALYSIS

PPE is the initial level of protection based on the activity hazards and Site conditions which have been identified. Upgrades to respiratory protection may be required based on the action levels discussed in Section 7.0. General on-Site provisions will include: extra nitrile, leather, and/or Kevlar gloves, extra protective coveralls, drinking water and electrolyte fluids, reflective vest, first aid kit, fire extinguisher, hearing protection, and washing facilities.

If Site conditions suggest the existence of a situation more hazardous than anticipated, the Site personnel will evacuate the immediate area. The hazard, level of precautions, and PPE will then be reevaluated.

4.2 HANDLING DRUMS AND CONTAINERS

Regulations for handling drums and containers are specified by OSHA in 29 CFR 1910.120(j). Potential hazards associated with handling drums include vapor generation, fire, explosions, and possible physical injury. Handling of drums/containers during remedial activities may be necessary. If drum/container handling is necessary, it will be performed in accordance with applicable regulations.

4.3 ELECTRICAL HAZARDS

4.3.1 Utilities

The Site may have shallow, buried utilities and also overhead utilities in certain areas. It will be necessary for parties disturbing the existing ground surface and conducting operations with heavy equipment having high clearances to exercise caution in performing project-related work with respect to the presence of utilities. Utility companies with active, buried lines in the Site area will be asked by the contractor performing intrusive activities to mark their facilities. Employees will use these data to choose work locations.

4.3.2 Underground Utilities

No excavating, drilling, boring, or other intrusive activities will be performed until an underground utility survey, conducted by knowledgeable persons or agencies, has been made. This survey will identify underground and in-workplace utilities such as the following:

- Electrical lines and appliances;
- Telephone lines;

- Cable television lines;
- Gas lines;
- Pipelines;
- Steam lines;
- Water lines;
- Sewer lines; and/or
- Pressurized air lines.

The location of utilities will be discussed with CORE personnel and contractors during a Site safety briefing. Utilities identified during survey should be marked or access otherwise restricted to avoid chance of accidental contact.

Even when a utility search has been completed, drilling, boring, and excavation should commence with caution until advanced beyond the depth at which such utilities are usually located. Utilities will be considered "live" or active until reliable sources demonstrate otherwise. Geophysical surveys, including ground penetrating radar (GPR) and electromagnetic (EM) survey, if necessary, will be completed in the area of all indoor boring locations to further refine the presence and locations of potential subsurface utilities.

4.3.3 Overhead Utilities

CORE does not anticipate performing work in the area of overhead utilities; however, if present, clearances will be adequate for the safe movement of vehicles and for the operation of construction equipment.

Overhead or above-ground electric lines should be considered active until a reliable source has documented them to be otherwise. Elevated work platforms, ladders, scaffolding, man-lifts, and drill or vehicle superstructures will be erected a minimum of 20 feet (the actual distance is dependent upon the voltage of the line) from overhead electrical lines until the line is de-energized, grounded, or shielded so arcing cannot occur between the work location or superstructure.

4.4 PHYSICAL HAZARDS

The drilling program poses the greatest potential threat to the safety of Site personnel. The following sections describe specific safety measures to be implemented during specific activities.

4.4.1 Heat Stress

Employees may be exposed to the hazards associated with heat stress when ambient temperatures exceed 70 degrees Fahrenheit (ºF). Employees should increase water intake while working in

conditions of high heat. Enough water should be available so that each employee can consume 1 quart of water per hour. In addition, they should increase number of rest breaks and/or rotate employees in shorter work shifts. Employees should rest in cool, dry, shaded areas for at least 5 minutes. Employees should not wait until they feel sick to cool down. Watch for signs and symptoms of heat exhaustion and fatigue. In the event of heat stroke, bring the victim to a cool environment, call for help, and initiate first aid procedures.

The following prevention, recognition, and treatment strategies will be implemented to protect personnel from heat stress. Personnel will be trained to recognize the symptoms of heat stress, and to apply the appropriate treatment.

Prevention

- Provide plenty of liquids. A 50 percent solution of fruit punch (or similar) in water, or plain water to be taken with salted foods such as pretzels will be available in the support zone.
- Buddy system. No individual will attempt to undertake any activity alone.
- Provide cooling devices. A spray hose and a source of water will be provided to reduce body temperature, cool protective clothing, and/or act as a quick-drench shower in case of an exposure incident.
- Adjustment of the work schedule. As is practicable, the most labor intensive tasks should be carried out during the coolest part of the day.

Recognition and Treatment

Any person who observes any of the following forms of heat stress, either in himself or in another worker, will report this information to the Site HSO as soon as possible.

1. Heat Rash (or prickly heat)

   Cause: Continuous exposure to hot and humid air, aggravated by chafing clothing.

   Symptoms: Eruption of red pimples around sweat ducts accompanied by intense itching and tingling.

   Treatment: Remove source of irritation and cool skin with water or wet clothes.

2. Heat Cramps (or heat prostration)

   Cause: Profuse perspiration accompanied by inadequate replenishment of body water and electrolytes.

   Symptoms: Sudden development of pain and/or muscle spasms in the abdominal region.

Treatment: Remove the worker to the contamination reduction zone. Provide fluids orally. Remove protective clothing. Decrease body temperatures and allow a period of rest in cool location.

3. Heat Exhaustion

Cause: Overexertion in a hot environment and profuse perspiration accompanied by inadequate replenishment of body water and electrolytes.

Symptoms: Muscular weakness, staggering gait, nausea, dizziness, shallow breathing, pale and clammy skin, approximately normal body temperature.

Treatment: Perform the following while simultaneously making arrangements for transport to a medical facility: Remove the worker to the contamination reduction zone. Remove protective clothing. Lie the worker down on his or her back, in a cool place, and raise the feet 6 to 12 inches. Keep warm, but loosen all clothing. If conscious, provide sips of a salt water solution, using one teaspoon of salt in 12 ounces of water. Transport the worker to a medical facility.

4. Heat Stroke

Cause: Same as heat exhaustion.

Symptoms: Dry and hot skin, dry mouth, dizziness, nausea, headache, rapid pulse.

Treatment: Cool worker immediately by immersing or spraying with cool water or sponge bare skin after removing protective clothing. Transport to hospital.

4.4.2 Cold Stress

Exposure to cold weather, wet conditions and extreme wind-chill factors may result in excessive loss of body heat (hypothermia) and/or frost bite. To guard against cold exposure and to prevent cold injuries, appropriate warm clothing should be worn, warm shelter must be readily available, rest periods should be adjusted as needed, and the physical conditions of on Site field personnel should be closely monitored. Personnel and supervisors working on Site will be made aware of the signs and symptoms of frost bite and hypothermia such as shivering, reduced blood pressure, reduced coordination, drowsiness, impaired judgment, fatigue, pupils dilated but reactive to light, and numbing of the toes and fingers. The potential for wetting of protective clothing should be of concern, since wet clothing (from sweat or splashes) will provide poor insulation against the cold.

4.4.3 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps, and generators. Employees who will perform suspected or established high noise tasks and operations for short durations (less than 1 hour) will wear hearing protection. If deemed necessary by the HSO, additional hearing protection may be added and the need to monitor sound levels for Site activities will be determined. Other employees who do not need to be in proximity should distance themselves from the equipment generating the noise.

4.4.4 Hand and Power Tools

In order to complete the various tasks for the project, personnel may use hand and power tools. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. Work gloves, safety glasses, and hard hats will be worn by the operating personnel when using hand and power tools.

4.4.5 Slips, Trips, and Falls

Working in and around the Site may pose slip, trip, and fall hazards due to slippery and uneven surfaces. Personnel will wear proper foot gear and will employ good work practice and housekeeping procedures to minimize the potential for slips, trips, and falls.

4.4.6 Manual Lifting

Manual lifting of objects and equipment may be required. Failure to follow proper lifting technique can result in back injuries and strains. Employees should use a buddy system and/or power equipment to lift heavy loads whenever possible and should evaluate loads before trying to lift them. Carrying heavy loads with a buddy and proper lifting techniques include: 1) make sure footing is solid; 2) make back straight with no curving or slouching; 3) center body over feet; 4) grasp the object firmly and as close to your body as possible; 5) lift with legs; and 6) turn with your feet, don't twist.

4.4.7 Overhead Dangers

Overhead dangers, including but not limited to falling debris and equipment, can occur while operating drill rigs and installing overhead remedial system components. CORE personnel will maintain a minimum distance from large overhead operations and proper communication with heavy equipment operators and their handlers, should work necessitate their presence beyond the minimum safety distance. Proper PPE will be worn during these types of activities including steel-toed/shank boots, safety vests, and hard hats.

4.4.8 Cuts and Lacerations

Field activities that involve drilling and sampling activities usually involve contact with various types of machinery. At least one person on Site must be currently certified in first aid and cardiopulmonary resuscitation (CPR) techniques. Personnel trained and certified in first aid should be prepared to

take care of cuts and bruises as well as other minor injuries. CORE will have a first aid kit approved by the American Red Cross available during all field activities.

4.4.9 Traffic Hazards

All traffic, vehicular and pedestrian, shall be maintained and protected at all times consistent with local, state, and federal, and agency regulations regarding such traffic and in accordance with direction of the Owners. Traffic hazards will be limited as the remediation project is to be completed primarily on private land and not in public right of way areas.

4.5 CHEMICAL HAZARDS

Chemicals that may potentially be encountered at the Site include VOCs, primarily tetrachloroethylene (PCE) and trichloroethylene (TCE). The health/safety characteristics and exposure limits of these compounds are listed in Table 1. The risk of exposure can be by dermal, ingestion, or respiratory routes, depending on the type of compound and intrusive activity being performed.

Particulate matter and VOCs in the breathing zone are not anticipated to pose a threat at the Site as neither was detected during previous Site investigations within the building structure. Exhaust from drilling activities will be vented via pipe to the exterior of the building.

If during air sparge and SVE well installation, the potential for workers to be exposed to particulates and compounds, such as VOCs, dusts, and metals, in soil and development water through inhalation/ingestion/dermal contact routes, workers may need to apply water or an amended water solution to the area to help control the generation of airborne dusts, particulates, and VOCs. Workers may also use respiratory protection including the use of an air-purifying respirator equipped with approved filter/cartridges. An analysis of the work tasks and potential for chemical exposure should be performed to determine the correct PPE, and/or respirator cartridge(s), if needed. The analysis should include a chemical waste profile to help ensure that PPE specified will be appropriate for the respective chemical hazard(s).

4.6 BIOLOGICAL HAZARDS

There are no anticipated biological hazards associated with the Site.

5.0 SITE CONTROL

In order to keep unauthorized personnel from entering the work areas during drilling activities without proper protective equipment, and for good control of overall Site safety, two work zones will be established. The two work zones are the support zone and the contamination reduction zone/exclusion zone. Actual zone width will be determined by optimal size of work area and by obstructions, if any. A brief description of the Site work zones follows.

5.1 SUPPORT ZONE

The support zone at the Site will be a mobile unit (automobile) including a cellular telephone for communication. The support zone will be located as near as practicable to the active work areas and decontamination areas.

5.2 CONTAMINATION REDUCTION ZONE/EXCLUSION ZONE

Due to the environmental setting for this project, the contamination reduction zone and exclusion zone will be incorporated into one zone at each well installation or construction location. This zone will be mobile and the location will be dependent upon where active work is being performed. The decontamination of personnel, light equipment, and heavy equipment will be performed at each well installation location.

A temporary storage location will be established at the Site for the storage of any drummed drill cuttings, decontamination water, core water, well purge water, recovered oil, and disposable clothing. The location will be situated away from vehicular and pedestrian traffic.

5.3 SITE VISITATION

It is possible that the Owners or officials from regulating bodies and jurisdiction will visit the Site during operations. It is also possible that an OSHA representative will wish to inspect the Site. All such officials must meet the requirements of occasional Site workers (24 hour OSHA-approved training and Site-specific training) before going into any active contamination reduction zone/exclusion zone. Visitors other than the Owners, NYCDEC, or OSHA representatives will be subject to the additional requirements of having to receive written permission from the Owners to conduct a Site visit. Because of the nature of the work, the work zone will be continually supervised. Signs will be used to prevent the entrance of unauthorized visitors.

All visitors must supply their own PPE and will be directed to appropriate disposal areas for soil or used PPE.

6.0 PERSONAL PROTECTIVE EQUIPMENT

Since personnel working on Site may be exposed to unexpected levels of hazardous airborne chemicals or compounds released during drilling activities, or may come in contact with VOCs, SVOCs and metals in drill cuttings or soil, various levels of protection will be utilized during field activities. Components of all levels of personal protection that will be available are listed in Table 2. Planned levels of protection for various activities are given in Table 3.

In the event that unexpected levels of organic vapors are encountered, any personnel working at Level D protection will don their respirators at once (upgrade to Level C). The Site HSO will consult with the Project HSO to decide if and when Level D protection may be resumed, or if a higher level of PPE is required. Some modification in safety equipment (e.g., switching from polycoated disposable coveralls to standard disposable coveralls) may be implemented in order to balance concerns for full contaminant protection against concerns for the possibility of heat stress resulting from the need to wear more restrictive PPE. Such modifications may be implemented only if approved in advance by the Site HSO, following consultation with the Project HSO. PPE which fully complies with the requirements of all required levels of protection should be immediately available at all times on the Site.

Level C respiratory protection will be provided using The National Institute for Occupational Safety and Health (NIOSH) -approved half-face respirators, with appropriate NIOSH approved cartridge for removal of organic vapors. All team members will be fit-tested for respirators using irritant smoke. Due to difficulties in achieving a proper seal between face and mask, persons with facial hair will not be allowed to work in areas requiring respiratory protection.

For the fullest protection of on-Site personnel, the supervising field engineer/geologist will conduct organic vapor monitoring at closely spaced intervals during subsurface intrusive activities. Monitoring will be accomplished by real-time monitoring equipment, such as a photoionization detector (PID).

The primary purpose of this monitoring will be to assess the adequacy of respiratory protection and to make it possible to stop work quickly if explosive or hazardous gases are encountered, or if an oxygen-deficient atmosphere is detected. The air monitoring to be carried out during all intrusive activities is summarized below.

Site personnel timesheets with employee and Project Manager signatures will serve to document the amount of time spent on Site by each team member.

7.0 COMMUNITY AIR MONITORING

Air monitoring will be performed throughout subsurface intrusive activities by trained CORE personnel. This includes any time that the building is occupied by any persons that are not associated directly with remedial activities and/or staff that are not properly trained in HAZWOPER procedures. Air will be monitored for total volatiles with a photoionization detector (PID). All air monitoring results and meteorological data (e.g., temperature range, wind speed, wind direction, etc.), if applicable, will be recorded on monitoring logs.

VOCs and particulates are not anticipated to be a concern to building tenants during intrusive activities based on the non-detection of both in the breathing zone during previous subsurface intrusive activities performed within the building structure. However, appropriate measures will be taken to ensure the safety of building occupants.

- If the work area is contained, such as in specific rooms with sealed doorways, and only persons directly involved in remedial activities that are HAZWOPER trained are present, community air monitoring is not required.
- In areas where work is not isolated (e.g. – hallways, occupied suites), or persons not directly associated with remedial activities are present, the work area will be enclosed with a minimum of two millimeter plastic sheeting and all seams between sheets of plastic as well as along the ceiling, walls, and floor will be sealed with duct tape.

Community air monitoring will be performed in accordance with NYSDOH guidance to guarantee the safety of both workers and building tenants. The NYSDOH Generic Community Air Monitoring Plan (CAMP) is included as Attachment A.

7.1 TOTAL VOLATILES

During intrusive activities performed indoors, air monitoring for VOCs will be performed within the work zone and immediately outside the work area using a PID equipped with a 10.2 eV lamp to detect target volatiles typical to the impacts previously identified on Site. When readings up to 1 part per million (ppm) above background in the breathing zone are observed, work activity will continue. Monitoring will be continuous, and recorded at 15-minute intervals.

Levels less than 1 ppm of total volatiles are permissible. If the concentrations of VOCs in ambient air in the work zone area exceed 1 ppm for the 15-minute average, work activity must be temporarily halted. Air monitoring is to remain continuous while work is halted. If vapor levels decrease below 1 ppm, work can resume with continued monitoring.

If vapor levels between 1 and 25 ppm are detected, work must be halted, the vapor source identified, abatement actions taken, and air monitoring continued. If sustained readings from 1 to 25 ppm above background in the breathing zone are observed, work will only be allowed to continue after an

upgrade to Level C PPE. Intrusive activities will be shut down if vapor in the work area exceed 25 ppm.

Air outside the work area will be continuously monitored. If action levels are exceeded outside the work area, the level will be compared to the level within the work area to determine if the exceedence is associated with remedial activities. During subsurface intrusive activities, a minimum of one SUMMA® canister with a flow controller pre-calibrated for a two hour sample will be available on Site. If air monitoring levels indicate that VOCs may have migrated out of the work area, or if there is a question about air quality, a sample will be collected to determine if elevated VOCs are the result of remedial activities or other activities within the building. If an action level exceedence outside the work area is determined to be the result of remedial activities, work will stop until the source of VOCs is identified and abated (e.g. – verifying floor and ceiling seals are intact, drill rig is properly exhausted to outside the building, etc.). Air monitoring will continue following abatement activities.

7.2 PARTICULATE MONITORING

For intrusive activities performed within the building structure, particulate concentrations will be continuously monitored within, and immediately outside of, the work area. A background reading will be recorded prior to initiation of intrusive activities. Real-time monitoring equipment capable of detecting particulate matter less than 10 micrometers (PM-10) in size will be utilized. Monitoring will be continuous and recorded at 15-minute intervals.

If the work area PM-10 level is 100 micrograms per cubic meter (µg/m3) greater than background concentrations over a 15-minute average period, dust suppression procedures will occur. If PM-10 concentrations in the work area exceed background concentrations by 150 µg/m3 or more, work must be halted while additional dust suppression measures are implemented.

Air outside the work area will be continuously monitored. If action levels are exceeded outside the work area, the level will be compared to the level within the work area to determine if the exceedence is associated with remedial activities. If an action level exceedence outside the work area is determined to be the result of remedial activities, work will stop until the source of excess particulate matter is identified and abated (e.g. – verifying floor and ceiling seals are intact). Air monitoring will continue following abatement activities.

7.3 AIR MONITORING EQUIPMENT CALIBRATION

The PID will be calibrated to a benzene surrogate (an isobutylene standard with a 100 ppm concentration) daily (prior to field activities) and the results will be recorded. Intrusive activities will not begin until all instruments are calibrated and ambient air conditions are recorded. The PID will be recalibrated throughout the day as necessary.

7.4 WORK STOPPAGE RESPONSES

The following responses will be initiated whenever one or more of the action levels necessitating a work stoppage is exceeded:

- The Site HSO will be consulted immediately;
- All personnel will be cleared from the work area until appropriate mitigation techniques have been implemented;
- Monitoring will be continued until the soil boring is grouted or finished as a monitoring well, air sparge well, or SVE well; and
- NYSDEC and NYSDOH will be notified as soon as possible.

Any chemical release to air, water, or soil must be reported to the Site HSO at once. Any exposure resulting from protective equipment failure must be immediately reported to the Site HSO and to the Project HSO in writing within 24 hours.

8.0 DECONTAMINATION PROCEDURES

8.1 DECONTAMINATION OF PERSONNEL

Decontamination of personnel will be performed at each contamination reduction zone/exclusion zone. This can be accomplished by washing and rinsing the outer gloves and outer boots over the decontamination trough. Disposable clothing can then be removed and discarded into a 30-gallon trash can with a vinyl liner. If personnel are in Level C protection, the above procedures will be followed and the respirator will be removed, sanitized, and placed in a plastic bag.

8.2 DECONTAMINATION OF EQUIPMENT

Heavy Equipment

Decontamination of heavy equipment (such as augers, core bits, rods) will be accomplished by steam cleaning on a decontamination pad constructed of wood and covered with water retaining polyethylene sheeting with a minimum thickness of 6 mil. Washing of heavy equipment will be completed with attention to minimize any overspray of water, debris and/or soil. All wash water and debris will be collected and containerized in Department of Transportation (DOT)-approved 55-gallon drums for later off-Site disposal. The polyethylene sheeting will be examined frequently for any tears or punctures that may cause a leak. The sheeting will be discarded in a municipal trash dumpster.

Mid-Weight Equipment

Decontamination of mid-weight equipment (such as split spoons, cutting shoes, pumps, non-disposable bailers, etc.) will be accomplished by scrubbing the equipment with a heavy duty bristle brush in a 5-gallon bucket containing water and Alconox® detergent. After washing and scrubbing, the equipment will be rinsed by placing it in a separate bucket of water to remove soap and debris. The wash and rinse water will be containerized in DOT-approved 55-gallon drums for later off-Site disposal.

Light Equipment

Decontamination of light equipment (such as tools, containers, monitoring instruments, radios, clipboards, etc.) will be accomplished by wiping equipment off with clean, damp cloths. The cloths can be discarded in the trash can with disposable clothing.

9.0 EMERGENCY PROCEDURES

The most likely incidents for which emergency measures might be required are:

- A sudden release of hazardous gases/vapors during drilling or excavating;
- An explosion or fire occurring during drilling or excavating; and/or
- A heavy equipment-related accident, or other accident resulting in personal injury.

Emergency procedures established to respond to these incidents are covered under the sections that follow.

9.1 COMMUNICATIONS

A portable telephone will be maintained by the Site HSO during the entire project. The phone will be frequently checked to ensure an appropriate signal is available for the phone to work properly.

9.2 FIRE/EXPLOSION

It will be the responsibility of the contractors to have a fire extinguisher available at the drill rig and/or excavation locations. The operator will have further responsibility of taking fire prevention measures such as the continuous removal from the rig of accumulated oil, grease, or other combustible materials.

In the event of a fire that cannot be controlled with available equipment, or in the event of an explosion, the local fire department will be summoned immediately by the Site HSO, who shall apprise them of the situation upon their arrival. The Owners will also be notified.

9.3 FIRST AID

First aid for personal injuries will be administered by the Site HSO. All accidents, however insignificant, will be reported to the Site HSO. Personnel designated to administer first aid will have received a minimum of eight hours training in first aid and CPR, and be certified by the American Red Cross. If a Site worker should require further treatment, he/she will be transported to the hospital. The on-Site vehicle will carry a copy of the HASP which includes written directions to the hospital, as well as a map showing the route.

The following sections are intended as a “quick guide” to basic first aid only. Effective CPR and first aid require hands-on training that is best accomplished by attending a class in person.

One common formula for performing first aid:

Do a primary scene and patient survey, followed by checking airway, breathing, and circulation (ABCs).

Survey the scene and approach the victim. Determine whether the scene is safe. Look for dangers, such as downed power lines, traffic, unstable vehicles, or accidents. Determine what may have happened, how many victims are involved, and if any bystanders can help. If several persons appear to be injured, perform triage.

Survey the patient and perform an initial assessment. Get consent from a conscious victim (parent/guardian if the victim is a minor) before providing care. If the victim is unconscious, consent is implied. Use infection control precautions and check for signs and symptoms of any life-threatening conditions and care for them. To perform an initial assessment:

- Check the victim for consciousness and obtain consent if the victim is conscious;
- Check the ABCs (airway, breathing and circulation); and
- Check for severe bleeding.

Provide brief care for the conditions. If the patient lacks air or circulation, they may begin to suffer brain damage after approximately four minutes. After ten minutes, they most likely will have some permanent brain damage. To care for breathing and circulation means first clearing the airway, and briefly attempting to restart their breathing or circulation with rescue breathing or CPR (and use of a portable defibrillator, where available). This step is crucial, because an unconscious person's airway can be blocked by a normal, comfortable-looking head position (e.g., on their back with a pillowed head). Often, simply tilting the head back will open the airway and restart their breathing. Likewise, many people recovering from a blocked airway vomit, and if they are unconscious, they can drown in the vomit. The standard prevention for both these issues is to turn a breathing, unconscious patient on their side, turning their head and spine in the same movement to avoid spinal injury, pillowing their head on one of their arms. Do not move casualties unless it is necessary to remove them from danger, or to make treatment possible (such as onto a hard surface for CPR).

1. Call for emergency services

Calling for emergency medical services must take priority over extended care such as long term rescue breathing or extended CPR, since these techniques are intended to gain time for emergency services to arrive as part of the chain of survival. However, if bystanders are available, both can be pursued at the same time. If you ask others to call an ambulance for you, make sure they report back to you once released by the emergency operator to confirm that the call has been made.

2. Do a secondary patient survey, and provide appropriate emergency first aid

The secondary survey is to gather information about conditions or injuries that may not be life threatening, but may become so if not cared for. Perform a secondary survey only if you are sure that the victim has no life-threatening conditions. A properly trained and certified person performs three stages in the secondary survey:

1. Interview the victim and include bystanders to supplement info from the patient:
    - Signs and Symptoms - Visible indications of injury and patient reported sensations (e.g. pain)
    - Allergies - especially those relevant to injury (i.e. allergy to latex, penicillin, etc.)
    - Medications - what current or recent medications the patient is taking
    - Past Medical History - any related history, or medical conditions that could complicate treatment (e.g. heart condition)
    - Last meal - last food and/or drink
    - Events - confirm how injury most likely occurred
2. Vitals
    - LOC - Level of Consciousness description (e.g. - alert, aware, disoriented, confused, unresponsive) or AVPU (Alert, Voice, Pain, Unresponsive)
    - Breathing Rate - Number of breaths per minute. Calculate by counting breaths for ten seconds and multiplying by six, or 15 seconds and multiplying by four.
    - Pulse Rate - Number of heart beats per minute. Calculate by counting pulse for ten seconds and multiplying by six, or 15 seconds and multiplying by four. Pulse for an unconscious person is taken on the neck (carotid pulse) and on the wrist (radial pulse) for a conscious person.
    - Skin Condition - Pale vs. normal, cool/cold vs. hot, clammy/sweaty vs. dry
3. Head-to-toe examination
    - Perform a head-to-toe examination
    - Look for medical alert bracelets or medallions.
    - Compare one side of the patient against the other
    - Look for pain or deformity

9.4 EMERGENCY ASSISTANCE

The following table list telephone numbers of police, fire, hospital, and other agencies whose services might be required, or from whom information might be needed. A hospital route map and directions to Mount Sinai Hospital Queens, is included in Attachment B.

Name	Contact Numbers
Mount Sinai Hospital Queens 25-10 30th Avenue Long Island City, New York 11102	Main Number: (718) 932-1000
NYCDEP	311
Fire Department	911
Police Department	911
Poison Information Center	1-800-222-1222
NYSDEC Emergency Hotline	1-800-457-7362

10.0 SAFETY CONCERNS AND CONTINGENCY MEASURES

Normally, it is the drilling program that poses the greatest potential threat to the safety of Site personnel. Drilling at the Site will be conducted under the OSHA Safety and Health Standards (29 CFR 1926/191) relative to heavy equipment operation. The following sections describe specific safety measures to be implemented during specific activities.

10.1 BUDDY SYSTEM

The buddy system is an arrangement in which persons are paired, as for mutual safety or assistance. All field work will be completed by at least a two person team.

10.2 SOIL BORINGS

An active drilling exclusion sub-zone is established by opening a borehole. A PID calibrated to a benzene surrogate will be used in this zone. Monitoring with real-time instrumentation will be performed at the borehole. Action levels will be considered to have been reached when a continuous, steady reading has been observed.

If at any time during subsurface intrusive activities, underground storage tanks (USTs), metal, or concrete are penetrated, drilling activities will cease immediately. After obtaining instrument readings, the project geologist/Site HSO will decide whether to continue or discontinue drilling.

10.3 DEVELOPMENT AND DECONTAMINATION WATER

Excess soil and purge and decontamination water generated during field activities will be screened with a PID. Investigation-derived waste (IDW) will be containerized in DOT-approved 55-gallon steel drums. All containers will be labeled with the contents and date, and will be stored at an on-Site staging area for later off-Site transport and disposal.

A waste management firm capable of handling both hazardous and nonhazardous wastes, such as National Response Corporation (NRC) of Great River, New York, will be employed to perform waste analysis and profiling, transport, and disposal for all IDW.

TABLES

TABLE 1
HAZARD CHARACTERISTICS OF SUSPECTED CONTAMINANTS

Substance	Incompatibles/Reactive	Exposure Routes/Target Organs	Standards
Tetrachloroethylene (PCE)	Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash	Inhalation, skin absorption, ingestion, skin and/or eye contact Central nervous system depression with dizziness and muscular incoordination; Eye and skin irritation upon contact; Liver and kidney damage	NIOSH REL: TWA Ca Minimize exposure OSHA PEL: TWA 100 ppm STEL 100 ppm IDLH: 150 ppm
Trichloroethylene (TCE)	Strong oxidizers, many fluorides	Inhalation, skin absorption, ingestion, skin and/or eye contact Eyes, skin, respiratory system, blood, central nervous system	TWA: 350 STEL: 440 CEIL: from ACGIH CEIL: 2380 (mg/m3) from ACGIH OSHA PEL: 100 ppm TWA IDLH: 1,000 ppm

REL = NIOSH recommended exposure limits, up to 10 hour work day exposure limit, 40 hours/week.
PEL = OSHA permissible exposure limit, 8 hour exposure limit, 40 hours/week, 29 CFR 1910.1000.
REL, PEL in mg/m^3 = (PEL in ppm x molecular weight) / 24.45.
STEL = Short Term Exposure Limit
TWA = time weighted average
OSHA = Occupational Safety and Health Agency
NIOSH = National Institute for Occupational Safety and Health
N.A. = No applicable value available
ND = no detectable exposure levels for proven carcinogenic substances

TABLE 2
COMPONENTS OF PERSONAL PROTECTION LEVELS

Level D Protection	Level C Protection
❒ Safety glasses with side shields (or goggles) ❒ Hard Hat ❒ Face Shield (optional) ❒ Ordinary coveralls ❒ Ordinary work gloves ❒ Steel-toe, steel-shank works shoes or boots (chemical resistant) ❒ Ordinary work gloves	❒ Hard Hat ❒ Ploy-coated disposable (or standard disposable) overalls ❒ Inner gloves of tight-fitting latex or vinyl ❒ Outer gloves of neoprene or nitrile ❒ Steel-toe, steel-shank work shoes or boots (chemical resistant) ❒ Outer boots of neoprene or butyl rubber ❒ Disposable outer "booties" (optional work shoes or boots) ❒ Full-face air-purifying respirator (to be worn)** ❒ Taping of gloves and boots to disposable coveralls

* Respirator to be fitted with NIOSH/MSHA - approved high-efficiency filter (HEPA) combination respirator cartridges approved for organic vapors, particulates, gases, and fumes.
** Half-face respirator, face shield, and safety glasses with side shields (or goggles) may be substituted with approval of the Site HSO.

TABLE 3
ANTICIPATED LEVELS OF PERSONAL PROTECTION FOR PLANNED ACTIVITIES

Task	PPE Level	Site-Specific Requirements	Respirator
Mobilization/Demobilization			
Reconnaissance	D	Safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D - None
Mobilization/Demobilization of Equipment and Supplies	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D – None
Establishment of Site Security, Work Zones, and Staging Area	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D - None
Groundwater/Soil Sampling			
Drilling, Groundwater Well Installation, Excavation, Digging Test Pits, Backfilling, Grading Observation, Sampling	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed	Level D initially, Level C-If action levels exceeded

TABLE 4
ACTION LEVELS DURING INTRUSIVE ACTIVITIES

Organic Vapors (PID)	Responses
0 to 1 ppm above Background	Continue drilling, decontamination, characterization, etc. Level D protection Continued monitoring every 15 minutes
1 ppm above Background	Temporarily halt work activity. Work may resume if vapor levels readily decrease to <1 ppm above Background. Continued monitoring every 15 minutes.
>1 to 25 ppm above Background, Sustained Reading	Discontinue drilling, decontamination, characterization, etc. Identify source of vapors, abatement actions. Work can resume when concentrations immediately outside the work area are <1 ppm. Continued monitoring every 15 minutes.
>25 ppm above Background, Sustained Reading	Discontinue intrusive activities

CORE ENVIRONMENTAL CONSULTANTS

ATTACHMENTS

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

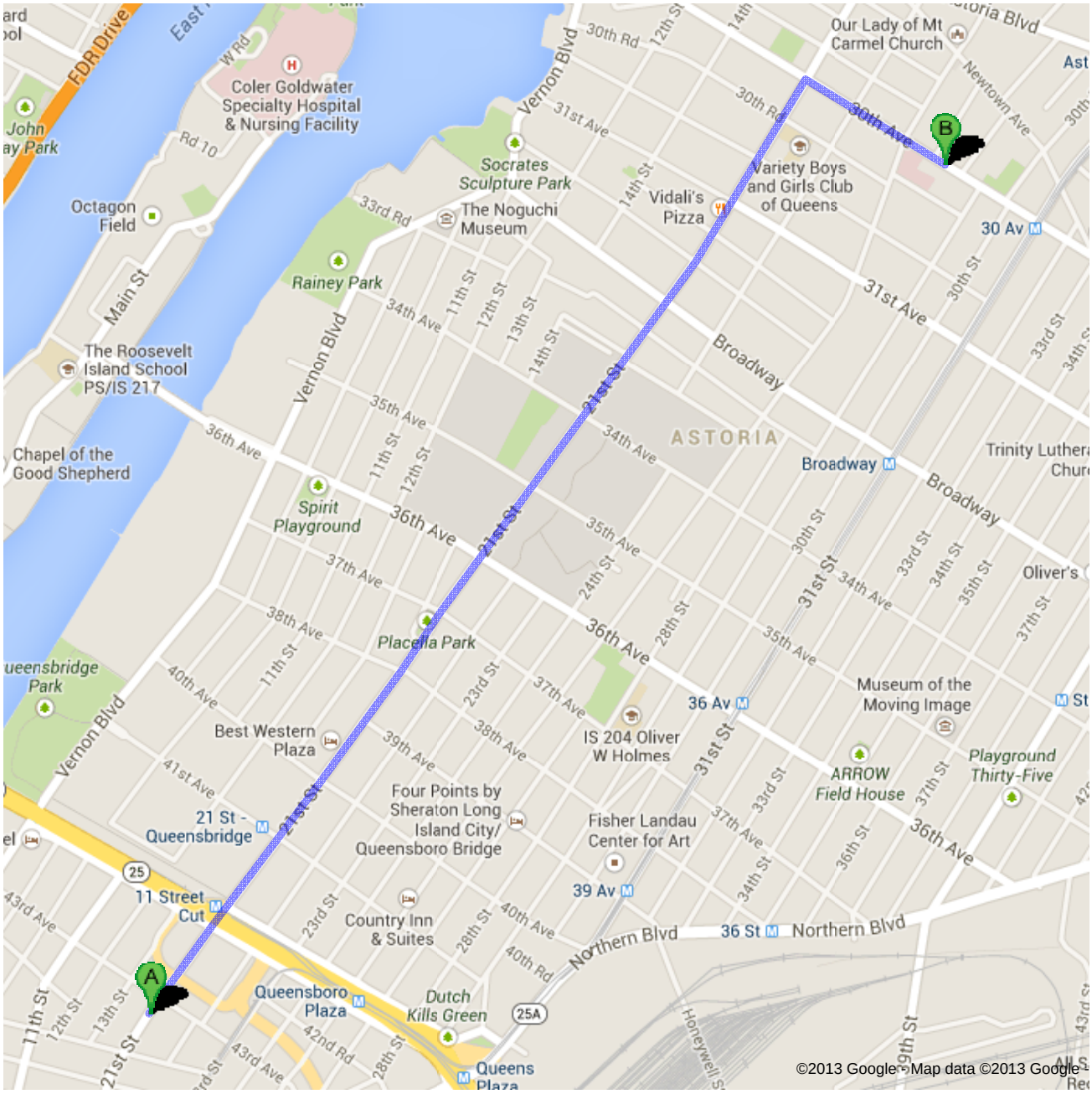
8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

ATTACHMENT B

Hospital Route Map/Directions

Google

Directions to Mount Sinai Hospital Queens
25-10 30th Ave, Long Island City, NY 11102
1.9 mi – about **6 mins**



43-01 21st St, Queens, NY 11101

1.	Head **northeast** on **21st St** toward **43rd Ave** About 5 mins	go 1.7 mi total 1.7 mi
2.	Turn right onto **30th Ave** Destination will be on the right About 59 secs	go 0.2 mi total 1.9 mi

Mount Sinai Hospital Queens
25-10 30th Ave, Long Island City, NY 11102

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

HAZARDOUS WASTE ACTIVITIES
HEALTH and SAFETY CHECKLIST and BRIEFING

Project: _____

Project Manager: _____

On Site Health & Safety Officer: _____

The Project Manager or on Site Health and Safety Officer will signify the completion of the following items by initializing and dating each item.

	Initial	Date
❒ Site health and safety plan prepared and approved by health and safety manager		
All employees who will be on Site		
❒ Have received initial (24 or 40 hr.) training		
❒ Have received annual 8 hr refresher training		
❒ Have reviewed the Site health and safety plan and received pre-job briefing		
❒ Have received respiratory protective equipment training including SCBA if required		
❒ Have received negative pressure respirator fit test		
❒ Have had a medical exam within the past 12 months		
❒ A pre-entry briefing has been conducted by myself on (/ /)		
❒ I deferred the pre-entry briefing responsibility to the HSO		

Each employee conducting field work shall sign this form after the pre-entry briefing is completed and prior to commencing work on Site. A copy of this signed form shall be kept at the Site, and the original sent to the office, for inclusion into the project file.

Site Personnel Sign-off:

❒ I have received a copy of the Site-Specific Health and Safety Plan.

❒ I have read the Plan and will comply with the provisions contained therein.

❒ I have attended a pre-entry briefing outlining the specific health and safety provisions on this Site.

Name: _____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

REPORT OF ACCIDENT INJURY

Project: _____ Date of Occurrence: _____

Location: (be specific) _____

_____

Type of Occurrence: (check all that apply)

- ❒ Fire
- ❒ Vehicle Accident
- ❒ Equipment Failure
- ❒ Disabling Injury
- ❒ Property Damage
- ❒ Chemical Exposure
- ❒ Explosion
- ❒ Other Injury
- ❒ Other (explain) _____

Injuries:

Name of Injured: _____ Company: _____

Name of Injured: _____ Company: _____

Name of Injured: _____ Company: _____

Name of Injured: _____ Company: _____

Name of Injured: _____ Company: _____

Witnesses to Accident/Injury:

Name of Injured: _____ Company: _____

Name of Injured: _____ Company: _____

Name of Injured: _____ Company: _____

Name of Injured: _____ Company: _____

Name of Injured: _____ Company: _____

What was being done at the time of the accident/injury?

_____

_____

_____

Nature of the Accident/Injury:

_____

_____

_____

REPORT OF ACCIDENT INJURY
(continued)

What caused the Accident/Injury? _____

_____

_____

_____

_____

What corrective action will be taken to prevent recurrence? _____

_____

_____

_____

_____

Signatures:

Health and Safety Officer _____ Date: _____

Project Manager _____ Date: _____

Reviewer _____Date: _____

Comments by Reviewer: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

MEDICAL DATA SHEET

This brief Medical Data Sheet will be completed by all personnel working on-Site and will be kept on Site during operations. This data sheet will accompany any personnel when medical assistance is needed or if transport to the hospital facilities is required:

Site: _____

Name:_____ Home Telephone: _____

Address:_____

_____

Age: _____ Height: _____ Weight: _____

Person to Contact in Case of Emergency:

_____Phone No. _____

Alternate Person to Contact in Case of Emergency:

_____Phone No. _____

Drug or other Allergies:

_____

_____

Particular Sensitivities: _____

Do You Wear Contacts? YES NO

Provide a List of Previous Illnesses:

_____

_____

_____

_____

_____

Provide a List of Previous Exposures to Hazardous Chemicals: _____

_____

_____

_____

_____

What Medications are you presently using? _____

_____

Do you have any Medical Restriction? _____

_____

_____

Name, Address, and Phone Number of Personal Physician:

Name: _____ Telephone: _____

Address: _____

ON SITE SAFETY BRIEFING

Each employee conducting field work shall sign this form after the pre-entry briefing is completed and prior to commencing work on Site. A copy of this signed form shall be kept at the Site, and the original sent to the office, for inclusion into the project file.

Site Personnel Sign-off:

❒ I have received a copy of the Site-Specific Health and Safety Plan.

❒ I have read the Plan and will comply with the provisions contained therein.

❒ I have attended a pre-entry briefing outlining the specific health and safety provisions on this Site.

Name: _____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

CORE Environmental, Inc. Project Manager

❒ A pre-entry briefing has been conducted by myself on _____

❒ I deferred the pre-entry briefing responsibility to the Health and Safety Officer.

Name: _____ Date: _____

APPENDIX F

Operation and Maintenance Manual

CORE ENVIRONMENTAL CONSULTANTS

AIR SPARGE/SOIL VAPOR EXTRACTION & SUB-SLAB DEPRESSURIZATION System Operation & Maintenance Manual The Wills Building 43-01 21st Street Long Island City, New York 11101

Prepared for:

Rockrose Development Corporation
15 East 26th Street, 7th Floor
New York, NY 10010

Prepared by:

2312 Wehrle Drive
Buffalo, NY 14221

August 1, 2015

TABLE OF CONTENTS

10.0 WARRANTY

- Limitation of Warranty & Limitation of Remedy

Recommended Maintenance Schedule

System Component	Activity	Materials	Operation
Roots URAI 615 Blower	Lubrication	Roots ™ Synthetic Oil P/N 813-106-	4000 – 8000 hrs
WEG 284T Motor	Lubrication	ESSO Polyrex EM (Polyurea base)	20,000 hrs
Solberg Inlet Filter (CT-275p-600c)	Replacement	Solberg 275P	10-15" WC over ΔP_i
Beckers KDT 3.140 Rotor Shaft	Lubrication	Amblygon TA 15/2	9-12 months
Beckers KDT 3.140 Motor Coupling	Lubrication	Amblygon TA 15/2	3000-4000 hours
Beckers KDT 3.140 Filter Cartridge	Inspect/Replacement	909514 00000	50 hours
Fantech AEV1000 Filter Cartridge	Inspect/Cleaning	017068	3 months

SECTION - 1

Air Sparge System

KDT 3.140

Rotary vane compressors
- oil-free and air-cooled
- incl. integrated suction filter and pressure regulating valve

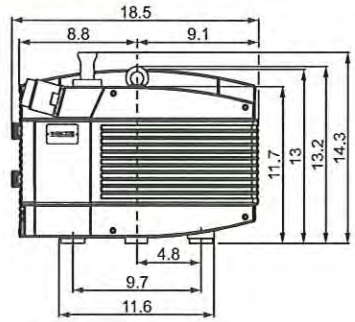
Drehschieber-Verdichter
- trockenlaufend und luftgekühlt
- inkl. integriertem Ansaugfilter und Druckregulierventil

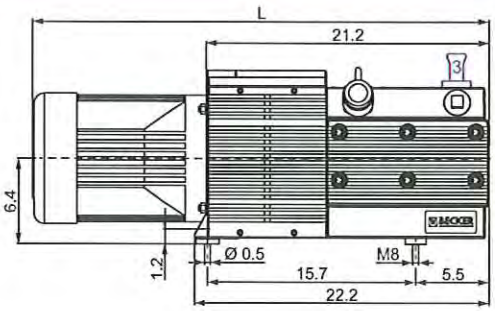
Compresseur à palettes
- fonctionnant à sec et refroidies par air
- incl. filtre d'aspiration intégré et soupape de regulage pression

Compressori a palette
- funzionanti a secco e raffreddate ad aria
- incl. filtro di aspirazione integrato e valvola regolazione pressione

Compresores de paletas
- sin aceite y refrigerado por aire
- incl. filtro de aspiración integrado y válvula reguladora de presión

fig.: KDT 3.80

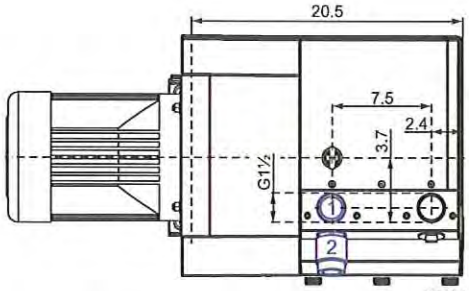




1 Pressure connection
Druckanschluss
Raccord pression
Raccordo pressione
Conexión de presión

2 Pressure regulating valve
Druckregulierventil
Soupape de regulage pression
Valvola regolazione pressione
Válvula reguladora de presión

3 Air nozzle
Ansaugdüse
Buse d'aspiration
Ugello di aspirazione
Boquilla de aire



[inch]

CFM		PSIG		hp 3~		Ⓜ	lbs	db(A) [1]	
50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz			50 Hz	60 Hz
76	90	7.25	7.25	7.4	8.9	1	172 + Ⓜ	80	82
		14.5	14.5	10.1	12.1	2	172 + Ⓜ	82	84
		21.75	21.75	10.1	12.1	2	172 + Ⓜ	82	84

Ⓜ	hp		V ±10%			rpm		A			lbs	no.	L	no.
	50 Hz	60 Hz	50 Hz	60 Hz		50 Hz	60 Hz	50 Hz	60 Hz			IP55 • ISO F • bimetal	inch	KDT + Ⓜ
1	7.4	8.9	Δ 230 / Y 400 IE2	Δ 265 / Y 460 IE2	Δ 230 / Y 400	1435	1720	20.6/11.9	20.2/11.6	23.4/13.5	95	42879422300003RE	36	G017032
	7.4	8.9	Δ 400 / Y - IE2	Δ 460 / Y - IE2	Δ 400 / Y -	1435	1720	13.2	12.7	14.3	95	42879490300003RE	36	G017266
	-	8.9	-	YY 230 / Y 460 IE2 + UL/CSA	usable @ 208	-	1755	-	22.8/11.4	24.4	120.5	42979407300114TA	36.1	G017267
	7.4	8.9	Δ 200 / Y 350	Δ 220 / Y 380-400 IE2	Δ 200 / Y 350	1420	1720	31.8/18.4	27.8/16.1-15.3	30.6/17.7	95	42879453000003RE	36	G017268
	-	8.9	-	Δ 400 / Y 690 IE2		-	1720	-	13.1/7.6		95	42979454300003RE	36	G018358
2	10.1	12.1	Δ 230 / Y 400 IE3	Δ 265 / Y 460 IE3	Δ 230 / Y 400	1445	1735	28/16.2	26.8/15.5	30.9/17.9	121.5	43089422300003RE	37.5	G017029 (14.5PSIG) G017039 (21.75PSIG)
	10.1	12.1	Δ 400 / Y - IE3	Δ 460 / Y - IE3	Δ 400 / Y -	1445	1735	16	15.8	18	121.5	43089490300003RE	37.5	G017257 (14.5PSIG) G017287 (21.75PSIG)
	-	12.1	-	YY 230 / Y 460 IE3 + UL/CSA	usable @ 208	-	1750	-	29.8/14.9	31.9	157	43189407300114TA	37.1	G017258 (14.5PSIG) G017288 (21.75PSIG)
	10.1	12.1	Δ 200 / Y 350	Δ 220 / Y 380-400 IE3	Δ 200 / Y 350	1450	1760	33.8/18.3	31.5/18.2-17.3	33.9/19.5	121.5	43089453000003RE	37.5	G017259 (14.5PSIG) G017289 (21.75PSIG)
	-	12.1	-	Δ 400 / Y 690 IE3		-	1760	-	19.2/11.1		121.5	43189454300003RE	37.5	G018458 (14.5PSIG) G018459 (21.75PSIG)

1) DIN EN ISO 3744 (KpA = 3 dB(A)) interval of 39.4inch, at medium load, both connection sides piped
DIN EN ISO 3744 (KpA = 3 dB(A)) Abstand von 39.4inch, bei mittlerer Belastung, beide Seiten abgeleitet
DIN EN ISO 3744 (KpA = 3 dB(A)) intervalle de 39.4inch, à règime moyen, avec dérivation des deux côtés
DIN EN ISO 3744 (KpA = 3 dB(A)) intervallo di 39.4inch, a medio regime, entrambi i lati derivati
DIN EN ISO 3744 (KpA = 3 dB(A)) intervalo de 39.4inch, en media carga, derivados de ambos lados

- Dimensions in inch
Maßangaben in inch
Mesures en inch
Misure in inch
Dimensiones en inch

BECKER

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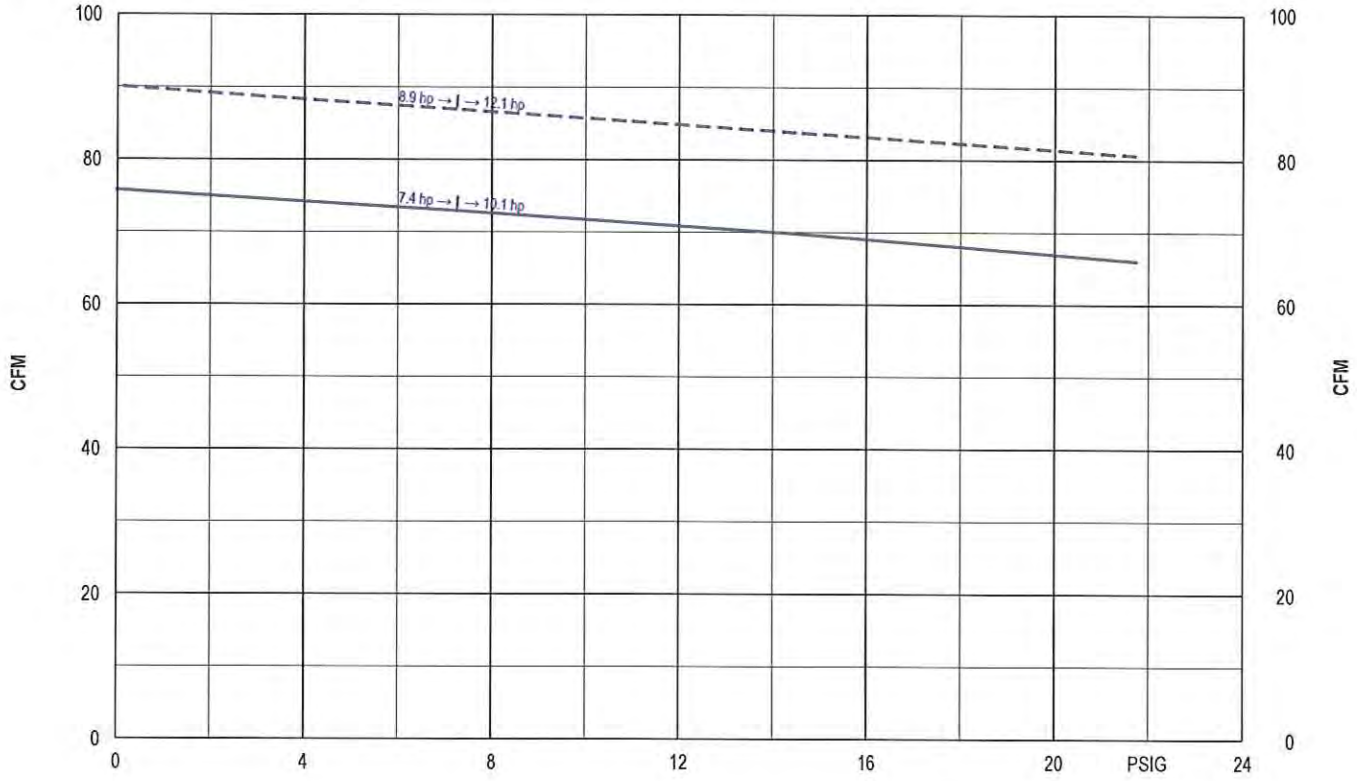
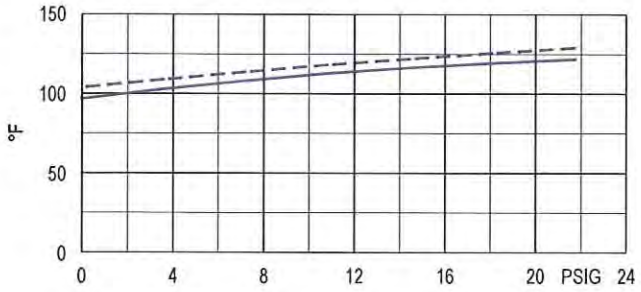
02.07.2014

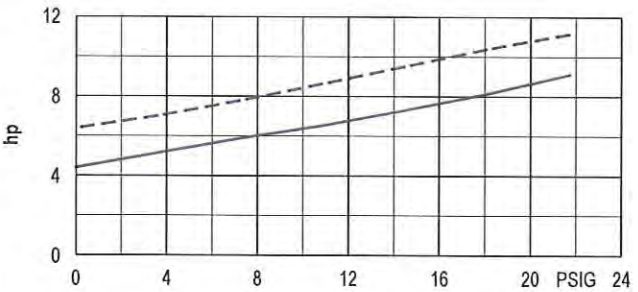
Blast air rate • Blasluftmenge • Débit d'air soufflé • Volume d'aria soffiata • Volumen de aire soplado



Exhaust air temperature • Ablufttemperatur • Température d'air à l'échappemant
Temperatura dell'aria scarica • Temperatura del aire de escape



Motor shaft power • Wellenleistung • Puissance du moteur axe
Potenza del motore albero • Capacidad de eje del motor



—— 50 Hz
- - - 60 Hz

• Reference data (atmosphere)	Bezugsdaten (Atmosphäre)	Référence (atmosphère)	Rifermento (atmosfera)	Referencia (atmosférica)	0 PSIG, 68°F
• Tolerance	Toleranz	Tolérance	Tolleranza	Tolerancia	±5 %

i	Variants	Varianten	Variantes	Varianti	Variantes
KDT 3.140/6	With increased corrosion protection	Mit erhöhtem Korrosionsschutz	Avec protection accrue contre la corrosion	Con una maggiore protezione anti-corrosione	Con el aumento de protección contra la corrosión
KDT 3.140 (SH 13)	In sound proof box SH 13	In Schallhaube SH 13	Dans caisse d'insonorisation SH 13	In casse insonorizzanti SH 13	En caja a prueba de sonido SH 13
KDT 3.140/0-400	VARIAIR Unit with frequency inverter	VARIAIR Unit mit Frequezumrichter	VARIAIR Unit avec convertisseur de frequence	VARIAIR Unit con convertitore di frequenca	VARIAIR Unit con variador de frecuencia
KDX 3.140	For x-tra operating hours	Für x-tra Betriebsstunden	Pour le heures de travail x-tra	Per x-tra ore operative	Para las horas de funcionamiento x-tra
	Performance data / dimensions can differ Combinations on request	Leistungsdaten / Abmessungen können abweichen Kombinationen auf Anfrage	Données de performance / mesures peuvent différer Combinaisons sur demande	Dati di performance / misure possono differire Combinazioni su richiesta	Datos de rendimiento / dimensiones pueden diferir Combinaciones a petición

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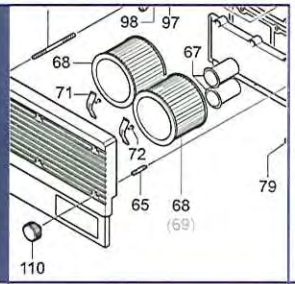
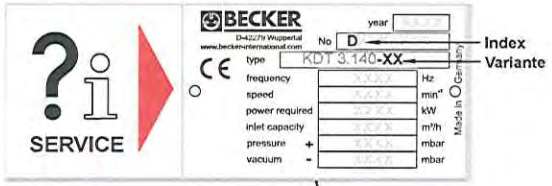
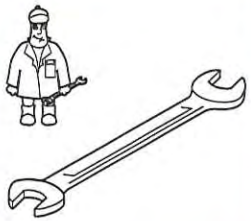
02.07.2014

KDT 3.140





Ersatzteilliste	Reservedelsliste	Lista pieselor de schimb
Spare parts list	Reservdelslista	Páirteanna spártha liosta
Liste de pièces de rechange	Varaosaluettelo	Κατάλογος ανταλλακτικών
Listino pezzi di ricambio	Reservedelsliste	Yedek parça listesi
Lista de piezas de recambio	Wykaz części zamiennych	Списък на резервните части
Lista de peças sobresselentes	Tartalékalkatrész lista	Перечень запасных частей
Reserveonderdelenlijst	Seznam náhradnich dílů	スペアパーツリスト
Atsarginių dalių sąrašas	Seznam nadomestnih delov	예비 부품 목록
Varuosad nimekirja	Zoznam náhradných dielov	备用零件目录
Rezerves daļu saraksts	Rezervni dijelovi popis	



Pos.	Menge [2] Quantity Quantité Quantità Cantidad	Bestell-Nr. Ident No. No. Identification No. Identificazione No. de pedido	Bezeichnung Description Designation Designazione Descripcion
¤	1	549000 21300	Dichtungssatz, Complete set of seals, Jeu de joints, Kit di guarnizioni, Junta Completa
11	SATZ/KIT	901334 00004	Schieber, Rotor Vane, Palette, Empujador
11		901381 00004	" (KDT 3.140/**0-52** + KDT 3.140/**6**)
11		901381 00007	" (KDT 3.140/**6-29** + KDT 3.140/**6-71**)
11		901385 00007	" (KDT 3.140/**6-71HD**)
68	2	909507 00000	Filterpatrone, Filter cartridge, Cartouche Filtrante, Cartuccia filtro, Cartucho de filtro
68	1	909507 00000	" KDT 3.140/**6**
69	1	909587 00000	" KDT 3.140/**6 - Polyester**
91	1	909514 00000	Filterpatrone, Filter cartridge, Cartouche Filtrante, Cartuccia filtro, Cartucho de filtro
91	0	-	" KDT 3.140/**6**

[2] erforderliche Bestellmenge / necessary order quantity / quantité nécessaire / quantità di ordinazione necessari / cantidad necesario

Wartung
Maintenance
Entretien
Manutenzione
Mantenimiento

28000021301 02/2015

KDT 3.140 | **Standard**

Variante

1-7 | 8-10

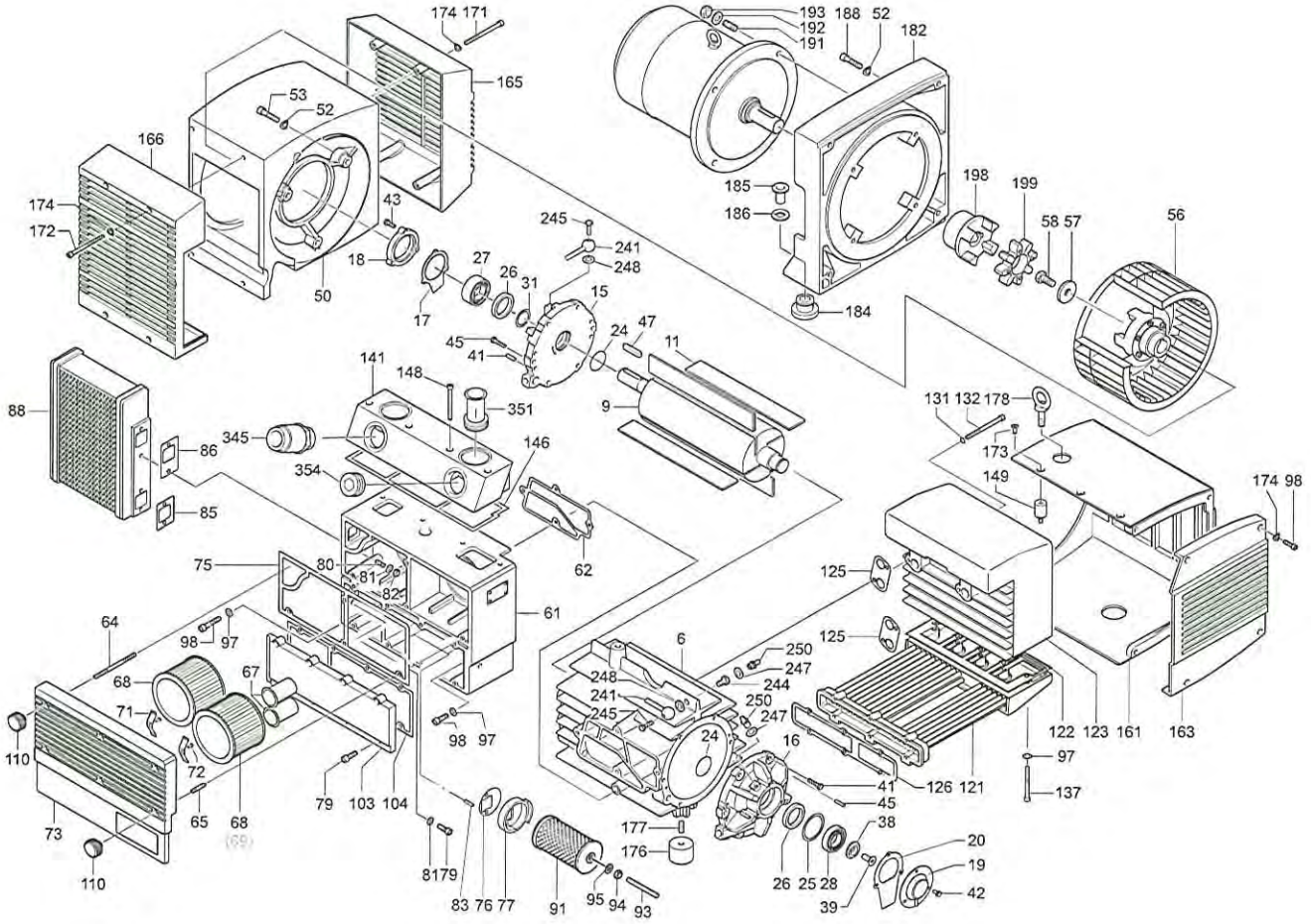
KDT 3.140/XX

①
US-motor

②
B5-250

③-⑦
/6, /0-52, /6-29,
/6-71, /6-71HD
- Korrosionsschutz
- corrosion protection
- protection contre la corrosion
- protezione anti-corrosione
- protección contra la corrosión

⑧
/0-54
- Kühlung
- refrigeration
- réfrigération
- refrigerazione
- refrigeración



D INDEX	Pos.	Bestell Nr.	Beschreibung
KDT 3.140	¤	549000 21300	**DICHTUNGSSATZ** [1]
	6	000101 21300	GEHÄUSE
	9	020004 21300	KOLBEN
	11	901334 00004	**SCHIEBER** (SATZ) [2]
	15	000801 21300	SEITENDECKEL, LINKS
	16	000701 21300	SEITENDECKEL, RECHTS
	17	025512 21300	DICHTUNG
	18	001101 21300	LAGERDECKEL
	19	001006 21300	LAGERDECKEL
	20	025513 21300	DICHTUNG
	24	911305 00000	DICHTUNGSSCHLAUCH
	25	917159 00000	AUSGLEICHSCHEIBE
	26	906544 00000	WELLENDICHTRING
	27	906621 00000	WÄLZLAGER
	28	906664 00000	WÄLZLAGER
	31	511400 10400	SATZ DISTANZSCHEIBEN
	38	016801 21300	SPANNSCHEIBE
	39	949807 00000	SENKSCHRAUBE
	41	945224 00000	SECHSKANTSCHRAUBE
	42	945218 00000	SECHSKANTSCHRAUBE
	43	901804 00000	SECHSKANTSCHRAUBE
	45	948742 00000	PASSKERBSTIFT
	47	947736 00000	PASSFEDER
	50	053201 21305	LATERNE
	52	950308 00000	UNTERLEGSCHEIBE
	53	945331 00000	INNENSECHSKANTSCHRAUBE
	56	544500 21300	KUPPLUNGSHÄLFTE MIT VENTILATOR
	57	949409 00000	UNTERLEGSCHEIBE
	58	945270 00000	WELLENENDSCHRAUBE
	61	040102 21300	FILTERGEHÄUSE
	62	025501 21300	DICHTUNG
	64	951009 00000	STIFTSCHRAUBE
	65	951003 00000	STIFTSCHRAUBE
	67	964407 00000	SCHALLDÄMPFERROHR
	68	909507 00000	**FILTERPATRONE** (2x) [2]
	71	009000 27000	ANPRESSFEDER
	72	948750 00000	BLINDNIET
	73	040204 21300	FILTERDECKEL
	75	025518 21300	DICHTUNG
	76	025516 21100	DICHTUNG
	77	022802 21100	FILTERTRÄGER
	79	945321 00000	INNENSECHSKANTSCHRAUBE
	80	946971 00000	STIFTSCHRAUBE
	81	947504 00000	UNTERLEGSCHEIBE
	82	947104 00000	SECHSKANTMUTTER
	83	952019 00000	SPANNHÜLSE
	85	025514 21100	DICHTUNG
	86	025515 21100	DICHTUNG
	88	560203 21300	KUEHLER
	91	909514 00000	**FILTERPATRONE** (1x) [2]
	93	903800 70000	STIFTSCHRAUBE
	94	947105 00000	SECHSKANTMUTTER
	95	949450 00000	U-SCHEIBE
	97	950304 00000	U-SCHEIBE
	98	945321 00000	INNENSECHSKANTSCHRAUBE
	103	068801 21300	STAUBABSCHEIDERDECKEL
	104	025515 21300	DICHTUNG
	110	921500 50000	HANDGRIFF
	121	560204 21300	KÜHLER

D INDEX	Pos.	Bestell Nr.	Beschreibung
	122	025506 21300	DICHTUNG
	123	066802 21300	DRUCKANSCHLUSSKASTEN
	125	025504 21300	DICHTUNG
	126	025514 21300	DICHTUNG
	131	948021 00000	DICHTRING
	132	945374 00000	INNENSECHSKANTSCHRAUBE
	137	945322 00000	INNENSECHSKANTSCHRAUBE
	141	016604 21300	ANSCHLUSSLEISTE
	146	025507 21300	DICHTUNG
	148	945364 00000	INNENSECHSKANTSCHRAUBE
	149	741310 30000	GUMMIPUFFER
	161	918300 21300	ABDECKHAUBE
	163	920800 21300	LUFTLEITRING
	165	960700 21300	LÜFTERHAUBE
	166	960701 21300	LÜFTERHAUBE
	171	945371 00000	INNENSECHSKANTSCHRAUBE
	172	945372 00000	INNENSECHSKANTSCHRAUBE
	173	949806 00000	SENKSCHRAUBE
	174	951703 00000	FEDERSCHEIBE
	176	741302 00000	GUMMIPUFFER
	177	945634 00000	GEWINDESTIFT
	178	948802 00000	RINGSCHRAUBE
	182	014903 21305	ZWISCHENFLANSCH
	184	951916 00000	KABELTÜLLE
	185	948772 00000	ROHRNIETE
	186	947508 00000	UNTERLEGSCHEIBE
	188	945335 00000	INNENSECHSKANTSCHRAUBE
	191	951022 00000	STIFTSCHRAUBE
	192	947506 00000	UNTERLEGSCHEIBE
	193	947106 00000	SECHSKANTMUTTER
	198	902100 21900	KUPPLUNGSHÄLFTE (MOT)
	199	902210 00000	KUPPLUNGSSCHEIBE
	241	012200 21300	LEITUNG
	244	912300 00000	ANSCHLUSSSCHRAUBE
	245	009400 19000	KUGELSTÜCKSCHRAUBE
	247	948074 00000	DICHTRING
	248	948021 00000	DICHTRING
	250	949002 00000	SCHMIERNIPPEL
	345	728000 99622	DRUCKREGULIERVENTIL / 0,6 BAR
	345	728001 99622	DRUCKREGULIERVENTIL / 1,0 BAR
	345	728002 99622	DRUCKREGULIERVENTIL / 2,0 BAR
	345	728003 99622	DRUCKREGULIERVENTIL / 0,3 BAR
	351	964313 00000	SCHALLDÄMPFERDÜSE
	354	912805 00000	VERSCHLUSSSTOPFEN
		743303 00000	**SPEZIALFETT** (FETTPRESSE, 50g)

[1] **Dichtungssatz** - 54900021300 - Pos.: 17, 20, 24, 62, 75, 76, 85, 86, 104, 122, 125, 126, 146

[2] erforderliche Bestellmenge / Wartung

D INDEX	Pos.	Ident No.	Description
KDT 3.140	¤	549000 21300	**SET OF SEALS** [1]
	6	000101 21300	PUMP BODY
	9	020004 21300	ROTOR
	11	901334 00004	**CARBON VANES** (KIT) [2]
	15	000801 21300	LID, LEFT
	16	000701 21300	LID, RIGHT
	17	025512 21300	GASKET
	18	001101 21300	BEARING COVER
	19	001006 21300	BEARING COVER
	20	025513 21300	GASKET
	24	911305 00000	SEAL
	25	917159 00000	COMPENSATING DISC
	26	906544 00000	SHAFT-SEALING RING
	27	906621 00000	BALL BEARING
	28	906664 00000	BALL BEARING
	31	511400 10400	SET DISTANCE DISC
	38	016801 21300	CLAMPING DISC
	39	949807 00000	SCREW
	41	945224 00000	HEX-HEAD SCREW
	42	945218 00000	HEX-HEAD SCREW
	43	901804 00000	HEX-HEAD SCREW
	45	948742 00000	STRAIGHT PIN
	47	947736 00000	KEY
	50	053201 21305	CONNECTION FLANGE
	52	950308 00000	WASHER
	53	945331 00000	SOCKET HEAD SCREW
	56	544500 21300	COUPLING WITH FAN
	57	949409 00000	WASHER
	58	945270 00000	SHAFT END BOLD
	61	040102 21300	FILTER HOUSING
	62	025501 21300	GASKET
	64	951009 00000	STUD
	65	951003 00000	STUD
	67	964407 00000	SILENCER TUBE
	68	909507 00000	**FILTER CARTRIDGE** (2x) [2]
	71	009000 27000	LEAF SPRING
	72	948750 00000	BLIND RIVET
	73	040204 21300	FILTER COVER
	75	025518 21300	GASKET
	76	025516 21100	GASKET
	77	022802 21100	FILTER HOLDER
	79	945321 00000	SOCKET HEAD SCREW
	80	946971 00000	STUD
	81	947504 00000	WASHER
	82	947104 00000	HEX.NUT
	83	952019 00000	LOCATING PEG
	85	025514 21100	GASKET
	86	025515 21100	GASKET
	88	560203 21300	COOLER
	91	909514 00000	**FILTER CARTRIDGE** (1x) [2]
	93	903800 70000	STUD
	94	947105 00000	HEX.NUT
	95	949450 00000	WASHER
	97	950304 00000	WASHER
	98	945321 00000	SOCKET HEAD SCREW
	103	068801 21300	DUST SEPARATOR COVER
	104	025515 21300	GASKET
	110	921500 50000	HANDLE
	121	560204 21300	COOLER

D INDEX	Pos.	Ident No.	Description
	122	025506 21300	GASKET
	123	066802 21300	PRESSURE CONNECTION BOX
	125	025504 21300	GASKET
	126	025514 21300	GASKET
	131	948021 00000	SEALING RING
	132	945374 00000	SOCKET HEAD SCREW
	137	945322 00000	SOCKET HEAD SCREW
	141	016604 21300	CONNECTING PIECE
	146	025507 21300	GASKET
	148	945364 00000	SOCKET HEAD SCREW
	149	741310 30000	RUBBER BUFFER
	161	918300 21300	COVERING HOOD
	163	920800 21300	AIR GUIDE COVER RING
	165	960700 21300	VENTILATOR HOOD
	166	960701 21300	VENTILATOR HOOD
	171	945371 00000	SOCKET HEAD SCREW
	172	945372 00000	SOCKET HEAD SCREW
	173	949806 00000	COUNTERSUNK SCREW
	174	951703 00000	SPRING DISC
	176	741302 00000	RUBBER BUFFER
	177	945634 00000	THREADED PIN
	178	948802 00000	RING SCREW
	182	014903 21305	FLANGE
	184	951916 00000	RUBBER BUSHING
	185	948772 00000	PIPE RIVET
	186	947508 00000	WASHER
	188	945335 00000	SOCKET HEAD SCREW
	191	951022 00000	STUD
	192	947506 00000	WASHER
	193	947106 00000	HEX.NUT
	198	902100 21900	COUPLING
	199	902210 00000	COUPLING DISC
	241	012200 21300	OIL-PIPE
	244	912300 00000	CONNECTING SCREW
	245	009400 19000	HOLLOW HOLDING SCREW
	247	948074 00000	SEALING RING
	248	948021 00000	SEALING RING
	250	949002 00000	GREASE NIPPLE
	345	728000 99622	PRESSURE REGULATION VALVE / 8,7 PSI
	345	728001 99622	PRESSURE REGULATION VALVE / 14,5 PSI
	345	728002 99622	PRESSURE REGULATING VALVE / 29 PSI
	345	728003 99622	PRESSURE REGULATING VALVE / 4,35 PSI
	351	964313 00000	NOZZLE
	354	912805 00000	PLUG
		743303 00000	**SPECIAL GREASE** (GREASE PRESS, 50g)

[1] **Set of seals** - 54900021300 - Pos.: 17, 20, 24, 62, 75, 76, 85, 86, 104, 122, 125, 126, 146
[2] necessary order quantity / maintenance

D INDICE	Pos.	No. Identification	Designation
KDT 3.140	¤	549000 21300	**JEU DE JOINTS** [1]
	6	000101 21300	CORP DE POMPE
	9	020004 21300	PISTON
	11	901334 00004	**PALETTE DE CHARBON** (KIT) [2]
	15	000801 21300	COUVERCLE A GAUCHE
	16	000701 21300	COUVERCLE A DROITE
	17	025512 21300	JOINT
	18	001101 21300	COUVERCLE DE ROULEMENTE
	19	001006 21300	COUVERCLE DE ROULEMENTE
	20	025513 21300	JOINT
	24	911305 00000	JOINT
	25	917159 00000	DISQUE DE COMPENSATION
	26	906544 00000	BAGUE D'ETANCHEITE P.L'AXE
	27	906621 00000	ROULEMENT A BILLES
	28	906664 00000	ROULEMENT A BILLES
	31	511400 10400	JEU DISQUE DE TOLERANCE
	38	016801 21300	DISQUE DE SERRAGE
	39	949807 00000	VIS
	41	945224 00000	VIS HEXAGONALE
	42	945218 00000	VIS HEXAGONALE
	43	901804 00000	VIS HEXAGONALE
	45	948742 00000	GOUPILLE CYLINDRIQUE
	47	947736 00000	CLAVETTE
	50	053201 21305	BRIDE DE RACCORDEMENT
	52	950308 00000	RONDELLE
	53	945331 00000	VIS HEXAGONALE INTERNE
	56	544500 21300	ACCOUPLEMENT AVEC VENTILATEUR
	57	949409 00000	RONDELLE
	58	945270 00000	VIS BOUT D'ARBRE
	61	040102 21300	BOITE POUR FILTRE
	62	025501 21300	JOINT
	64	951009 00000	PRISONNIER
	65	951003 00000	PRISONNIER
	67	964407 00000	TUBE SILENCIEUX
	68	909507 00000	**CARTOUCHE FILTRANTE** (2x) [2]
	71	009000 27000	RESSORT-JAME
	72	948750 00000	RIVET AVEUGLIE
	73	040204 21300	COUVERCLE DE FILTRE
	75	025518 21300	JOINT
	76	025516 21100	JOINT
	77	022802 21100	SUPPORT FILTRE
	79	945321 00000	VIS HEXAGONALE INTERNE
	80	946971 00000	PRISONNIER
	81	947504 00000	RONDELLE
	82	947104 00000	ECROU A 6PANS
	83	952019 00000	DOUILLE DE ETRAGE
	85	025514 21100	JOINT
	86	025515 21100	JOINT
	88	560203 21300	REFROIDISSEUR
	91	909514 00000	**CARTOUCHE FILTRANTE** (1x) [2]
	93	903800 70000	PRISONNIER
	94	947105 00000	ECROU A 6 PANS
	95	949450 00000	RONDELLE
	97	950304 00000	RONDELLE
	98	945321 00000	VIS HEXAGONALE INTERNE
	103	068801 21300	COUVERCLE
	104	025515 21300	JOINT
	110	921500 50000	POIGNEE
	121	560204 21300	REFROIDISSEUR

D INDICE	Pos.	No. Identification	Designation
	122	025506 21300	JOINT
	123	066802 21300	BOITIER DE RACCORD DE REFOULEMENT
	125	025504 21300	JOINT
	126	025514 21300	JOINT
	131	948021 00000	JOINT
	132	945374 00000	VIS HEXAGONALE INTERNE
	137	945322 00000	VIS HEXAGONALE INTERNE
	141	016604 21300	PIECE RACCORD
	146	025507 21300	JOINT
	148	945364 00000	VIS HEXAGONALE INTERNE
	149	741310 30000	AMORTISSEUR EN CAOUTCHOUC
	161	918300 21300	CARTER
	163	920800 21300	CAPOT DE CANALISATION DE L'AIR
	165	960700 21300	CARTER DE VENTILATEUR
	166	960701 21300	CARTER DE VENTILATEUR
	171	945371 00000	VIS HEXAGONALE INTERNE
	172	945372 00000	VIS HEXAGONALE INTERNE
	173	949806 00000	VIS À TÊTE NOYÉE
	174	951703 00000	DISQUE DE RESSORT
	176	741302 00000	AMORTISSEUR EN CAOUTCHOUC
	177	945634 00000	GOUPILLE FILETEE
	178	948802 00000	PITON
	182	014903 21305	BRIDE
	184	951916 00000	PROTECTION EN CAOUTCHOUC
	185	948772 00000	RIVET TUBE
	186	947508 00000	RONDELLE
	188	945335 00000	VIS HEXAGONALE INTERNE
	191	951022 00000	PRISONNIER
	192	947506 00000	RONDELLE
	193	947106 00000	ECROU A 6 PANS
	198	902100 21900	ACCOUPLEMENT
	199	902210 00000	DISQUE D'ACCOUPLEMENT
	241	012200 21300	TUYEAU DE GRAISSAGE
	244	912300 00000	VIS DE RACCORD
	245	009400 19000	VIS CREUSE DE FIXATION
	247	948074 00000	JOINT
	248	948021 00000	JOINT
	250	949002 00000	GRAISSEUR
	345	728000 99622	SOUPAPE REGLAGE PRESSION / 0,6 BAR
	345	728001 99622	SOUPAPE REGLAGE PRESSION / 1,0 BAR
	345	728002 99622	SOUPAPE REGLAGE PRESSION / 2,0 BAR
	345	728003 99622	SOUPAPE REGLAGE PRESSION / 0,3 BAR
	351	964313 00000	BUSE
	354	912805 00000	BOUCHON
		743303 00000	**GRAISSE SPÉCIFIQUE** (POMPE À GRAISSE, 50g)

[1] **Jeu de joints** - 54900021300 - Pos.: 17, 20, 24, 62, 75, 76, 85, 86, 104, 122, 125, 126, 146
[2] quantité nécessaire / entretien

D INDICE	Pos.	No. Identificazione	Designazione
KDT 3.140	¤	549000 21300	**SERIE DI GUARNIZIONE** [1]
	6	000101 21300	CARCASSA
	9	020004 21300	ROTORE
	11	901334 00004	**PALETTE DI CHARBONE** (KIT) [2]
	15	000801 21300	COPERCHIO SINISTRA
	16	000701 21300	COPERCHIO DESTRA
	17	025512 21300	GUARNIZIONE
	18	001101 21300	COPERCHIO CUSCINETTO
	19	001006 21300	COPERCHIO CUSCINETTO
	20	025513 21300	GUARNIZIONE
	24	911305 00000	GUARNIZIONE
	25	917159 00000	DISCO COMPENSATORE
	26	906544 00000	GUARNIZIONE PER L'ALBERO
	27	906621 00000	CUSCINETTO A SFERA
	28	906664 00000	CUSCINETTO A SFERA
	31	511400 10400	SERIE DISCO GIUOCO
	38	016801 21300	DISCO DI FISSAGIO
	39	949807 00000	VITE
	41	945224 00000	VITE ESAGONALE
	42	945218 00000	VITE ESAGONALE
	43	901804 00000	VITE ESAGONALE
	45	948742 00000	PERNO
	47	947736 00000	CHIAVETTA
	50	053201 21305	FLANGIA DI RACCORDE
	52	950308 00000	RONDELLA
	53	945331 00000	VITE ESAGONALE INTERNA
	56	544500 21300	GIUNTO CON VENTILATORE
	57	949409 00000	RONDELLA
	58	945270 00000	VITE DI CHIUSURA ALBERO
	61	040102 21300	CONTENITORE FILTRO
	62	025501 21300	GUARNIZIONE
	64	951009 00000	L'ASTA A VITE
	65	951003 00000	L'ASTA A VITE
	67	964407 00000	TUBO SILENZIATORE
	68	909507 00000	**CARTUCCIA FILTRO** (2x) [2]
	71	009000 27000	MOLLA
	72	948750 00000	RIVETTO CIECO
	73	040204 21300	COPERCHIO FILTRO
	75	025518 21300	GUARNIZIONE
	76	025516 21100	GUARNIZIONE
	77	022802 21100	SUPPORTO FILTRO
	79	945321 00000	VITE ESAGONALE INTERNA
	80	946971 00000	L'ASTA A VITE
	81	947504 00000	RONDELLA
	82	947104 00000	DADO ESAGONALE
	83	952019 00000	SPINE DI RISCONTRO
	85	025514 21100	GUARNIZIONE
	86	025515 21100	GUARNIZIONE
	88	560203 21300	RAFFREDDATORE
	91	909514 00000	**CARTUCCIA FILTRO** (1x) [2]
	93	903800 70000	L'ASTA A VITE
	94	947105 00000	DADO ESAGONALE
	95	949450 00000	RONDELLA
	97	950304 00000	RONDELLA
	98	945321 00000	VITE ESAGONALE INTERNA
	103	068801 21300	COPERCHIO
	104	025515 21300	GUARNIZIONI
	110	921500 50000	MANETTA
	121	560204 21300	RAFFREDDATORE

D INDICE	Pos.	No. Identificazione	Designazione
	122	025506 21300	GUARNIZIONE
	123	066802 21300	SCATOLA DI RACCORDO DI MANDATA
	125	025504 21300	GUARNIZIONE
	126	025514 21300	GUARNIZIONI
	131	948021 00000	ANELLO GUARNIZIONE
	132	945374 00000	VITE ESAGONALE INTERNA
	137	945322 00000	VITE ESAGONALE INTERNA
	141	016604 21300	PEZZI RACCORDI
	146	025507 21300	GUARNIZIONE
	148	945364 00000	VITE ESAGONALE INTERNA
	149	741310 30000	AMMORTIZZATORE IN GOMMA
	161	918300 21300	CARTER
	163	920800 21300	CAPPOTTA DEL CONDOTTA ARIA
	165	960700 21300	CARTER VENTILATORE
	166	960701 21300	CARTER VENTILATORE
	171	945371 00000	VITE ESAGONALE INTERNA
	172	945372 00000	VITE ESAGONALE INTERNA
	173	949806 00000	VITE A TESTA SVASATA
	174	951703 00000	DISCO A MOLLA
	176	741302 00000	AMMORTIZZATORE IN GOMMA
	177	945634 00000	SPINA FILETTATURA
	178	948802 00000	GANCIO
	182	014903 21305	FLANGIA
	184	951916 00000	PROTEZIONE IN GOMMA
	185	948772 00000	CHIODO TUBOLARE
	186	947508 00000	RONDELLA
	188	945335 00000	VITE ESAGONALE INTERNA
	191	951022 00000	L'ASTA A VITE
	192	947506 00000	RONDELLA
	193	947106 00000	DADO ESAGONALE
	198	902100 21900	GIUNTO
	199	902210 00000	DISCO GUINTO
	241	012200 21300	CONDOTTO
	244	912300 00000	ATTACO FILETTATO
	245	009400 19000	VITE PASSAGGIO OLIO
	247	948074 00000	ANELLO GUARNIZIONE
	248	948021 00000	ANELLO GUARNIZIONE
	250	949002 00000	RACCORDO DI LUBRIFICAZIONE
	345	728000 99622	VALVOLA REGULAZIONE PRESSIONE / 0,6 BAR
	345	728001 99622	VALVOLA REGULAZIONE PRESSIONE / 1,0 BAR
	345	728002 99622	VALVOLA REGULAZIONE PRESSIONE / 2,0 BAR
	345	728003 99622	VALVOLA REGULAZIONE PRESSIONE / 0,3 BAR
	351	964313 00000	UGGELLO
	354	912805 00000	TAPPO DI CHIUSURA
		743303 00000	**GRASSO SPECIALE** (INGRASSATORE A PISTOLA, 50g)

[1] **Serie di guarnizione** - 54900021300 - Pos.: 17, 20, 24, 62, 75, 76, 85, 86, 104, 122, 125, 126, 146

[2] quantità di ordinazione necessari / manutenzione

D ÍNDICE	Pos.	No. De pedido	Descripción
KDT 3.140	¤	549000 21300	**JUNTA COMPLETA** [1]
	6	000101 21300	CARCASA
	9	020004 21300	ÉMBOLO, ACABADO
	11	901334 00004	**EMPUJADOR** (KIT) [2]
	15	000801 21300	TAPA LATERAL
	16	000701 21300	TAPA LATERAL DERECHA
	17	025512 21300	JUNTA
	18	001101 21300	TAPA DE COJINETE
	19	001006 21300	TAPA DE COJINETE
	20	025513 21300	JUNTA
	24	911305 00000	MANGUERA DE JUNTA
	25	917159 00000	ARANDELA DE COMPENSACIÓN
	26	906544 00000	ANILLO DE JUNTA DE ÁRBOL
	27	906621 00000	COJINETE DE RODAMIENTO
	28	906664 00000	COJINETE DE RODAMIENTO
	31	511400 10400	JUEGO DE ARANDELAS DISTANCIADORAS
	38	016801 21300	ARANDELA TENSORA
	39	949807 00000	TORNILLO AVELLANADO
	41	945224 00000	TORNILLO DE CABEZA HEXAGONAL
	42	945218 00000	TORNILLO DE CABEZA HEXAGONAL
	43	901804 00000	TORNILLO DE CABEZA HEXAGONAL
	45	948742 00000	PASADOR ENTALLADO DE AJUSTE
	47	947736 00000	LENGÜETA DE AJUSTE
	50	053201 21305	FAROL
	52	950308 00000	ARANDELA
	53	945331 00000	TORNILLO HEXAGONAL INTERIOR
	56	544500 21300	MITAD DE ACOPLAMIENTO CON VENTILADOR
	57	949409 00000	ARANDELA
	58	945270 00000	TORNILLO TERMINAL DE ÁRBOL
	61	040102 21300	CARCASA DE FILTRO
	62	025501 21300	JUNTA
	64	951009 00000	ESPÁRRAGO
	65	951003 00000	ESPÁRRAGO
	67	964407 00000	TUBO DE SILENCIADOR
	68	909507 00000	**CARTUCHO DE FILTRO** (2x) [2]
	71	009000 27000	MUELLE DE PRESIÓN
	72	948750 00000	REMACHE CIEGO
	73	040204 21300	TAPA DE FILTRO
	75	025518 21300	JUNTA
	76	025516 21100	JUNTA
	77	022802 21100	SOPORTE DE FILTRO
	79	945321 00000	TORNILLO HEXAGONAL INTERIOR
	80	946971 00000	ESPÁRRAGO
	81	947504 00000	ARANDELA
	82	947104 00000	TUERCA HEXAGONAL
	83	952019 00000	CASQUILLO TENSOR
	85	025514 21100	JUNTA
	86	025515 21100	JUNTA
	88	560203 21300	REFRIGERADOR
	91	909514 00000	**CARTUCHO DE FILTRO** (1x) [2]
	93	903800 70000	ESPÁRRAGO
	94	947105 00000	TUERCA HEXAGONAL
	95	949450 00000	ARANDELA
	97	950304 00000	ARANDELA
	98	945321 00000	TORNILLO HEXAGONAL INTERIOR
	103	068801 21300	TAPA DE SEPARADOR DE POLVO
	104	025515 21300	JUNTA
	110	921500 50000	EMPUÑADURA
	121	560204 21300	REFRIGERADOR

D ÍNDICE	Pos.	No. De pedido	Descripción
	122	025506 21300	JUNTA
	123	066802 21300	CAJA DE EMPALME DE PRESIÓN
	125	025504 21300	JUNTA
	126	025514 21300	JUNTA
	131	948021 00000	ANILLO DE JUNTA
	132	945374 00000	TORNILLO HEXAGONAL INTERIOR
	137	945322 00000	TORNILLO HEXAGONAL INTERIOR
	141	016604 21300	PIEZA DE EMPALME
	146	025507 21300	JUNTA
	148	945364 00000	TORNILLO HEXAGONAL INTERIOR
	149	741310 30000	AMORTIGUADOR DE GOMA
	161	918300 21300	CAPERUZA DE RECUBRIMIENTO
	163	920800 21300	CAPERUZA CONDUCTOR DE AIRE
	165	960700 21300	CAPERUZA DE VENTILADOR
	166	960701 21300	CAPERUZA DE VENTILADOR
	171	945371 00000	TORNILLO HEXAGONAL INTERIOR
	172	945372 00000	TORNILLO HEXAGONAL INTERIOR
	173	949806 00000	TORNILLO AVELLANADO
	174	951703 00000	ARANDELA ELÁSTICA
	176	741302 00000	AMORTIGUADOR DE GOMA
	177	945634 00000	VARILLA ROSCADA
	178	948802 00000	TORNILLO DE CÁNCAMO
	182	014903 21305	BRIDA INTERMEDIA
	184	951916 00000	BOQUILLA DE CABLE
	185	948772 00000	REMACHE TUBULAR
	186	947508 00000	ARANDELA
	188	945335 00000	TORNILLO HEXAGONAL INTERIOR
	191	951022 00000	ESPÁRRAGO
	192	947506 00000	ARANDELA
	193	947106 00000	TUERCA HEXAGONAL
	198	902100 21900	MITAD DE ACOPLAMIENTO (MOT)
	199	902210 00000	DISCO DE ACOPLAMIENTO
	241	012200 21300	CONDUCTO
	244	912300 00000	TORNILLO DE EMPALME
	245	009400 19000	TORNILLO DE PIEZA ESFÉRICA
	247	948074 00000	ANILLO DE JUNTA
	248	948021 00000	ANILLO DE JUNTA
	250	949002 00000	BOQUILLA DE TOLVA DE LUBRICACIÓN
	345	728000 99622	VÁLVULA REGULADORA DE PRESIÓN / 0,6 BAR
	345	728001 99622	VÁLVULA REGULADORA DE PRESIÓN / 1,0 BAR
	345	728002 99622	VÁLVULA REGULADORA DE PRESIÓN / 2,0 BAR
	345	728003 99622	VÁLVULA REGULADORA DE PRESIÓN / 0,3 BAR
	351	964313 00000	TOBERA DE SILENCIADOR
	354	912805 00000	TAPÓN DE DESGASTE
		743303 00000	**GRASA ESPECIAL** (PISTOLA DE GRASA, 50g)

[1] **Junta completa** - 54900021300 - Pos.: 17, 20, 24, 62, 75, 76, 85, 86, 104, 122, 125, 126, 146
[2] cantidad necesario / mantenimiento

KDT 3.140 Variante ↓		Pos. [2]	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⊕⇨	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⇨⊖	Beschreibung / Description / Designation / Designazione / Desripcion
① US-motor		191	951018 00000	~~951022 00000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		198		~~902100 21900~~	MOTORKUPPLUNG / COUPLING / ACCOUPLEMENT / GIUNTO / ACOPLAMIENTO
		234	037900 10400		ZWISCHENFLANSCH / INTERMEDIATE FLANGE / BRIDE INTERMEDIAIRE / FLANGE INTERMEDIA / BRIDA INTERMEDIA
		236	902100 21300		MOTORKUPPLUNG / COUPLING / ACCOUPLEMENT / GIUNTO / ACOPLAMIENTO
② B5-250		182	014902 21305	~~014903 21305~~	ZWISCHENFLANSCH / INTERMEDIATE FLANGE / BRIDE INTERMEDIAIRE / FLANGE INTERMEDIA / BRIDA INTERMEDIA
		191	951018 00000	~~951022 00000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		198	902109 00000	~~902100 00000~~	MOTORKUPPLUNG / COUPLING / ACCOUPLEMENT / GIUNTO / ACOPLAMIENTO
③ /0-52 - Korrosionsschutz - corrosion protection - protection contre la corrosion - protezione anti-corrosione - protección contra la corrosión		9	020005 21300	~~020004 21300~~	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
		11	901381 00004	~~901334 00004~~	**SATZ (KIT)** SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR
		345		~~72800X 99622~~	DRUCKREGULIERVENTIL / PRESSURE REGULATING VALVE / SOUPAPE REGLAGE PRESSION / VALVOLA REGULAZIONE PRESSIONE / VÁLVULA REGULADORA DE PRESIÓN
		403	734000 02000		DRUCKREGULIERVENTIL 2,2 BAR / PRESSURE REGULATING VALVE 32 PSI / SOUPAPE REGLAGE PRESSION 2,2 BAR / VALVOLA REGULAZIONE PRESSIONE 2,2 BAR / VÁLVULA REGULADORA DE PRESIÓN 2,2 BAR
⑧ /0-54 - Kühlung - refrigeration - réfrigération - refrigerazione - refrigeración		88		~~560203 21300~~	KÜHLER / COOLER / REFROIDISSEUR / RAFFREDDATORE / REFRIGERADOR
		230	019901 21100		UMLENKSTÜCK / RETURN PIECE / PIECE DE RETOUR / PEZZO INVERSIONE / PIEZA DE DESVIACIÓN

[2] variantenabhängige Bauteile / variant-dependent components / composants variante-dependantes / componenti variante-dispendenti / componentes variante-dependientes

Variante ⊕⇨

KDT 3.140 Variante		Pos. [2]	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⊕⇨	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⇨⊖	Beschreibung / Description / Designation / Designazione / Desripcion
④ /6 - Korrosionsschutz - corrosion protection - protection contre la corrosion - protezione anti-corrosione - protección contra la corrosión		6	000111 21300	~~000101 21300~~	GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA
		9	020011 21300	~~020004 21300~~	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
		11	901381 00004	~~901334 00004~~	**SATZ (KIT)** SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR
		15	000811 21300	~~000801 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		16	000711 21300	~~000701 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		68		~~909507 00000~~	FILTERPATRONE (**1x**) / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		69	909587 00000		FILTERPATRONE (**1x POLYESTER**) / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		76		~~025516 21100~~	DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA
		77		~~022802 21100~~	FILTERTRÄGER / FILTER HOLDER / SUPPORT FILTRE / SUPPORTO FILTRO / SOPORTE DE FILTRO
		83		~~952019 00000~~	SPANNHÜLSE / LOCATING PEG / DOUILLE DE ETRAGE / SPINE DI RISCONTRO / CASQUILLO TENSOR
		91		~~909514 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRANTE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		93	945634 00000	~~903800 70000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		94		~~947105 00000~~	SECHSKANTMUTTER / HEX.NUT / ECROU A 6 PANS / DADO ESAGONALE / TUERCA HEXAGONAL
		95		~~949450 00000~~	U-SCHEIBE / WASHER / RONDELLE / RONDELLA / ARANDELA
Ⓢ /6-29 - Korrosionsschutz - corrosion protection - protection contre la corrosion - protezione anti-corrosione - protección contra la corrosión		6	000111 21300	~~000101 21300~~	GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA
		9	020012 21300	~~020004 21300~~	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
		11	901381 00007	~~901334 00004~~	**SATZ (KIT)** SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR
		15	000811 21300	~~000801 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		16	000711 21300	~~000701 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		68		~~909507 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		69	909587 00000		FILTERPATRONE (**1x POLYESTER**) / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		76		~~025516 21100~~	DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA
		77		~~022802 21100~~	FILTERTRÄGER / FILTER HOLDER / SUPPORT FILTRE / SUPPORTO FILTRO / SOPORTE DE FILTRO
		83		~~952019 00000~~	SPANNHÜLSE / LOCATING PEG / DOUILLE DE ETRAGE / SPINE DI RISCONTRO / CASQUILLO TENSOR
		88		~~560203 21300~~	KÜHLER / COOLER / REFROIDISSEUR / RAFFREDDATORE / REFRIGERADOR
		91		~~909514 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRANTE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		93	945634 00000	~~903800 70000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		94		~~947105 00000~~	SECHSKANTMUTTER / HEX.NUT / ECROU A 6 PANS / DADO ESAGONALE / TUERCA HEXAGONAL
		95		~~949450 00000~~	U-SCHEIBE / WASHER / RONDELLE / RONDELLA / ARANDELA
		163	920801 21300	~~920800 21300~~	LUFTLEITRING / AIR GUIDE COVER RING / CAPOT DE CANALISATION DE L'AIR / CAPPOTTA DEL CONDOTTA ARIA / CAPERUZA CONDUCTOR DE AIRE
		230	019901 21100		UMLENKSTÜCK / RETURN PIECE / PIECE DE RETOUR / PEZZO INVERSIONE / PIEZA DE DESVIACIÓN
		378	903260 00000		DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA

[2] variantenabhängige Bauteile / variant-dependent components / composants variante-dependantes / componenti variante-dispendenti / componentes variante-dependientes

KDT 3.140 Variante		Pos. [2]	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⊕⇨	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⇨⊖	Beschreibung / Description / Designation / Designazione / Desripcion
⑥ /6-71 - Korrosionsschutz - corrosion protection - protection contre la corrosion - protezione anti-corrosione - protección contra la corrosión		6	000111 21300	~~000101 21300~~	GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA
		9	020012 21300	~~020004 21300~~	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
		11	901381 00007	~~901334 00004~~	**SATZ (KIT)** SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR
		15	000811 21300	~~000801 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		16	000711 21300	~~000701 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		68		~~909587 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		69	909587 00000		FILTERPATRONE (**1x POLYESTER**) / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		73	040205 21300	~~040204 21300~~	FILTERDECKEL / FILTER COVER / COUVERCLE DE FILTRE / COPERCHIO FILTRO / TAPA DE FILTRO
		76		~~025516 21100~~	DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA
		77		~~022802 21100~~	FILTERTRÄGER / FILTER HOLDER / SUPPORT FILTRE / SUPPORTO FILTRO / SOPORTE DE FILTRO
		83		~~952019 00000~~	SPANNHÜLSE / LOCATING PEG / DOUILLE DE ETRAGE / SPINE DI RISCONTRO / CASQUILLO TENSOR
		88		~~560203 21300~~	KÜHLER / COOLER / REFROIDISSEUR / RAFFREDDATORE / REFRIGERADOR
		91		~~909514 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRANTE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		93	945634 00000	~~903800 70000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		94		~~947105 00000~~	SECHSKANTMUTTER / HEX.NUT / ECROU A 6 PANS / DADO ESAGONALE / TUERCA HEXAGONAL
		95		~~949450 00000~~	U-SCHEIBE / WASHER / RONDELLE / RONDELLA / ARANDELA
		110	947401 00000	~~921500 50000~~	HUTMUTTER / CAP NUT / ÉCROU BORGNE / DADO CIECO / TUERCA DE CAPERUZA
		163	920801 21300	~~920800 21300~~	LUFTLEITRING / AIR GUIDE COVER RING / CAPOT DE CANALISATION DE L'AIR / CAPPOTTA DEL CONDOTTA ARIA / CAPERUZA CONDUCTOR DE AIRE
		230	019901 21100		UMLENKSTÜCK / RETURN PIECE / PIECE DE RETOUR / PEZZO INVERSIONE / PIEZA DE DESVIACIÓN
		378	903260 00000		DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA

[2] variantenabhängige Bauteile / variant-dependent components / composants variante-dependantes / componenti variante-dispendenti / componentes variante-dependientes

KDT 3.140 Variante		Pos. [2]	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⊕⇨	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⇨⊖	Beschreibung / Description / Designation / Designazione / Desripcion
⑦ /6-71HD - Korrosionsschutz - corrosion protection - protection contre la corrosion - protezione anti-corrosione - protección contra la corrosión		6	000111 21300	~~000101 21300~~	GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA
		9	020012 21300	~~020004 21300~~	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
		11	901385 00007	~~901334 00004~~	**SATZ (KIT)** SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR
		15	000811 21300	~~000801 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		16	000711 21300	~~000701 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		68		~~909587 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		69	909587 00000		FILTERPATRONE (**1x POLYESTER**) / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		73	040205 21300	~~040204 21300~~	FILTERDECKEL / FILTER COVER / COUVERCLE DE FILTRE / COPERCHIO FILTRO / TAPA DE FILTRO
		76		~~025516 21100~~	DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA
		77		~~022802 21100~~	FILTERTRÄGER / FILTER HOLDER / SUPPORT FILTRE / SUPPORTO FILTRO / SOPORTE DE FILTRO
		83		~~952019 00000~~	SPANNHÜLSE / LOCATING PEG / DOUILLE DE ETRAGE / SPINE DI RISCONTRO / CASQUILLO TENSOR
		88		~~560203 21300~~	KÜHLER / COOLER / REFROIDISSEUR / RAFFREDDATORE / REFRIGERADOR
		91		~~909514 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRANTE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		93	945634 00000	~~903800 70000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		94		~~947105 00000~~	SECHSKANTMUTTER / HEX.NUT / ECROU A 6 PANS / DADO ESAGONALE / TUERCA HEXAGONAL
		95		~~949450 00000~~	U-SCHEIBE / WASHER / RONDELLE / RONDELLA / ARANDELA
		110	947401 00000	~~921500 50000~~	HUTMUTTER / CAP NUT / ÉCROU BORGNE / DADO CIECO / TUERCA DE CAPERUZA
		163	920801 21300	~~920800 21300~~	LUFTLEITRING / AIR GUIDE COVER RING / CAPOT DE CANALISATION DE L'AIR / CAPPOTTA DEL CONDOTTA ARIA / CAPERUZA CONDUCTOR DE AIRE
		230	019901 21100		UMLENKSTÜCK / RETURN PIECE / PIECE DE RETOUR / PEZZO INVERSIONE / PIEZA DE DESVIACIÓN
		378	903260 00000		DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA

[2] variantenabhängige Bauteile / variant-dependent components / composants variante-dependantes / componenti variante-dispendenti / componentes variante-dependientes

BECKER

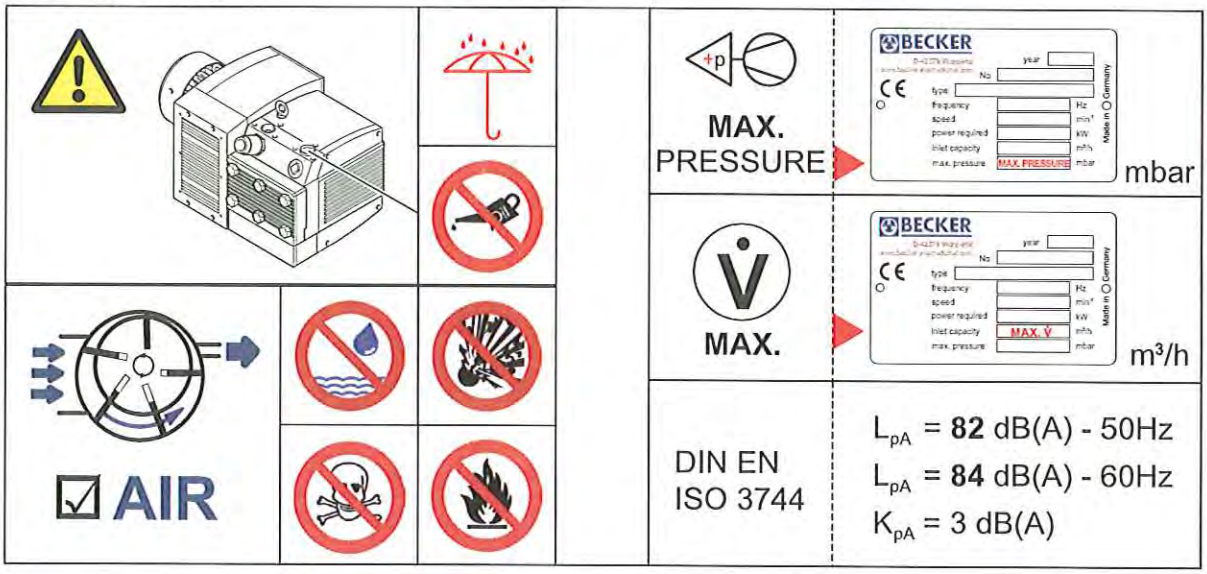
Betriebsanleitung
Operating Instructions
Instructions de service
Istruzioni d'uso
Handleiding
Instrucciones para el manejo
Manual de instruções
Naudojimosi instrukcija
Kasutusjuhend
Lietošanas instrukcija
Driftsinstruks
Driftsinstruktioner
Käyttöohje
Driftsvejledning
Instrukcja obsługi

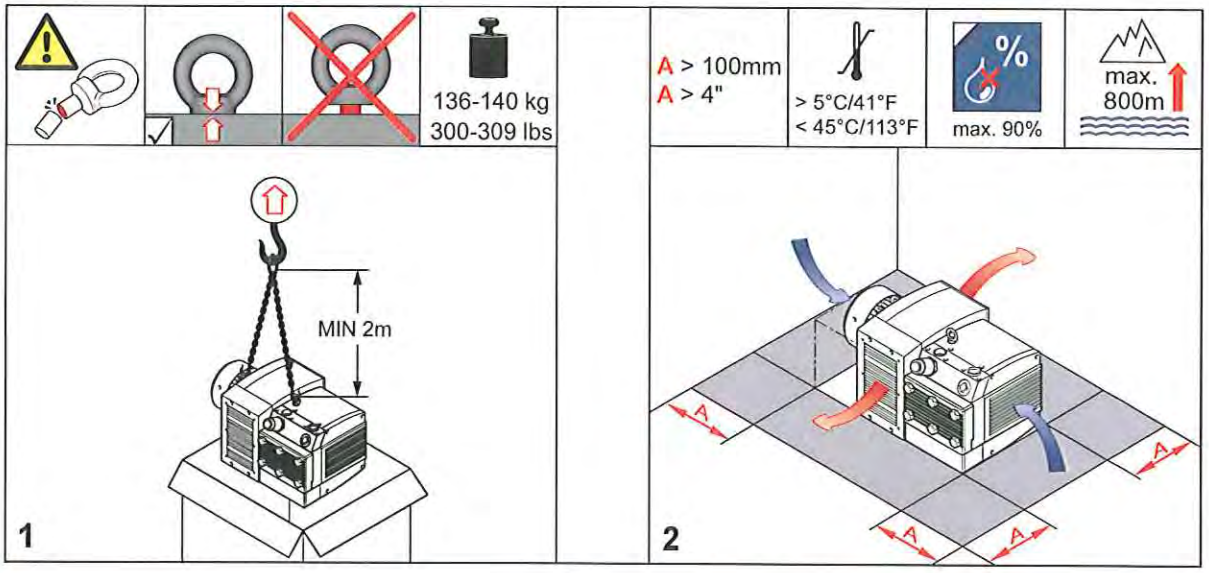
Kezelési útmutató
Návod k obsluze
Navodilo za uporabo
Návod na obsluhu
Upute za rad
Manual de operatii
Treoracha Oibriúcháin
Οδηγίες χρήσης
El Kitabi
Инструкции за експлоатация
Инструкция по эксплуатации
取扱説明書
사용설명서
使用说明书

KDT 3.140

2006/42/EG

DIN EN ISO 14001:2005
DIN EN ISO 9001
001929 QM





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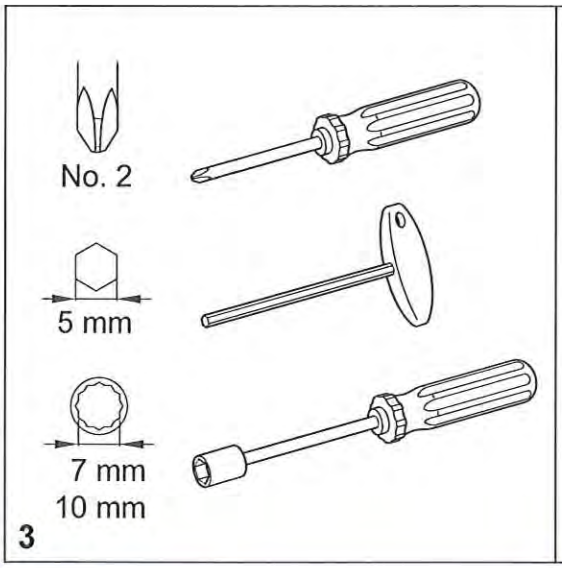
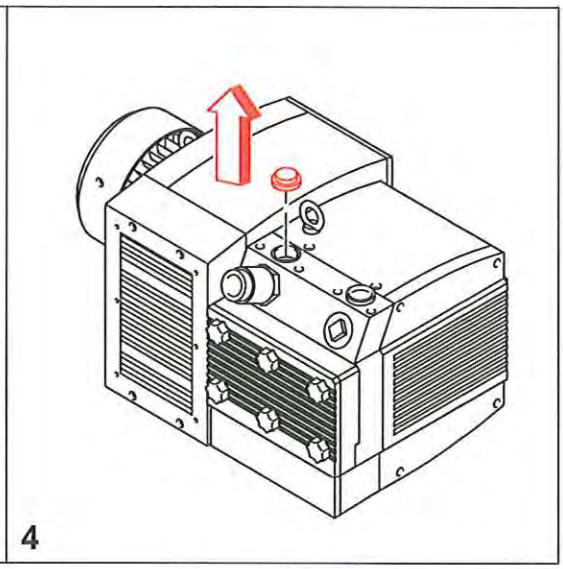

No. 2
5 mm
7 mm
10 mm
3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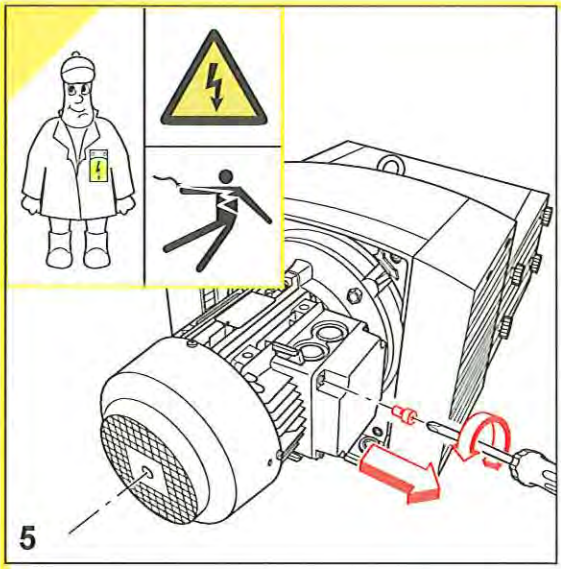
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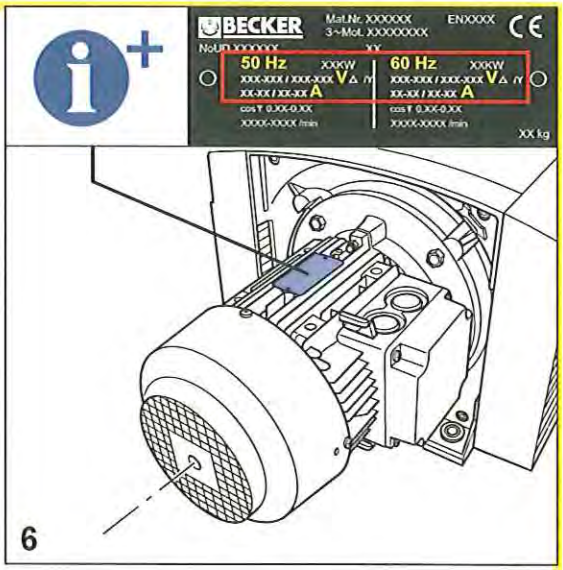
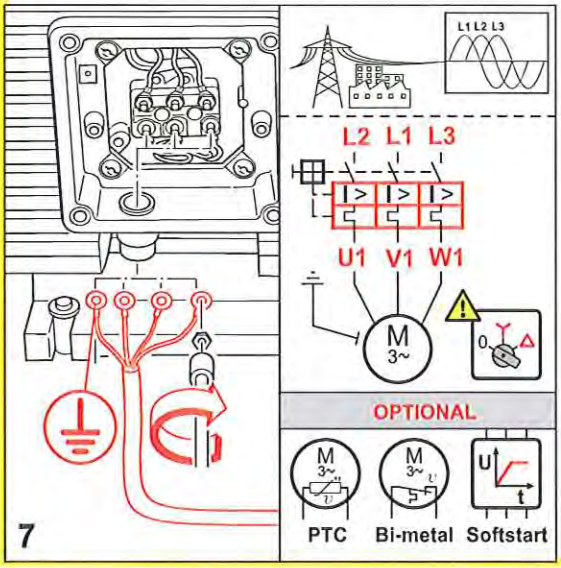
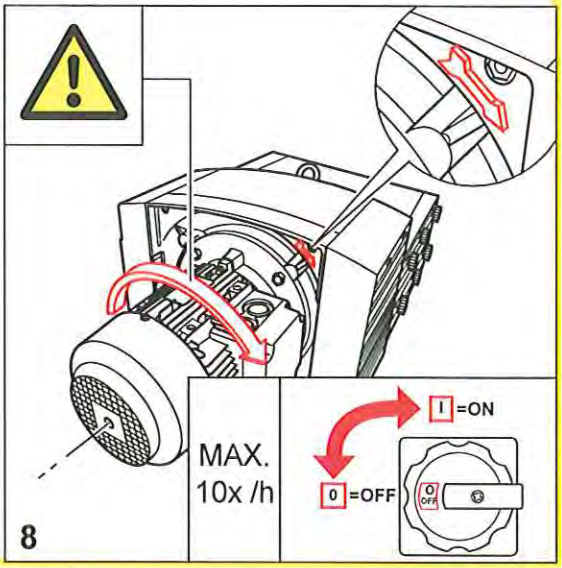

BECKER
50 Hz
60 Hz
6


L1 L2 L3
L2 L1 L3
U1 V1 W1
M
3~
OPTIONAL
PTC
Bi-metal
Softstart
7


MAX.
10x /h
I =ON
0 =OFF
8

KDT 3.140

Rotary vane compressors
- oil-free and air-cooled
- incl. integrated suction filter and pressure regulating valve

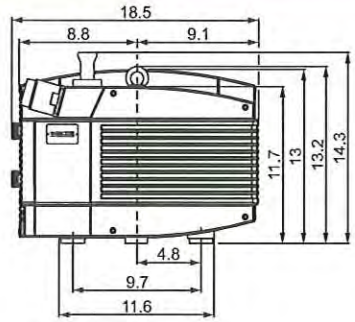
Drehschieber-Verdichter
- trockenlaufend und luftgekühlt
- inkl. integriertem Ansaugfilter und Druckregulierventil

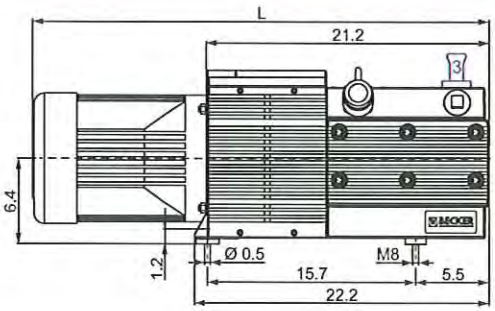
Compresseur à palettes
- fonctionnant à sec et refroidies par air
- incl. filtre d'aspiration intégré et soupape de regulage pression

Compressori a palette
- funzionanti a secco e raffreddate ad aria
- incl. filtro di aspirazione integrato e valvola regolazione pressione

Compresores de paletas
- sin aceite y refrigerado por aire
- incl. filtro de aspiración integrado y válvula reguladora de presión

fig.: KDT 3.80

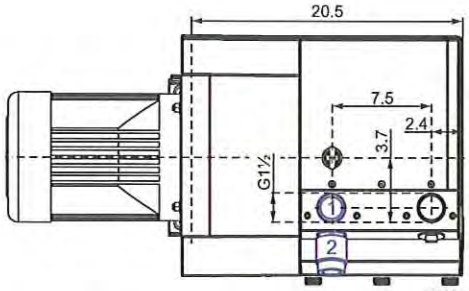




1 Pressure connection
Druckanschluss
Raccord pression
Raccordo pressione
Conexión de presión

2 Pressure regulating valve
Druckregulierventil
Soupape de regulage pression
Valvola regolazione pressione
Válvula reguladora de presión

3 Air nozzle
Ansaugdüse
Buse d'aspiration
Ugello di aspirazione
Boquilla de aire



[inch]

CFM		PSIG		hp 3~		Ⓜ	lbs	db(A) [1]	
50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz			50 Hz	60 Hz
76	90	7.25	7.25	7.4	8.9	1	172 + Ⓜ	80	82
		14.5	14.5	10.1	12.1	2	172 + Ⓜ	82	84
		21.75	21.75	10.1	12.1	2	172 + Ⓜ	82	84

Ⓜ	hp		V ±10%			rpm		A			lbs	no.	L	no.
	50 Hz	60 Hz	50 Hz	60 Hz		50 Hz	60 Hz	50 Hz	60 Hz			IP55 • ISO F • bimetal	inch	KDT + Ⓜ
1	7.4	8.9	Δ 230 / Y 400 IE2	Δ 265 / Y 460 IE2	Δ 230 / Y 400	1435	1720	20.6/11.9	20.2/11.6	23.4/13.5	95	42879422300003RE	36	G017032
	7.4	8.9	Δ 400 / Y - IE2	Δ 460 / Y - IE2	Δ 400 / Y -	1435	1720	13.2	12.7	14.3	95	42879490300003RE	36	G017266
	-	8.9	-	YY 230 / Y 460 IE2 + UL/CSA	usable @ 208	-	1755	-	22.8/11.4	24.4	120.5	42979407300114TA	36.1	G017267
	7.4	8.9	Δ 200 / Y 350	Δ 220 / Y 380-400 IE2	Δ 200 / Y 350	1420	1720	31.8/18.4	27.8/16.1-15.3	30.6/17.7	95	42879453000003RE	36	G017268
	-	8.9	-	Δ 400 / Y 690 IE2		-	1720	-	13.1/7.6		95	42979454300003RE	36	G018358
2	10.1	12.1	Δ 230 / Y 400 IE3	Δ 265 / Y 460 IE3	Δ 230 / Y 400	1445	1735	28/16.2	26.8/15.5	30.9/17.9	121.5	43089422300003RE	37.5	G017029 (14.5PSIG) G017039 (21.75PSIG)
	10.1	12.1	Δ 400 / Y - IE3	Δ 460 / Y - IE3	Δ 400 / Y -	1445	1735	16	15.8	18	121.5	43089490300003RE	37.5	G017257 (14.5PSIG) G017287 (21.75PSIG)
	-	12.1	-	YY 230 / Y 460 IE3 + UL/CSA	usable @ 208	-	1750	-	29.8/14.9	31.9	157	43189407300114TA	37.1	G017258 (14.5PSIG) G017288 (21.75PSIG)
	10.1	12.1	Δ 200 / Y 350	Δ 220 / Y 380-400 IE3	Δ 200 / Y 350	1450	1760	33.8/18.3	31.5/18.2-17.3	33.9/19.5	121.5	43089453000003RE	37.5	G017259 (14.5PSIG) G017289 (21.75PSIG)
	-	12.1	-	Δ 400 / Y 690 IE3		-	1760	-	19.2/11.1		121.5	43189454300003RE	37.5	G018458 (14.5PSIG) G018459 (21.75PSIG)

1) DIN EN ISO 3744 (KpA = 3 dB(A)) interval of 39.4inch, at medium load, both connection sides piped
DIN EN ISO 3744 (KpA = 3 dB(A)) Abstand von 39.4inch, bei mittlerer Belastung, beide Seiten abgeleitet
DIN EN ISO 3744 (KpA = 3 dB(A)) intervalle de 39.4inch, à règime moyen, avec dérivation des deux côtés
DIN EN ISO 3744 (KpA = 3 dB(A)) intervallo di 39.4inch, a medio regime, entrambi i lati derivati
DIN EN ISO 3744 (KpA = 3 dB(A)) intervalo de 39.4inch, en media carga, derivados de ambos lados

- Dimensions in inch
Maßangaben in inch
Mesures en inch
Misure in inch
Dimensiones en inch

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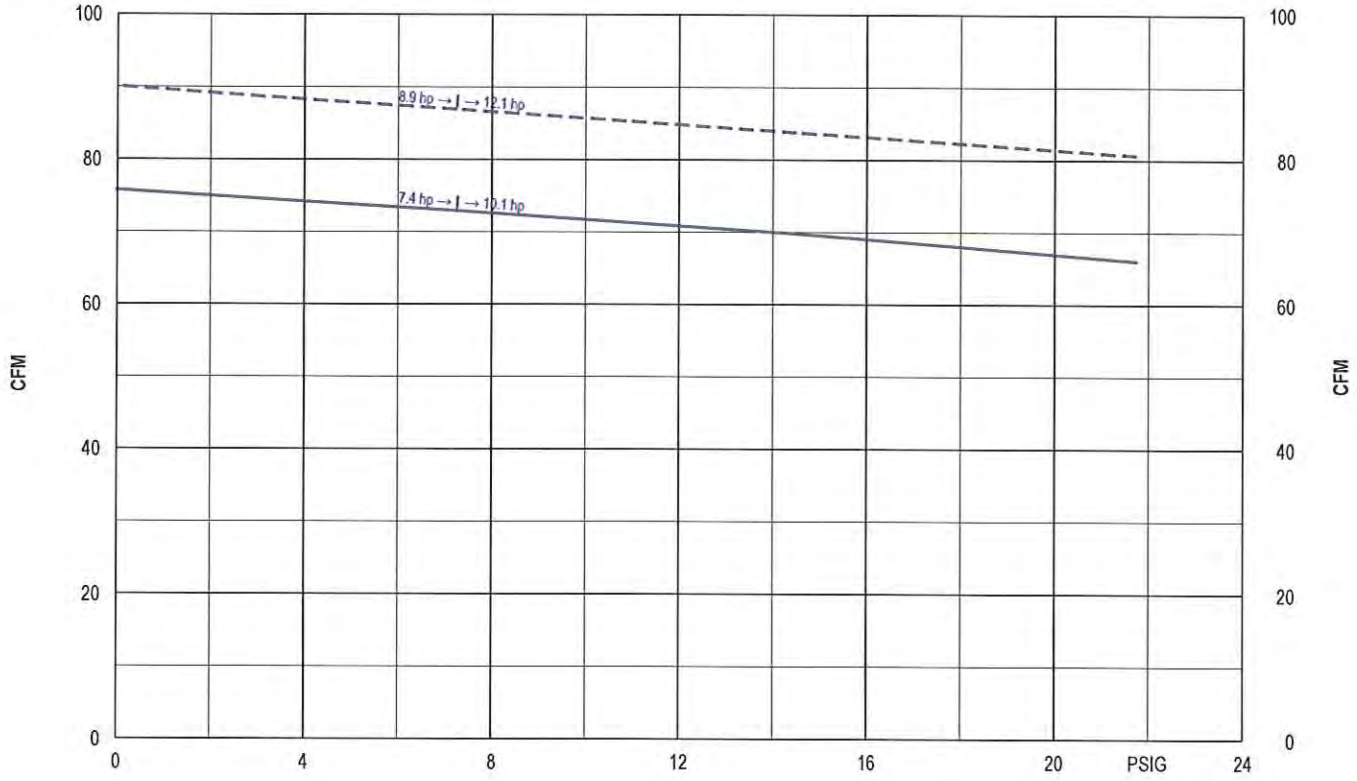
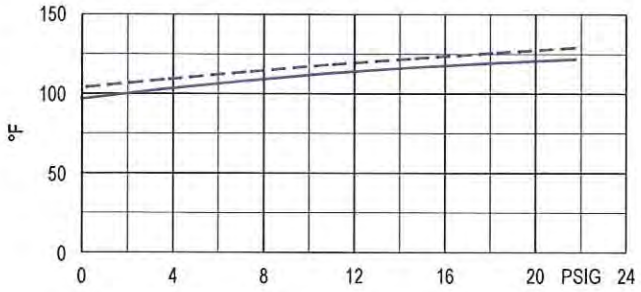
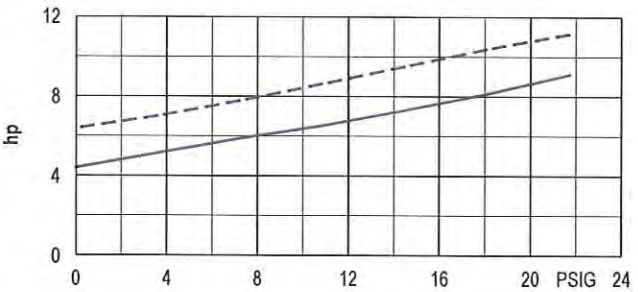
Blast air rate • Blasluftmenge • Débit d'air soufflé • Volume d'aria soffiata • Volumen de aire soplado



Exhaust air temperature • Ablufttemperatur • Température d'air à l'échappemant
Temperatura dell'aria scarica • Temperatura del aire de escape



Motor shaft power • Wellenleistung • Puissance du moteur axe
Potenza del motore albero • Capacidad de eje del motor



—— 50 Hz
- - - 60 Hz

• Reference data (atmosphere)	Bezugsdaten (Atmosphäre)	Référence (atmosphère)	Rifermento (atmosfera)	Referencia (atmosférica)	0 PSIG, 68°F
• Tolerance	Toleranz	Tolérance	Tolleranza	Tolerancia	±5 %

i	Variants	Varianten	Variantes	Varianti	Variantes
KDT 3.140/6	With increased corrosion protection	Mit erhöhtem Korrosionsschutz	Avec protection accrue contre la corrosion	Con una maggiore protezione anti-corrosione	Con el aumento de protección contra la corrosión
KDT 3.140 (SH 13)	In sound proof box SH 13	In Schallhaube SH 13	Dans caisse d'insonorisation SH 13	In casse insonorizzanti SH 13	En caja a prueba de sonido SH 13
KDT 3.140/0-400	VARIAIR Unit with frequency inverter	VARIAIR Unit mit Frequezumrichter	VARIAIR Unit avec convertisseur de frequence	VARIAIR Unit con convertitore di frequenca	VARIAIR Unit con variador de frecuencia
KDX 3.140	For x-tra operating hours	Für x-tra Betriebsstunden	Pour le heures de travail x-tra	Per x-tra ore operative	Para las horas de funcionamiento x-tra
	Performance data / dimensions can differ Combinations on request	Leistungsdaten / Abmessungen können abweichen Kombinationen auf Anfrage	Données de performance / mesures peuvent différer Combinaisons sur demande	Dati di performance / misure possono differire Combinazioni su richiesta	Datos de rendimiento / dimensiones pueden diferir Combinaciones a petición

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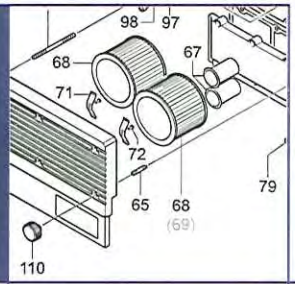
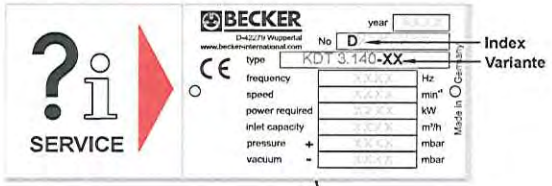
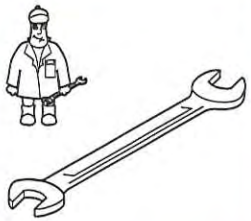
KDT 3.140





Ersatzteilliste	Reservedelsliste	Lista pieselor de schimb
Spare parts list	Reservdelslista	Páirteanna spártha liosta
Liste de pièces de rechange	Varaosaluettelo	Κατάλογος ανταλλακτικών
Listino pezzi di ricambio	Reservedelsliste	Yedek parça listesi
Lista de piezas de recambio	Wykaz części zamiennych	Списък на резервните части
Lista de peças sobresselentes	Tartalékalkatrész lista	Перечень запасных частей
Reserveonderdelenlijst	Seznam náhradnich dílů	スペアパーツリスト
Atsarginių dalių sąrašas	Seznam nadomestnih delov	예비 부품 목록
Varuosad nimekirja	Zoznam náhradných dielov	备用零件目录
Rezerves daļu saraksts	Rezervni dijelovi popis	



Pos.	Menge [2] Quantity Quantité Quantità Cantidad	Bestell-Nr. Ident No. No. Identification No. Identificazione No. de pedido	Bezeichnung Description Designation Designazione Descripcion
¤	1	549000 21300	Dichtungssatz, Complete set of seals, Jeu de joints, Kit di guarnizioni, Junta Completa
11	SATZ/KIT	901334 00004	Schieber, Rotor Vane, Palette, Empujador
11		901381 00004	" (KDT 3.140/**0-52** + KDT 3.140/**6**)
11		901381 00007	" (KDT 3.140/**6-29** + KDT 3.140/**6-71**)
11		901385 00007	" (KDT 3.140/**6-71HD**)
68	2	909507 00000	Filterpatrone, Filter cartridge, Cartouche Filtrante, Cartuccia filtro, Cartucho de filtro
68	1	909507 00000	" KDT 3.140/**6**
69	1	909587 00000	" KDT 3.140/**6 - Polyester**
91	1	909514 00000	Filterpatrone, Filter cartridge, Cartouche Filtrante, Cartuccia filtro, Cartucho de filtro
91	0	-	" KDT 3.140/**6**

[2] erforderliche Bestellmenge / necessary order quantity / quantité nécessaire / quantità di ordinazione necessari / cantidad necesario

Wartung
Maintenance
Entretien
Manutenzione
Mantenimiento

28000021301 02/2015

KDT 3.140 | **Standard**

Variante

1-7 | 8-10

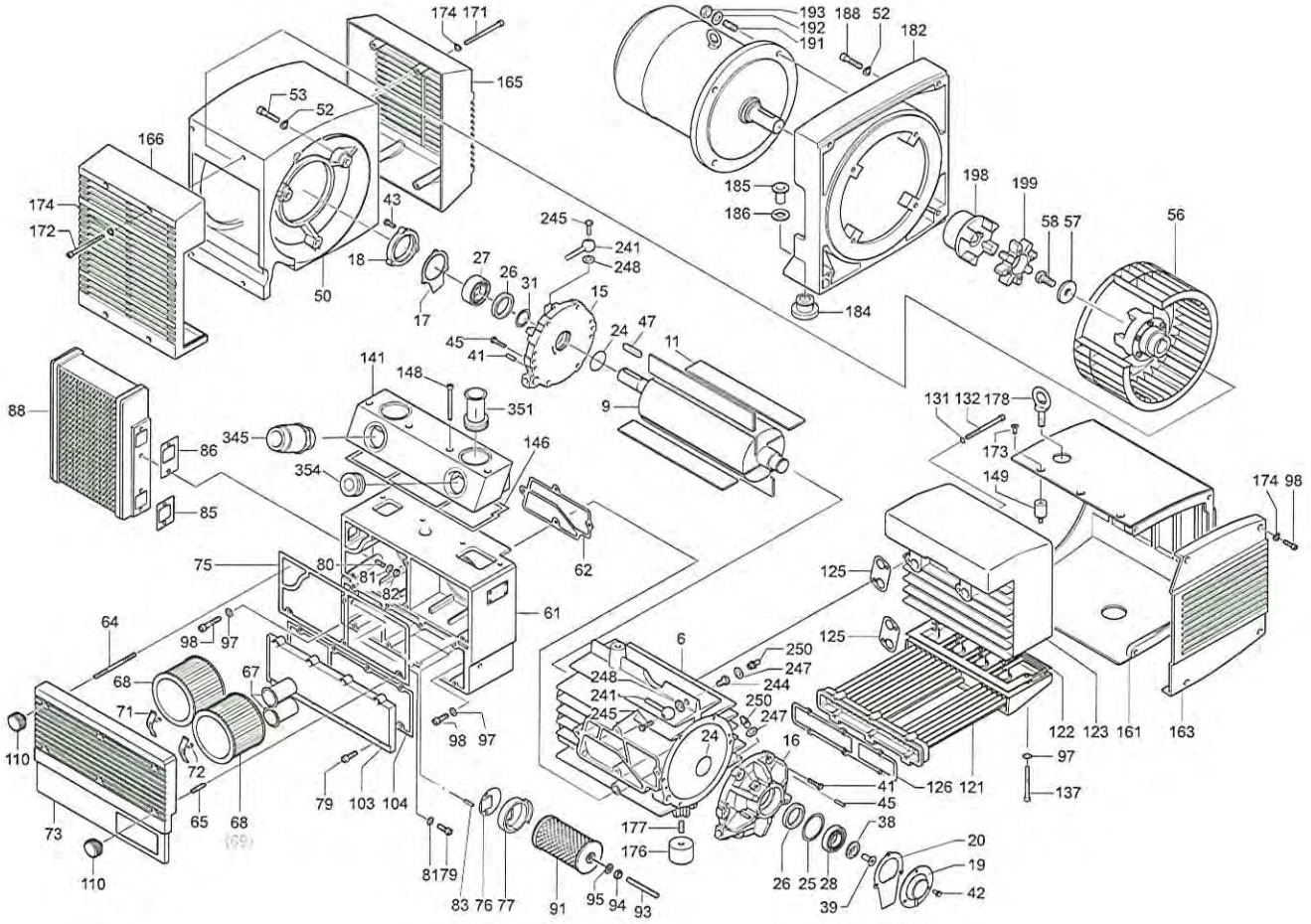
KDT 3.140/XX

①
US-motor

②
B5-250

③-⑦
/6, /0-52, /6-29,
/6-71, /6-71HD
- Korrosionsschutz
- corrosion protection
- protection contre la corrosion
- protezione anti-corrosione
- protección contra la corrosión

⑧
/0-54
- Kühlung
- refrigeration
- réfrigération
- refrigerazione
- refrigeración



D INDEX	Pos.	Bestell Nr.	Beschreibung
KDT 3.140	¤	549000 21300	**DICHTUNGSSATZ** [1]
	6	000101 21300	GEHÄUSE
	9	020004 21300	KOLBEN
	11	901334 00004	**SCHIEBER** (SATZ) [2]
	15	000801 21300	SEITENDECKEL, LINKS
	16	000701 21300	SEITENDECKEL, RECHTS
	17	025512 21300	DICHTUNG
	18	001101 21300	LAGERDECKEL
	19	001006 21300	LAGERDECKEL
	20	025513 21300	DICHTUNG
	24	911305 00000	DICHTUNGSSCHLAUCH
	25	917159 00000	AUSGLEICHSCHEIBE
	26	906544 00000	WELLENDICHTRING
	27	906621 00000	WÄLZLAGER
	28	906664 00000	WÄLZLAGER
	31	511400 10400	SATZ DISTANZSCHEIBEN
	38	016801 21300	SPANNSCHEIBE
	39	949807 00000	SENKSCHRAUBE
	41	945224 00000	SECHSKANTSCHRAUBE
	42	945218 00000	SECHSKANTSCHRAUBE
	43	901804 00000	SECHSKANTSCHRAUBE
	45	948742 00000	PASSKERBSTIFT
	47	947736 00000	PASSFEDER
	50	053201 21305	LATERNE
	52	950308 00000	UNTERLEGSCHEIBE
	53	945331 00000	INNENSECHSKANTSCHRAUBE
	56	544500 21300	KUPPLUNGSHÄLFTE MIT VENTILATOR
	57	949409 00000	UNTERLEGSCHEIBE
	58	945270 00000	WELLENENDSCHRAUBE
	61	040102 21300	FILTERGEHÄUSE
	62	025501 21300	DICHTUNG
	64	951009 00000	STIFTSCHRAUBE
	65	951003 00000	STIFTSCHRAUBE
	67	964407 00000	SCHALLDÄMPFERROHR
	68	909507 00000	**FILTERPATRONE** (2x) [2]
	71	009000 27000	ANPRESSFEDER
	72	948750 00000	BLINDNIET
	73	040204 21300	FILTERDECKEL
	75	025518 21300	DICHTUNG
	76	025516 21100	DICHTUNG
	77	022802 21100	FILTERTRÄGER
	79	945321 00000	INNENSECHSKANTSCHRAUBE
	80	946971 00000	STIFTSCHRAUBE
	81	947504 00000	UNTERLEGSCHEIBE
	82	947104 00000	SECHSKANTMUTTER
	83	952019 00000	SPANNHÜLSE
	85	025514 21100	DICHTUNG
	86	025515 21100	DICHTUNG
	88	560203 21300	KUEHLER
	91	909514 00000	**FILTERPATRONE** (1x) [2]
	93	903800 70000	STIFTSCHRAUBE
	94	947105 00000	SECHSKANTMUTTER
	95	949450 00000	U-SCHEIBE
	97	950304 00000	U-SCHEIBE
	98	945321 00000	INNENSECHSKANTSCHRAUBE
	103	068801 21300	STAUBABSCHEIDERDECKEL
	104	025515 21300	DICHTUNG
	110	921500 50000	HANDGRIFF
	121	560204 21300	KÜHLER

D INDEX	Pos.	Bestell Nr.	Beschreibung
	122	025506 21300	DICHTUNG
	123	066802 21300	DRUCKANSCHLUSSKASTEN
	125	025504 21300	DICHTUNG
	126	025514 21300	DICHTUNG
	131	948021 00000	DICHTRING
	132	945374 00000	INNENSECHSKANTSCHRAUBE
	137	945322 00000	INNENSECHSKANTSCHRAUBE
	141	016604 21300	ANSCHLUSSLEISTE
	146	025507 21300	DICHTUNG
	148	945364 00000	INNENSECHSKANTSCHRAUBE
	149	741310 30000	GUMMIPUFFER
	161	918300 21300	ABDECKHAUBE
	163	920800 21300	LUFTLEITRING
	165	960700 21300	LÜFTERHAUBE
	166	960701 21300	LÜFTERHAUBE
	171	945371 00000	INNENSECHSKANTSCHRAUBE
	172	945372 00000	INNENSECHSKANTSCHRAUBE
	173	949806 00000	SENKSCHRAUBE
	174	951703 00000	FEDERSCHEIBE
	176	741302 00000	GUMMIPUFFER
	177	945634 00000	GEWINDESTIFT
	178	948802 00000	RINGSCHRAUBE
	182	014903 21305	ZWISCHENFLANSCH
	184	951916 00000	KABELTÜLLE
	185	948772 00000	ROHRNIETE
	186	947508 00000	UNTERLEGSCHEIBE
	188	945335 00000	INNENSECHSKANTSCHRAUBE
	191	951022 00000	STIFTSCHRAUBE
	192	947506 00000	UNTERLEGSCHEIBE
	193	947106 00000	SECHSKANTMUTTER
	198	902100 21900	KUPPLUNGSHÄLFTE (MOT)
	199	902210 00000	KUPPLUNGSSCHEIBE
	241	012200 21300	LEITUNG
	244	912300 00000	ANSCHLUSSSCHRAUBE
	245	009400 19000	KUGELSTÜCKSCHRAUBE
	247	948074 00000	DICHTRING
	248	948021 00000	DICHTRING
	250	949002 00000	SCHMIERNIPPEL
	345	728000 99622	DRUCKREGULIERVENTIL / 0,6 BAR
	345	728001 99622	DRUCKREGULIERVENTIL / 1,0 BAR
	345	728002 99622	DRUCKREGULIERVENTIL / 2,0 BAR
	345	728003 99622	DRUCKREGULIERVENTIL / 0,3 BAR
	351	964313 00000	SCHALLDÄMPFERDÜSE
	354	912805 00000	VERSCHLUSSSTOPFEN
		743303 00000	**SPEZIALFETT** (FETTPRESSE, 50g)

[1] **Dichtungssatz** - 54900021300 - Pos.: 17, 20, 24, 62, 75, 76, 85, 86, 104, 122, 125, 126, 146

[2] erforderliche Bestellmenge / Wartung

D INDEX	Pos.	Ident No.	Description
KDT 3.140	¤	549000 21300	**SET OF SEALS** [1]
	6	000101 21300	PUMP BODY
	9	020004 21300	ROTOR
	11	901334 00004	**CARBON VANES** (KIT) [2]
	15	000801 21300	LID, LEFT
	16	000701 21300	LID, RIGHT
	17	025512 21300	GASKET
	18	001101 21300	BEARING COVER
	19	001006 21300	BEARING COVER
	20	025513 21300	GASKET
	24	911305 00000	SEAL
	25	917159 00000	COMPENSATING DISC
	26	906544 00000	SHAFT-SEALING RING
	27	906621 00000	BALL BEARING
	28	906664 00000	BALL BEARING
	31	511400 10400	SET DISTANCE DISC
	38	016801 21300	CLAMPING DISC
	39	949807 00000	SCREW
	41	945224 00000	HEX-HEAD SCREW
	42	945218 00000	HEX-HEAD SCREW
	43	901804 00000	HEX-HEAD SCREW
	45	948742 00000	STRAIGHT PIN
	47	947736 00000	KEY
	50	053201 21305	CONNECTION FLANGE
	52	950308 00000	WASHER
	53	945331 00000	SOCKET HEAD SCREW
	56	544500 21300	COUPLING WITH FAN
	57	949409 00000	WASHER
	58	945270 00000	SHAFT END BOLD
	61	040102 21300	FILTER HOUSING
	62	025501 21300	GASKET
	64	951009 00000	STUD
	65	951003 00000	STUD
	67	964407 00000	SILENCER TUBE
	68	909507 00000	**FILTER CARTRIDGE** (2x) [2]
	71	009000 27000	LEAF SPRING
	72	948750 00000	BLIND RIVET
	73	040204 21300	FILTER COVER
	75	025518 21300	GASKET
	76	025516 21100	GASKET
	77	022802 21100	FILTER HOLDER
	79	945321 00000	SOCKET HEAD SCREW
	80	946971 00000	STUD
	81	947504 00000	WASHER
	82	947104 00000	HEX.NUT
	83	952019 00000	LOCATING PEG
	85	025514 21100	GASKET
	86	025515 21100	GASKET
	88	560203 21300	COOLER
	91	909514 00000	**FILTER CARTRIDGE** (1x) [2]
	93	903800 70000	STUD
	94	947105 00000	HEX.NUT
	95	949450 00000	WASHER
	97	950304 00000	WASHER
	98	945321 00000	SOCKET HEAD SCREW
	103	068801 21300	DUST SEPARATOR COVER
	104	025515 21300	GASKET
	110	921500 50000	HANDLE
	121	560204 21300	COOLER

D INDEX	Pos.	Ident No.	Description
	122	025506 21300	GASKET
	123	066802 21300	PRESSURE CONNECTION BOX
	125	025504 21300	GASKET
	126	025514 21300	GASKET
	131	948021 00000	SEALING RING
	132	945374 00000	SOCKET HEAD SCREW
	137	945322 00000	SOCKET HEAD SCREW
	141	016604 21300	CONNECTING PIECE
	146	025507 21300	GASKET
	148	945364 00000	SOCKET HEAD SCREW
	149	741310 30000	RUBBER BUFFER
	161	918300 21300	COVERING HOOD
	163	920800 21300	AIR GUIDE COVER RING
	165	960700 21300	VENTILATOR HOOD
	166	960701 21300	VENTILATOR HOOD
	171	945371 00000	SOCKET HEAD SCREW
	172	945372 00000	SOCKET HEAD SCREW
	173	949806 00000	COUNTERSUNK SCREW
	174	951703 00000	SPRING DISC
	176	741302 00000	RUBBER BUFFER
	177	945634 00000	THREADED PIN
	178	948802 00000	RING SCREW
	182	014903 21305	FLANGE
	184	951916 00000	RUBBER BUSHING
	185	948772 00000	PIPE RIVET
	186	947508 00000	WASHER
	188	945335 00000	SOCKET HEAD SCREW
	191	951022 00000	STUD
	192	947506 00000	WASHER
	193	947106 00000	HEX.NUT
	198	902100 21900	COUPLING
	199	902210 00000	COUPLING DISC
	241	012200 21300	OIL-PIPE
	244	912300 00000	CONNECTING SCREW
	245	009400 19000	HOLLOW HOLDING SCREW
	247	948074 00000	SEALING RING
	248	948021 00000	SEALING RING
	250	949002 00000	GREASE NIPPLE
	345	728000 99622	PRESSURE REGULATION VALVE / 8,7 PSI
	345	728001 99622	PRESSURE REGULATION VALVE / 14,5 PSI
	345	728002 99622	PRESSURE REGULATING VALVE / 29 PSI
	345	728003 99622	PRESSURE REGULATING VALVE / 4,35 PSI
	351	964313 00000	NOZZLE
	354	912805 00000	PLUG
		743303 00000	**SPECIAL GREASE** (GREASE PRESS, 50g)

[1] **Set of seals** - 54900021300 - Pos.: 17, 20, 24, 62, 75, 76, 85, 86, 104, 122, 125, 126, 146
[2] necessary order quantity / maintenance

D INDICE	Pos.	No. Identification	Designation
KDT 3.140	¤	549000 21300	**JEU DE JOINTS** [1]
	6	000101 21300	CORP DE POMPE
	9	020004 21300	PISTON
	11	901334 00004	**PALETTE DE CHARBON** (KIT) [2]
	15	000801 21300	COUVERCLE A GAUCHE
	16	000701 21300	COUVERCLE A DROITE
	17	025512 21300	JOINT
	18	001101 21300	COUVERCLE DE ROULEMENTE
	19	001006 21300	COUVERCLE DE ROULEMENTE
	20	025513 21300	JOINT
	24	911305 00000	JOINT
	25	917159 00000	DISQUE DE COMPENSATION
	26	906544 00000	BAGUE D'ETANCHEITE P.L'AXE
	27	906621 00000	ROULEMENT A BILLES
	28	906664 00000	ROULEMENT A BILLES
	31	511400 10400	JEU DISQUE DE TOLERANCE
	38	016801 21300	DISQUE DE SERRAGE
	39	949807 00000	VIS
	41	945224 00000	VIS HEXAGONALE
	42	945218 00000	VIS HEXAGONALE
	43	901804 00000	VIS HEXAGONALE
	45	948742 00000	GOUPILLE CYLINDRIQUE
	47	947736 00000	CLAVETTE
	50	053201 21305	BRIDE DE RACCORDEMENT
	52	950308 00000	RONDELLE
	53	945331 00000	VIS HEXAGONALE INTERNE
	56	544500 21300	ACCOUPLEMENT AVEC VENTILATEUR
	57	949409 00000	RONDELLE
	58	945270 00000	VIS BOUT D'ARBRE
	61	040102 21300	BOITE POUR FILTRE
	62	025501 21300	JOINT
	64	951009 00000	PRISONNIER
	65	951003 00000	PRISONNIER
	67	964407 00000	TUBE SILENCIEUX
	68	909507 00000	**CARTOUCHE FILTRANTE** (2x) [2]
	71	009000 27000	RESSORT-JAME
	72	948750 00000	RIVET AVEUGLIE
	73	040204 21300	COUVERCLE DE FILTRE
	75	025518 21300	JOINT
	76	025516 21100	JOINT
	77	022802 21100	SUPPORT FILTRE
	79	945321 00000	VIS HEXAGONALE INTERNE
	80	946971 00000	PRISONNIER
	81	947504 00000	RONDELLE
	82	947104 00000	ECROU A 6PANS
	83	952019 00000	DOUILLE DE ETRAGE
	85	025514 21100	JOINT
	86	025515 21100	JOINT
	88	560203 21300	REFROIDISSEUR
	91	909514 00000	**CARTOUCHE FILTRANTE** (1x) [2]
	93	903800 70000	PRISONNIER
	94	947105 00000	ECROU A 6 PANS
	95	949450 00000	RONDELLE
	97	950304 00000	RONDELLE
	98	945321 00000	VIS HEXAGONALE INTERNE
	103	068801 21300	COUVERCLE
	104	025515 21300	JOINT
	110	921500 50000	POIGNEE
	121	560204 21300	REFROIDISSEUR

D INDICE	Pos.	No. Identification	Designation
	122	025506 21300	JOINT
	123	066802 21300	BOITIER DE RACCORD DE REFOULEMENT
	125	025504 21300	JOINT
	126	025514 21300	JOINT
	131	948021 00000	JOINT
	132	945374 00000	VIS HEXAGONALE INTERNE
	137	945322 00000	VIS HEXAGONALE INTERNE
	141	016604 21300	PIECE RACCORD
	146	025507 21300	JOINT
	148	945364 00000	VIS HEXAGONALE INTERNE
	149	741310 30000	AMORTISSEUR EN CAOUTCHOUC
	161	918300 21300	CARTER
	163	920800 21300	CAPOT DE CANALISATION DE L'AIR
	165	960700 21300	CARTER DE VENTILATEUR
	166	960701 21300	CARTER DE VENTILATEUR
	171	945371 00000	VIS HEXAGONALE INTERNE
	172	945372 00000	VIS HEXAGONALE INTERNE
	173	949806 00000	VIS À TÊTE NOYÉE
	174	951703 00000	DISQUE DE RESSORT
	176	741302 00000	AMORTISSEUR EN CAOUTCHOUC
	177	945634 00000	GOUPILLE FILETEE
	178	948802 00000	PITON
	182	014903 21305	BRIDE
	184	951916 00000	PROTECTION EN CAOUTCHOUC
	185	948772 00000	RIVET TUBE
	186	947508 00000	RONDELLE
	188	945335 00000	VIS HEXAGONALE INTERNE
	191	951022 00000	PRISONNIER
	192	947506 00000	RONDELLE
	193	947106 00000	ECROU A 6 PANS
	198	902100 21900	ACCOUPLEMENT
	199	902210 00000	DISQUE D'ACCOUPLEMENT
	241	012200 21300	TUYEAU DE GRAISSAGE
	244	912300 00000	VIS DE RACCORD
	245	009400 19000	VIS CREUSE DE FIXATION
	247	948074 00000	JOINT
	248	948021 00000	JOINT
	250	949002 00000	GRAISSEUR
	345	728000 99622	SOUPAPE REGLAGE PRESSION / 0,6 BAR
	345	728001 99622	SOUPAPE REGLAGE PRESSION / 1,0 BAR
	345	728002 99622	SOUPAPE REGLAGE PRESSION / 2,0 BAR
	345	728003 99622	SOUPAPE REGLAGE PRESSION / 0,3 BAR
	351	964313 00000	BUSE
	354	912805 00000	BOUCHON
		743303 00000	**GRAISSE SPÉCIFIQUE** (POMPE À GRAISSE, 50g)

[1] **Jeu de joints** - 54900021300 - Pos.: 17, 20, 24, 62, 75, 76, 85, 86, 104, 122, 125, 126, 146
[2] quantité nécessaire / entretien

D INDICE	Pos.	No. Identificazione	Designazione
KDT 3.140	¤	549000 21300	**SERIE DI GUARNIZIONE** [1]
	6	000101 21300	CARCASSA
	9	020004 21300	ROTORE
	11	901334 00004	**PALETTE DI CHARBONE** (KIT) [2]
	15	000801 21300	COPERCHIO SINISTRA
	16	000701 21300	COPERCHIO DESTRA
	17	025512 21300	GUARNIZIONE
	18	001101 21300	COPERCHIO CUSCINETTO
	19	001006 21300	COPERCHIO CUSCINETTO
	20	025513 21300	GUARNIZIONE
	24	911305 00000	GUARNIZIONE
	25	917159 00000	DISCO COMPENSATORE
	26	906544 00000	GUARNIZIONE PER L'ALBERO
	27	906621 00000	CUSCINETTO A SFERA
	28	906664 00000	CUSCINETTO A SFERA
	31	511400 10400	SERIE DISCO GIUOCO
	38	016801 21300	DISCO DI FISSAGIO
	39	949807 00000	VITE
	41	945224 00000	VITE ESAGONALE
	42	945218 00000	VITE ESAGONALE
	43	901804 00000	VITE ESAGONALE
	45	948742 00000	PERNO
	47	947736 00000	CHIAVETTA
	50	053201 21305	FLANGIA DI RACCORDE
	52	950308 00000	RONDELLA
	53	945331 00000	VITE ESAGONALE INTERNA
	56	544500 21300	GIUNTO CON VENTILATORE
	57	949409 00000	RONDELLA
	58	945270 00000	VITE DI CHIUSURA ALBERO
	61	040102 21300	CONTENITORE FILTRO
	62	025501 21300	GUARNIZIONE
	64	951009 00000	L'ASTA A VITE
	65	951003 00000	L'ASTA A VITE
	67	964407 00000	TUBO SILENZIATORE
	68	909507 00000	**CARTUCCIA FILTRO** (2x) [2]
	71	009000 27000	MOLLA
	72	948750 00000	RIVETTO CIECO
	73	040204 21300	COPERCHIO FILTRO
	75	025518 21300	GUARNIZIONE
	76	025516 21100	GUARNIZIONE
	77	022802 21100	SUPPORTO FILTRO
	79	945321 00000	VITE ESAGONALE INTERNA
	80	946971 00000	L'ASTA A VITE
	81	947504 00000	RONDELLA
	82	947104 00000	DADO ESAGONALE
	83	952019 00000	SPINE DI RISCONTRO
	85	025514 21100	GUARNIZIONE
	86	025515 21100	GUARNIZIONE
	88	560203 21300	RAFFREDDATORE
	91	909514 00000	**CARTUCCIA FILTRO** (1x) [2]
	93	903800 70000	L'ASTA A VITE
	94	947105 00000	DADO ESAGONALE
	95	949450 00000	RONDELLA
	97	950304 00000	RONDELLA
	98	945321 00000	VITE ESAGONALE INTERNA
	103	068801 21300	COPERCHIO
	104	025515 21300	GUARNIZIONI
	110	921500 50000	MANETTA
	121	560204 21300	RAFFREDDATORE

D INDICE	Pos.	No. Identificazione	Designazione
	122	025506 21300	GUARNIZIONE
	123	066802 21300	SCATOLA DI RACCORDO DI MANDATA
	125	025504 21300	GUARNIZIONE
	126	025514 21300	GUARNIZIONI
	131	948021 00000	ANELLO GUARNIZIONE
	132	945374 00000	VITE ESAGONALE INTERNA
	137	945322 00000	VITE ESAGONALE INTERNA
	141	016604 21300	PEZZI RACCORDI
	146	025507 21300	GUARNIZIONE
	148	945364 00000	VITE ESAGONALE INTERNA
	149	741310 30000	AMMORTIZZATORE IN GOMMA
	161	918300 21300	CARTER
	163	920800 21300	CAPPOTTA DEL CONDOTTA ARIA
	165	960700 21300	CARTER VENTILATORE
	166	960701 21300	CARTER VENTILATORE
	171	945371 00000	VITE ESAGONALE INTERNA
	172	945372 00000	VITE ESAGONALE INTERNA
	173	949806 00000	VITE A TESTA SVASATA
	174	951703 00000	DISCO A MOLLA
	176	741302 00000	AMMORTIZZATORE IN GOMMA
	177	945634 00000	SPINA FILETTATURA
	178	948802 00000	GANCIO
	182	014903 21305	FLANGIA
	184	951916 00000	PROTEZIONE IN GOMMA
	185	948772 00000	CHIODO TUBOLARE
	186	947508 00000	RONDELLA
	188	945335 00000	VITE ESAGONALE INTERNA
	191	951022 00000	L'ASTA A VITE
	192	947506 00000	RONDELLA
	193	947106 00000	DADO ESAGONALE
	198	902100 21900	GIUNTO
	199	902210 00000	DISCO GUINTO
	241	012200 21300	CONDOTTO
	244	912300 00000	ATTACO FILETTATO
	245	009400 19000	VITE PASSAGGIO OLIO
	247	948074 00000	ANELLO GUARNIZIONE
	248	948021 00000	ANELLO GUARNIZIONE
	250	949002 00000	RACCORDO DI LUBRIFICAZIONE
	345	728000 99622	VALVOLA REGULAZIONE PRESSIONE / 0,6 BAR
	345	728001 99622	VALVOLA REGULAZIONE PRESSIONE / 1,0 BAR
	345	728002 99622	VALVOLA REGULAZIONE PRESSIONE / 2,0 BAR
	345	728003 99622	VALVOLA REGULAZIONE PRESSIONE / 0,3 BAR
	351	964313 00000	UGGELLO
	354	912805 00000	TAPPO DI CHIUSURA
		743303 00000	**GRASSO SPECIALE** (INGRASSATORE A PISTOLA, 50g)

[1] **Serie di guarnizione** - 54900021300 - Pos.: 17, 20, 24, 62, 75, 76, 85, 86, 104, 122, 125, 126, 146

[2] quantità di ordinazione necessari / manutenzione

D ÍNDICE	Pos.	No. De pedido	Descripción
KDT 3.140	¤	549000 21300	**JUNTA COMPLETA** [1]
	6	000101 21300	CARCASA
	9	020004 21300	ÉMBOLO, ACABADO
	11	901334 00004	**EMPUJADOR** (KIT) [2]
	15	000801 21300	TAPA LATERAL
	16	000701 21300	TAPA LATERAL DERECHA
	17	025512 21300	JUNTA
	18	001101 21300	TAPA DE COJINETE
	19	001006 21300	TAPA DE COJINETE
	20	025513 21300	JUNTA
	24	911305 00000	MANGUERA DE JUNTA
	25	917159 00000	ARANDELA DE COMPENSACIÓN
	26	906544 00000	ANILLO DE JUNTA DE ÁRBOL
	27	906621 00000	COJINETE DE RODAMIENTO
	28	906664 00000	COJINETE DE RODAMIENTO
	31	511400 10400	JUEGO DE ARANDELAS DISTANCIADORAS
	38	016801 21300	ARANDELA TENSORA
	39	949807 00000	TORNILLO AVELLANADO
	41	945224 00000	TORNILLO DE CABEZA HEXAGONAL
	42	945218 00000	TORNILLO DE CABEZA HEXAGONAL
	43	901804 00000	TORNILLO DE CABEZA HEXAGONAL
	45	948742 00000	PASADOR ENTALLADO DE AJUSTE
	47	947736 00000	LENGÜETA DE AJUSTE
	50	053201 21305	FAROL
	52	950308 00000	ARANDELA
	53	945331 00000	TORNILLO HEXAGONAL INTERIOR
	56	544500 21300	MITAD DE ACOPLAMIENTO CON VENTILADOR
	57	949409 00000	ARANDELA
	58	945270 00000	TORNILLO TERMINAL DE ÁRBOL
	61	040102 21300	CARCASA DE FILTRO
	62	025501 21300	JUNTA
	64	951009 00000	ESPÁRRAGO
	65	951003 00000	ESPÁRRAGO
	67	964407 00000	TUBO DE SILENCIADOR
	68	909507 00000	**CARTUCHO DE FILTRO** (2x) [2]
	71	009000 27000	MUELLE DE PRESIÓN
	72	948750 00000	REMACHE CIEGO
	73	040204 21300	TAPA DE FILTRO
	75	025518 21300	JUNTA
	76	025516 21100	JUNTA
	77	022802 21100	SOPORTE DE FILTRO
	79	945321 00000	TORNILLO HEXAGONAL INTERIOR
	80	946971 00000	ESPÁRRAGO
	81	947504 00000	ARANDELA
	82	947104 00000	TUERCA HEXAGONAL
	83	952019 00000	CASQUILLO TENSOR
	85	025514 21100	JUNTA
	86	025515 21100	JUNTA
	88	560203 21300	REFRIGERADOR
	91	909514 00000	**CARTUCHO DE FILTRO** (1x) [2]
	93	903800 70000	ESPÁRRAGO
	94	947105 00000	TUERCA HEXAGONAL
	95	949450 00000	ARANDELA
	97	950304 00000	ARANDELA
	98	945321 00000	TORNILLO HEXAGONAL INTERIOR
	103	068801 21300	TAPA DE SEPARADOR DE POLVO
	104	025515 21300	JUNTA
	110	921500 50000	EMPUÑADURA
	121	560204 21300	REFRIGERADOR

D ÍNDICE	Pos.	No. De pedido	Descripción
	122	025506 21300	JUNTA
	123	066802 21300	CAJA DE EMPALME DE PRESIÓN
	125	025504 21300	JUNTA
	126	025514 21300	JUNTA
	131	948021 00000	ANILLO DE JUNTA
	132	945374 00000	TORNILLO HEXAGONAL INTERIOR
	137	945322 00000	TORNILLO HEXAGONAL INTERIOR
	141	016604 21300	PIEZA DE EMPALME
	146	025507 21300	JUNTA
	148	945364 00000	TORNILLO HEXAGONAL INTERIOR
	149	741310 30000	AMORTIGUADOR DE GOMA
	161	918300 21300	CAPERUZA DE RECUBRIMIENTO
	163	920800 21300	CAPERUZA CONDUCTOR DE AIRE
	165	960700 21300	CAPERUZA DE VENTILADOR
	166	960701 21300	CAPERUZA DE VENTILADOR
	171	945371 00000	TORNILLO HEXAGONAL INTERIOR
	172	945372 00000	TORNILLO HEXAGONAL INTERIOR
	173	949806 00000	TORNILLO AVELLANADO
	174	951703 00000	ARANDELA ELÁSTICA
	176	741302 00000	AMORTIGUADOR DE GOMA
	177	945634 00000	VARILLA ROSCADA
	178	948802 00000	TORNILLO DE CÁNCAMO
	182	014903 21305	BRIDA INTERMEDIA
	184	951916 00000	BOQUILLA DE CABLE
	185	948772 00000	REMACHE TUBULAR
	186	947508 00000	ARANDELA
	188	945335 00000	TORNILLO HEXAGONAL INTERIOR
	191	951022 00000	ESPÁRRAGO
	192	947506 00000	ARANDELA
	193	947106 00000	TUERCA HEXAGONAL
	198	902100 21900	MITAD DE ACOPLAMIENTO (MOT)
	199	902210 00000	DISCO DE ACOPLAMIENTO
	241	012200 21300	CONDUCTO
	244	912300 00000	TORNILLO DE EMPALME
	245	009400 19000	TORNILLO DE PIEZA ESFÉRICA
	247	948074 00000	ANILLO DE JUNTA
	248	948021 00000	ANILLO DE JUNTA
	250	949002 00000	BOQUILLA DE TOLVA DE LUBRICACIÓN
	345	728000 99622	VÁLVULA REGULADORA DE PRESIÓN / 0,6 BAR
	345	728001 99622	VÁLVULA REGULADORA DE PRESIÓN / 1,0 BAR
	345	728002 99622	VÁLVULA REGULADORA DE PRESIÓN / 2,0 BAR
	345	728003 99622	VÁLVULA REGULADORA DE PRESIÓN / 0,3 BAR
	351	964313 00000	TOBERA DE SILENCIADOR
	354	912805 00000	TAPÓN DE DESGASTE
		743303 00000	**GRASA ESPECIAL** (PISTOLA DE GRASA, 50g)

[1] **Junta completa** - 54900021300 - Pos.: 17, 20, 24, 62, 75, 76, 85, 86, 104, 122, 125, 126, 146
[2] cantidad necesario / mantenimiento

KDT 3.140 Variante ↓		Pos. [2]	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⊕⇨	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⇨⊖	Beschreibung / Description / Designation / Designazione / Desripcion
① US-motor		191	951018 00000	~~951022 00000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		198		~~902100 21900~~	MOTORKUPPLUNG / COUPLING / ACCOUPLEMENT / GIUNTO / ACOPLAMIENTO
		234	037900 10400		ZWISCHENFLANSCH / INTERMEDIATE FLANGE / BRIDE INTERMEDIAIRE / FLANGE INTERMEDIA / BRIDA INTERMEDIA
		236	902100 21300		MOTORKUPPLUNG / COUPLING / ACCOUPLEMENT / GIUNTO / ACOPLAMIENTO
② B5-250		182	014902 21305	~~014903 21305~~	ZWISCHENFLANSCH / INTERMEDIATE FLANGE / BRIDE INTERMEDIAIRE / FLANGE INTERMEDIA / BRIDA INTERMEDIA
		191	951018 00000	~~951022 00000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		198	902109 00000	~~902100 00000~~	MOTORKUPPLUNG / COUPLING / ACCOUPLEMENT / GIUNTO / ACOPLAMIENTO
③ /0-52 - Korrosionsschutz - corrosion protection - protection contre la corrosion - protezione anti-corrosione - protección contra la corrosión		9	020005 21300	~~020004 21300~~	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
		11	901381 00004	~~901334 00004~~	**SATZ (KIT)** SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR
		345		~~72800X 99622~~	DRUCKREGULIERVENTIL / PRESSURE REGULATING VALVE / SOUPAPE REGLAGE PRESSION / VALVOLA REGULAZIONE PRESSIONE / VÁLVULA REGULADORA DE PRESIÓN
		403	734000 02000		DRUCKREGULIERVENTIL 2,2 BAR / PRESSURE REGULATING VALVE 32 PSI / SOUPAPE REGLAGE PRESSION 2,2 BAR / VALVOLA REGULAZIONE PRESSIONE 2,2 BAR / VÁLVULA REGULADORA DE PRESIÓN 2,2 BAR
⑧ /0-54 - Kühlung - refrigeration - réfrigération - refrigerazione - refrigeración		88		~~560203 21300~~	KÜHLER / COOLER / REFROIDISSEUR / RAFFREDDATORE / REFRIGERADOR
		230	019901 21100		UMLENKSTÜCK / RETURN PIECE / PIECE DE RETOUR / PEZZO INVERSIONE / PIEZA DE DESVIACIÓN

[2] variantenabhängige Bauteile / variant-dependent components / composants variante-dependantes / componenti variante-dispendenti / componentes variante-dependientes

Variante ⊕⇨

KDT 3.140 Variante		Pos. [2]	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⊕⇨	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⇨⊖	Beschreibung / Description / Designation / Designazione / Desripcion
④ /6 - Korrosionsschutz - corrosion protection - protection contre la corrosion - protezione anti-corrosione - protección contra la corrosión		6	000111 21300	~~000101 21300~~	GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA
		9	020011 21300	~~020004 21300~~	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
		11	901381 00004	~~901334 00004~~	**SATZ (KIT)** SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR
		15	000811 21300	~~000801 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		16	000711 21300	~~000701 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		68		~~909507 00000~~	FILTERPATRONE (**1x**) / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		69	909587 00000		FILTERPATRONE (**1x POLYESTER**) / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		76		~~025516 21100~~	DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA
		77		~~022802 21100~~	FILTERTRÄGER / FILTER HOLDER / SUPPORT FILTRE / SUPPORTO FILTRO / SOPORTE DE FILTRO
		83		~~952019 00000~~	SPANNHÜLSE / LOCATING PEG / DOUILLE DE ETRAGE / SPINE DI RISCONTRO / CASQUILLO TENSOR
		91		~~909514 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRANTE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		93	945634 00000	~~903800 70000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		94		~~947105 00000~~	SECHSKANTMUTTER / HEX.NUT / ECROU A 6 PANS / DADO ESAGONALE / TUERCA HEXAGONAL
		95		~~949450 00000~~	U-SCHEIBE / WASHER / RONDELLE / RONDELLA / ARANDELA
Ⓢ /6-29 - Korrosionsschutz - corrosion protection - protection contre la corrosion - protezione anti-corrosione - protección contra la corrosión		6	000111 21300	~~000101 21300~~	GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA
		9	020012 21300	~~020004 21300~~	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
		11	901381 00007	~~901334 00004~~	**SATZ (KIT)** SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR
		15	000811 21300	~~000801 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		16	000711 21300	~~000701 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		68		~~909507 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		69	909587 00000		FILTERPATRONE (**1x POLYESTER**) / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		76		~~025516 21100~~	DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA
		77		~~022802 21100~~	FILTERTRÄGER / FILTER HOLDER / SUPPORT FILTRE / SUPPORTO FILTRO / SOPORTE DE FILTRO
		83		~~952019 00000~~	SPANNHÜLSE / LOCATING PEG / DOUILLE DE ETRAGE / SPINE DI RISCONTRO / CASQUILLO TENSOR
		88		~~560203 21300~~	KÜHLER / COOLER / REFROIDISSEUR / RAFFREDDATORE / REFRIGERADOR
		91		~~909514 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRANTE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		93	945634 00000	~~903800 70000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		94		~~947105 00000~~	SECHSKANTMUTTER / HEX.NUT / ECROU A 6 PANS / DADO ESAGONALE / TUERCA HEXAGONAL
		95		~~949450 00000~~	U-SCHEIBE / WASHER / RONDELLE / RONDELLA / ARANDELA
		163	920801 21300	~~920800 21300~~	LUFTLEITRING / AIR GUIDE COVER RING / CAPOT DE CANALISATION DE L'AIR / CAPPOTTA DEL CONDOTTA ARIA / CAPERUZA CONDUCTOR DE AIRE
		230	019901 21100		UMLENKSTÜCK / RETURN PIECE / PIECE DE RETOUR / PEZZO INVERSIONE / PIEZA DE DESVIACIÓN
		378	903260 00000		DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA

[2] variantenabhängige Bauteile / variant-dependent components / composants variante-dependantes / componenti variante-dispendenti / componentes variante-dependientes

KDT 3.140 Variante		Pos. [2]	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⊕⇨	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⇨⊖	Beschreibung / Description / Designation / Designazione / Desripcion
⑥ /6-71 - Korrosionsschutz - corrosion protection - protection contre la corrosion - protezione anti-corrosione - protección contra la corrosión		6	000111 21300	~~000101 21300~~	GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA
		9	020012 21300	~~020004 21300~~	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
		11	901381 00007	~~901334 00004~~	**SATZ (KIT)** SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR
		15	000811 21300	~~000801 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		16	000711 21300	~~000701 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		68		~~909587 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		69	909587 00000		FILTERPATRONE (**1x POLYESTER**) / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		73	040205 21300	~~040204 21300~~	FILTERDECKEL / FILTER COVER / COUVERCLE DE FILTRE / COPERCHIO FILTRO / TAPA DE FILTRO
		76		~~025516 21100~~	DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA
		77		~~022802 21100~~	FILTERTRÄGER / FILTER HOLDER / SUPPORT FILTRE / SUPPORTO FILTRO / SOPORTE DE FILTRO
		83		~~952019 00000~~	SPANNHÜLSE / LOCATING PEG / DOUILLE DE ETRAGE / SPINE DI RISCONTRO / CASQUILLO TENSOR
		88		~~560203 21300~~	KÜHLER / COOLER / REFROIDISSEUR / RAFFREDDATORE / REFRIGERADOR
		91		~~909514 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRANTE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		93	945634 00000	~~903800 70000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		94		~~947105 00000~~	SECHSKANTMUTTER / HEX.NUT / ECROU A 6 PANS / DADO ESAGONALE / TUERCA HEXAGONAL
		95		~~949450 00000~~	U-SCHEIBE / WASHER / RONDELLE / RONDELLA / ARANDELA
		110	947401 00000	~~921500 50000~~	HUTMUTTER / CAP NUT / ÉCROU BORGNE / DADO CIECO / TUERCA DE CAPERUZA
		163	920801 21300	~~920800 21300~~	LUFTLEITRING / AIR GUIDE COVER RING / CAPOT DE CANALISATION DE L'AIR / CAPPOTTA DEL CONDOTTA ARIA / CAPERUZA CONDUCTOR DE AIRE
		230	019901 21100		UMLENKSTÜCK / RETURN PIECE / PIECE DE RETOUR / PEZZO INVERSIONE / PIEZA DE DESVIACIÓN
		378	903260 00000		DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA

[2] variantenabhängige Bauteile / variant-dependent components / composants variante-dependantes / componenti variante-dispendenti / componentes variante-dependientes

KDT 3.140 Variante		Pos. [2]	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⊕⇨	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido ⇨⊖	Beschreibung / Description / Designation / Designazione / Desripcion
⑦ /6-71HD - Korrosionsschutz - corrosion protection - protection contre la corrosion - protezione anti-corrosione - protección contra la corrosión		6	000111 21300	~~000101 21300~~	GEHÄUSE / PUMP BODY / CORP DE POMPE / CARCASSA / CARCASA
		9	020012 21300	~~020004 21300~~	KOLBEN / ROTOR / PISTON / ROTORE / ÉMBOLO
		11	901385 00007	~~901334 00004~~	**SATZ (KIT)** SCHIEBER / VANES / PALETTE / PALETTE / EMPUJADOR
		15	000811 21300	~~000801 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		16	000711 21300	~~000701 21300~~	SEITENDECKEL / LID LATERAL / COUVERCLE LATÉRAL / COPERCHIO LATERALE / TAPA LATERAL
		68		~~909587 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		69	909587 00000		FILTERPATRONE (**1x POLYESTER**) / FILTER CARTRIDGE / CARTOUCHE FILTRE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		73	040205 21300	~~040204 21300~~	FILTERDECKEL / FILTER COVER / COUVERCLE DE FILTRE / COPERCHIO FILTRO / TAPA DE FILTRO
		76		~~025516 21100~~	DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA
		77		~~022802 21100~~	FILTERTRÄGER / FILTER HOLDER / SUPPORT FILTRE / SUPPORTO FILTRO / SOPORTE DE FILTRO
		83		~~952019 00000~~	SPANNHÜLSE / LOCATING PEG / DOUILLE DE ETRAGE / SPINE DI RISCONTRO / CASQUILLO TENSOR
		88		~~560203 21300~~	KÜHLER / COOLER / REFROIDISSEUR / RAFFREDDATORE / REFRIGERADOR
		91		~~909514 00000~~	FILTERPATRONE / FILTER CARTRIDGE / CARTOUCHE FILTRANTE / CARTUCCIA FILTRO / CARTUCHO DE FILTRO
		93	945634 00000	~~903800 70000~~	STIFTSCHRAUBE / STUD / GOUJON PRISONNIER / VITE PRIGIONIERA / PRISIONERO CON ROSCA
		94		~~947105 00000~~	SECHSKANTMUTTER / HEX.NUT / ECROU A 6 PANS / DADO ESAGONALE / TUERCA HEXAGONAL
		95		~~949450 00000~~	U-SCHEIBE / WASHER / RONDELLE / RONDELLA / ARANDELA
		110	947401 00000	~~921500 50000~~	HUTMUTTER / CAP NUT / ÉCROU BORGNE / DADO CIECO / TUERCA DE CAPERUZA
		163	920801 21300	~~920800 21300~~	LUFTLEITRING / AIR GUIDE COVER RING / CAPOT DE CANALISATION DE L'AIR / CAPPOTTA DEL CONDOTTA ARIA / CAPERUZA CONDUCTOR DE AIRE
		230	019901 21100		UMLENKSTÜCK / RETURN PIECE / PIECE DE RETOUR / PEZZO INVERSIONE / PIEZA DE DESVIACIÓN
		378	903260 00000		DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA

[2] variantenabhängige Bauteile / variant-dependent components / composants variante-dependantes / componenti variante-dispendenti / componentes variante-dependientes

BECKER

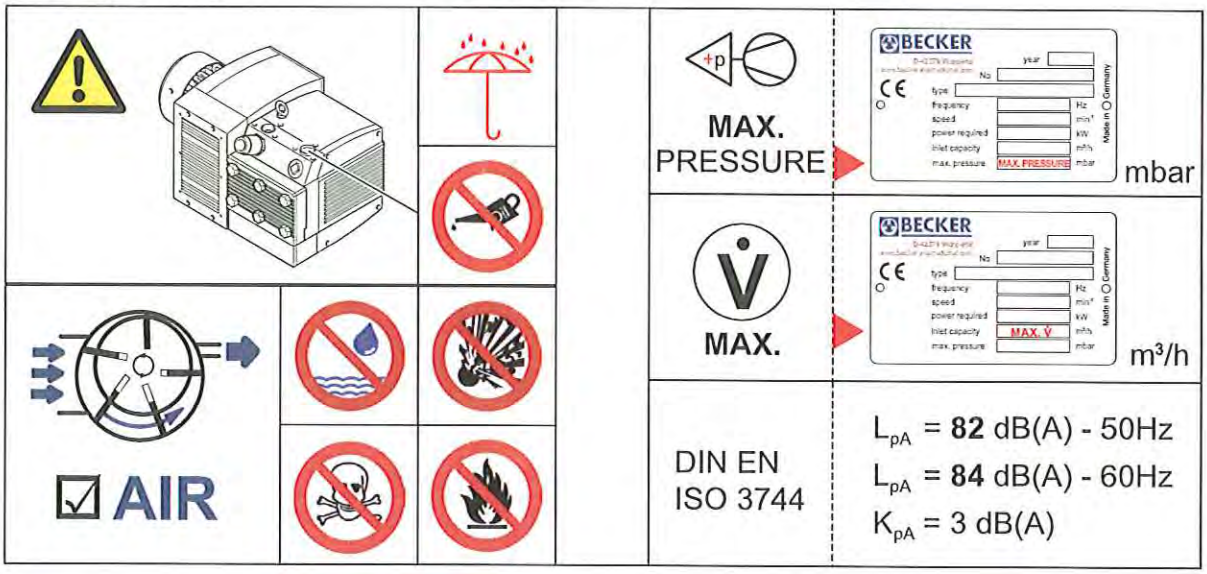
Betriebsanleitung
Operating Instructions
Instructions de service
Istruzioni d'uso
Handleiding
Instrucciones para el manejo
Manual de instruções
Naudojimosi instrukcija
Kasutusjuhend
Lietošanas instrukcija
Driftsinstruks
Driftsinstruktioner
Käyttöohje
Driftsvejledning
Instrukcja obsługi

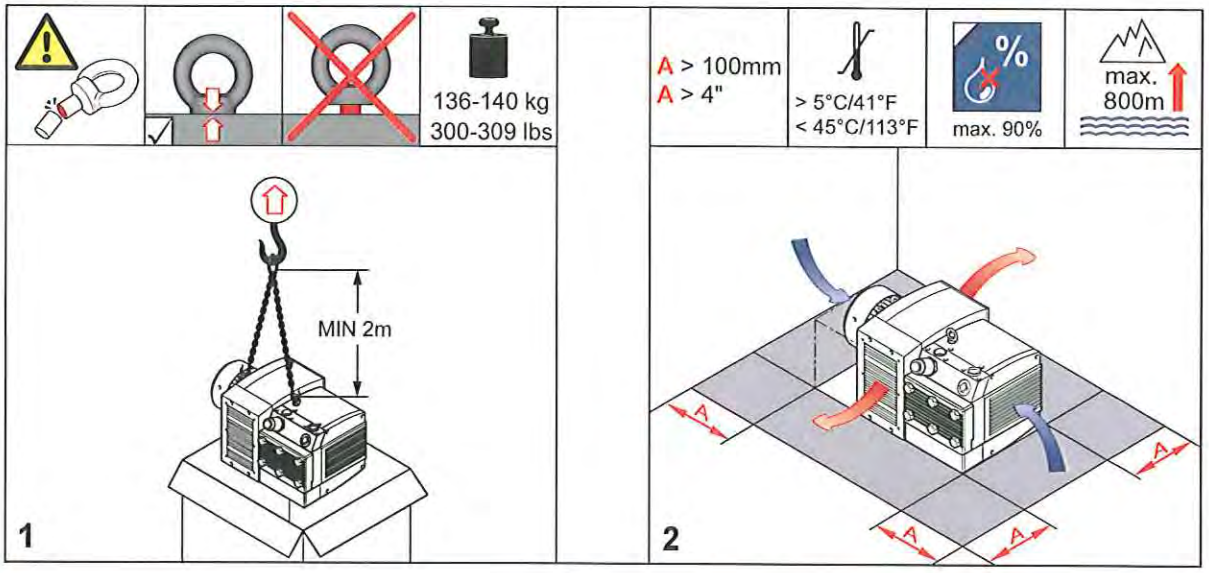
Kezelési útmutató
Návod k obsluze
Navodilo za uporabo
Návod na obsluhu
Upute za rad
Manual de operatii
Treoracha Oibriúcháin
Οδηγίες χρήσης
El Kitabi
Инструкции за експлоатация
Инструкция по эксплуатации
取扱説明書
사용설명서
使用说明书

KDT 3.140

2006/42/EG

DIN EN ISO 14001:2005
DIN EN ISO 9001
001929 QM





28100021301 01/15

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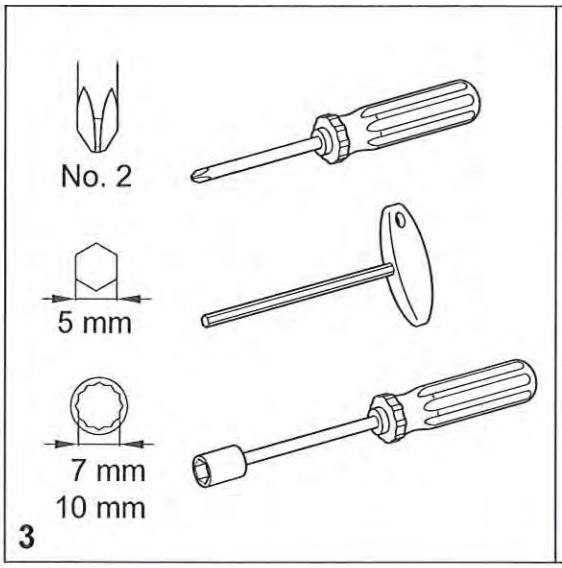
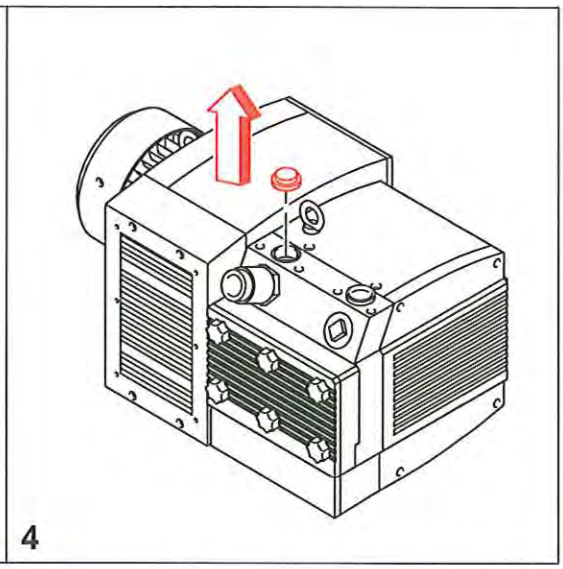

No. 2
5 mm
7 mm
10 mm
3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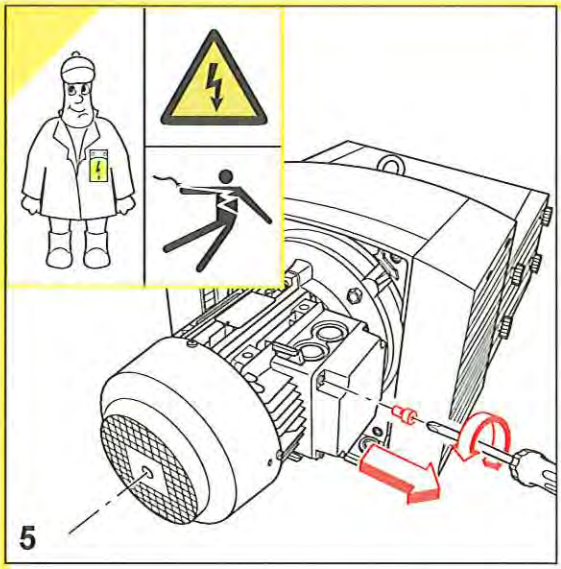
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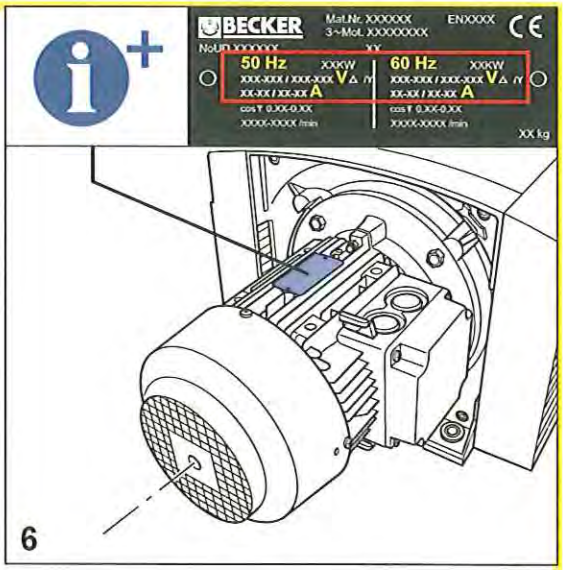
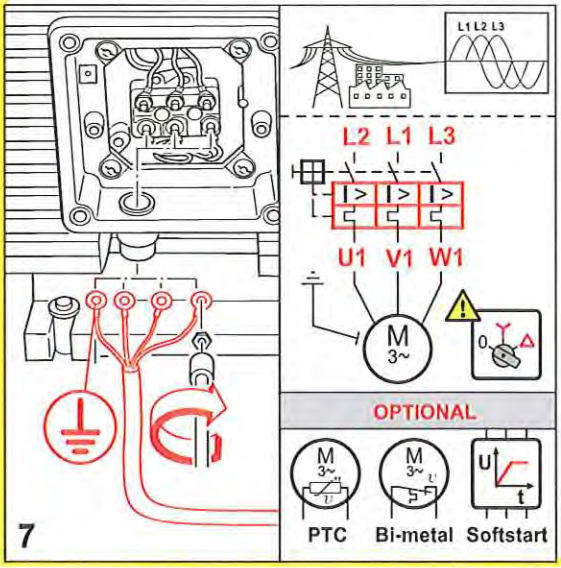
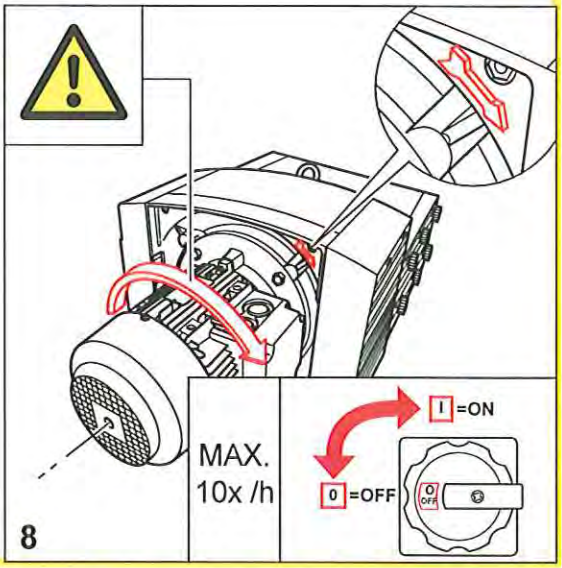
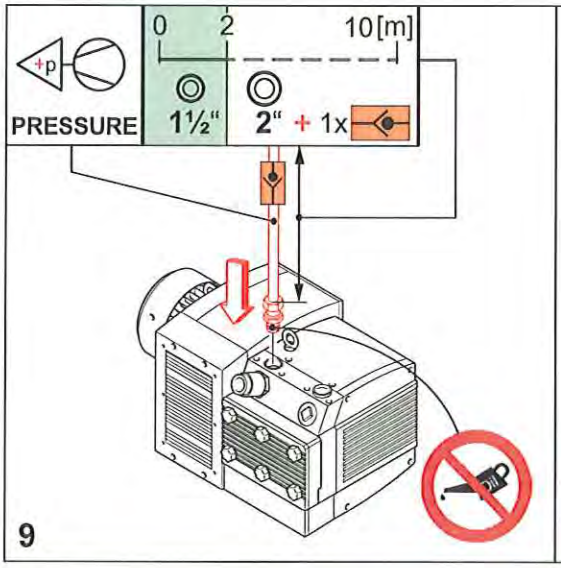
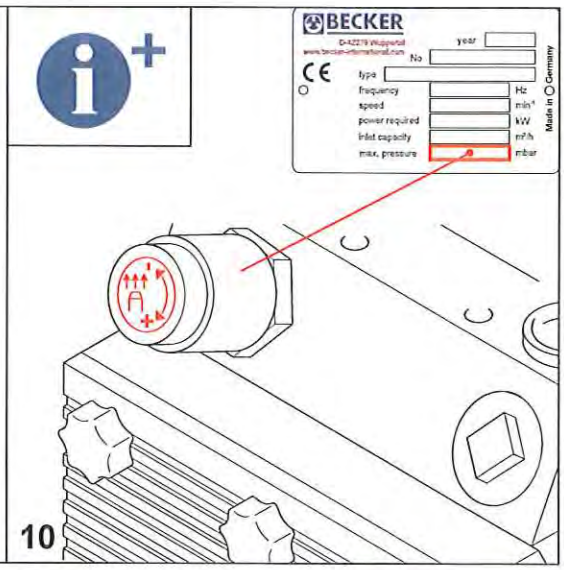
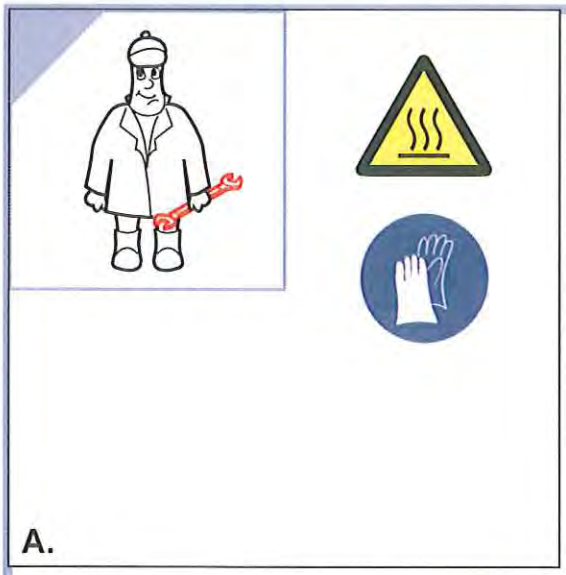

BECKER
50 Hz
60 Hz
6

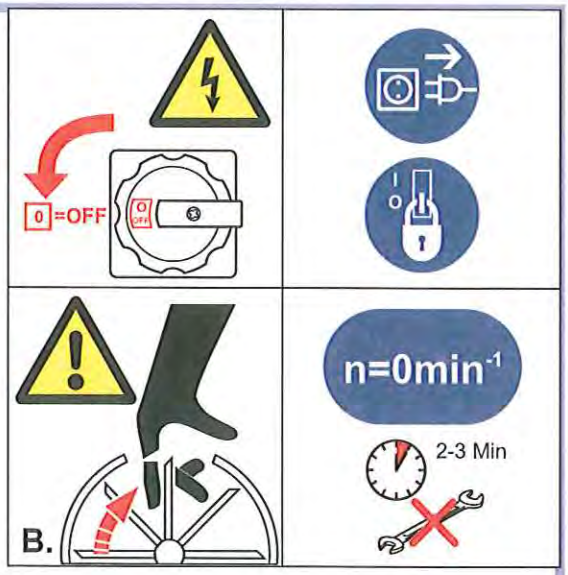

L1 L2 L3
L2 L1 L3
U1 V1 W1
M
3~
OPTIONAL
PTC
Bi-metal
Softstart
7

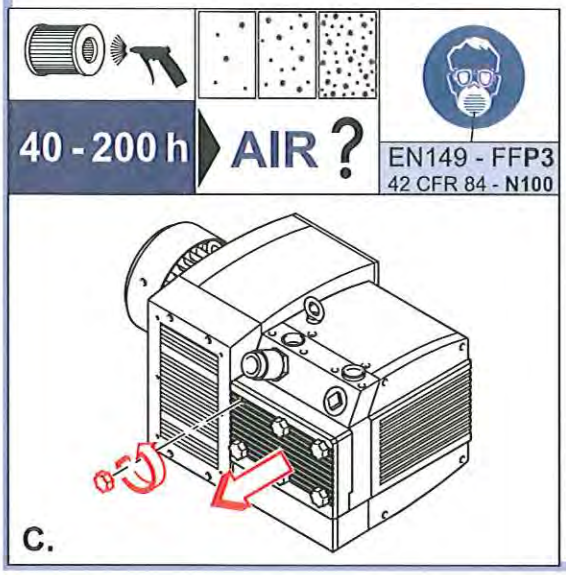

MAX.
10x /h
I =ON
0 =OFF
8

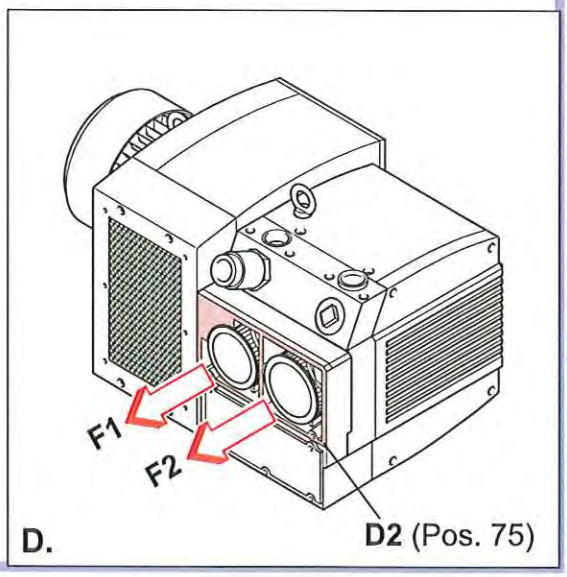

PRESSURE
0
2
10[m]
1½"
2" + 1x
9

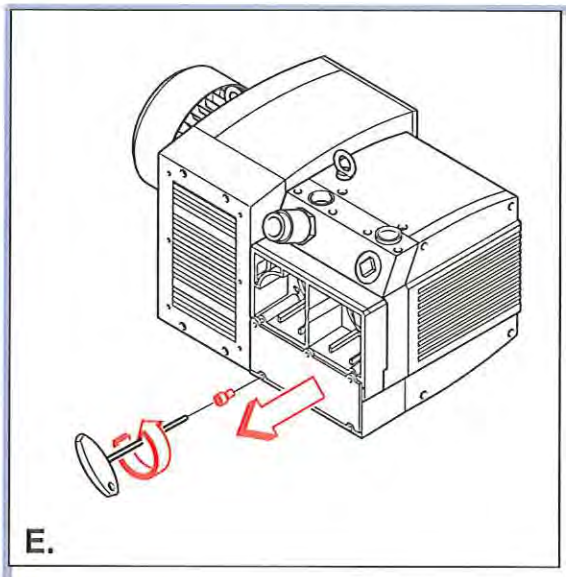

BECKER
year
No
type
frequency
speed
power required
inlet capacity
max. pressure
Hz
min⁻¹
kW
m³/h
mbar
Made in Germany
10


A.


0 =OFF
n=0min-1
2-3 Min
B.


40 - 200 h
AIR ?
EN149 - FFP3
42 CFR 84 - N100
C.


F1
F2
D2 (Pos. 75)
D.



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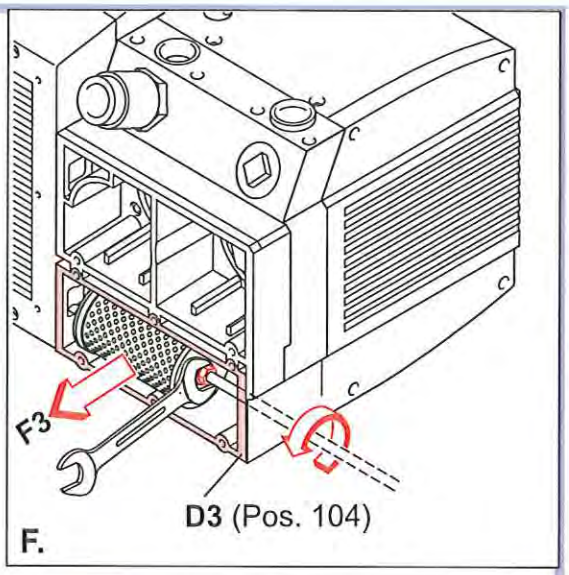

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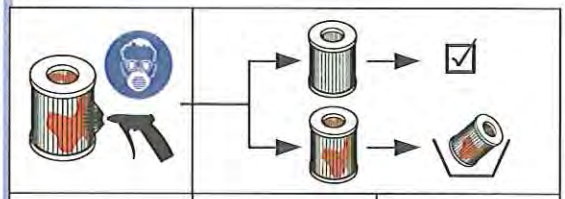

F1 = F2 (standard)	F2* (polyester) KDT 3.140/**6**	F3 (standard)
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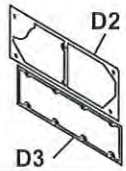
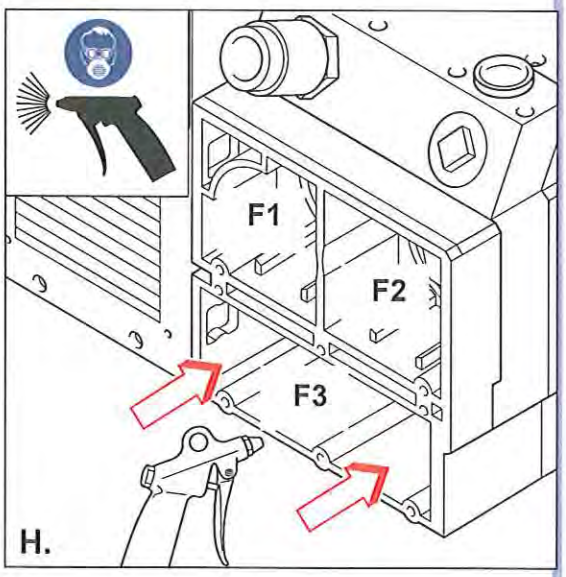


Satz / Kit
Pos.: 17, 20, 24, 62, **75**, 76, 85, 86, **104**, 122, 125, 126, 146

No.: **549000 21300**



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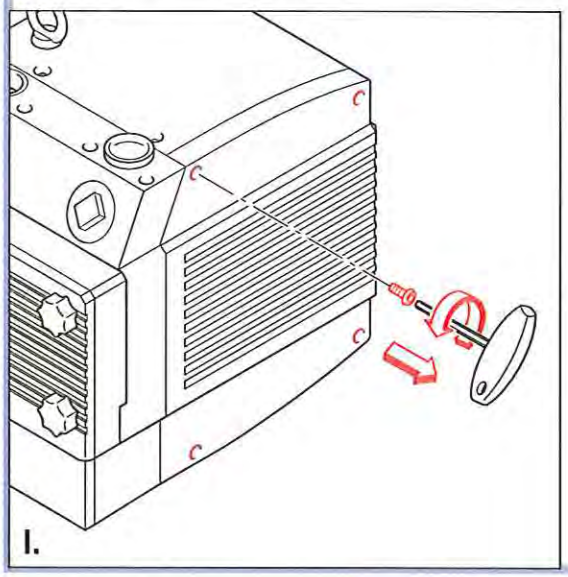

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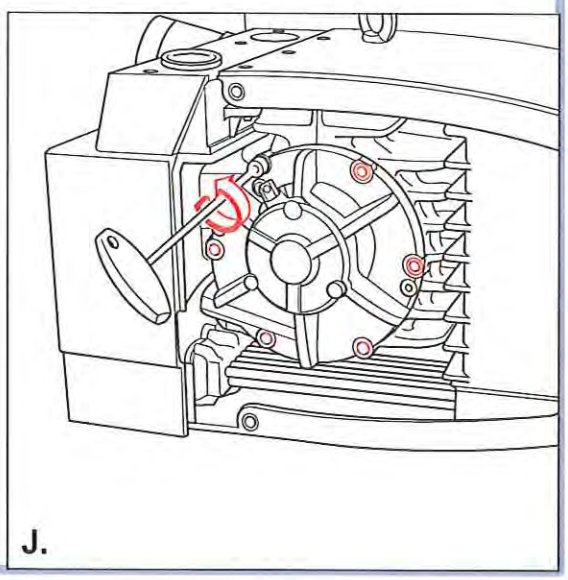

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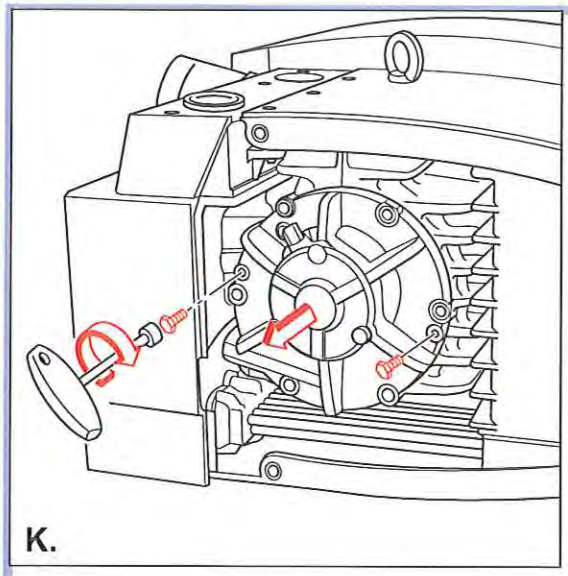
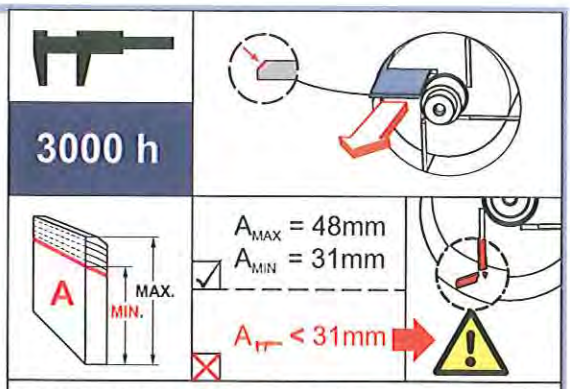
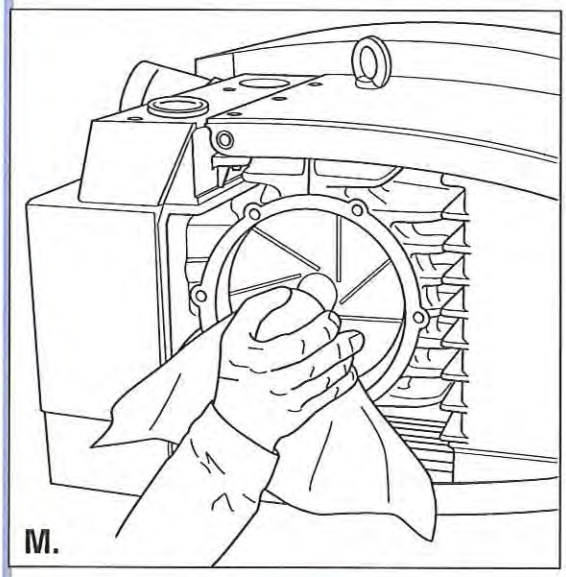


K.



KDT 3.140 (**standard**)	→	No. 90133400004 **(SET)**
KDT 3.140/**0-52**	→	No. 90138100004 **(SET)**
KDT 3.140/**6**	→	" "
KDT 3.140/**6-29**	→	No. 90138100007 **(SET)**
KDT 3.140/**6-71**	→	" "
KDT 3.140/**6-71 HD**	→	No. 90138500007 **(SET)**



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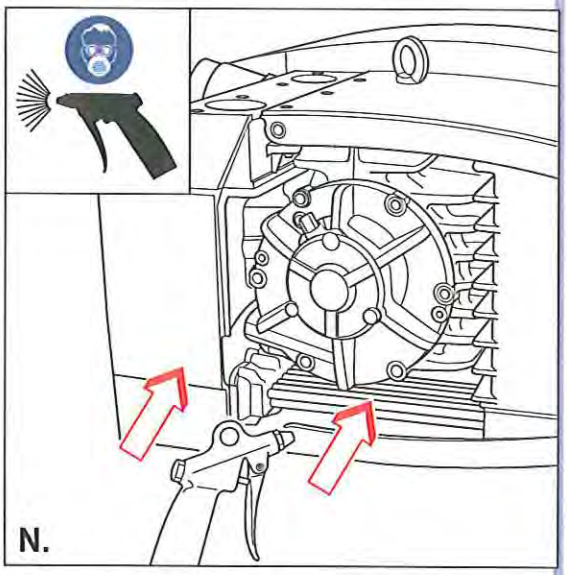

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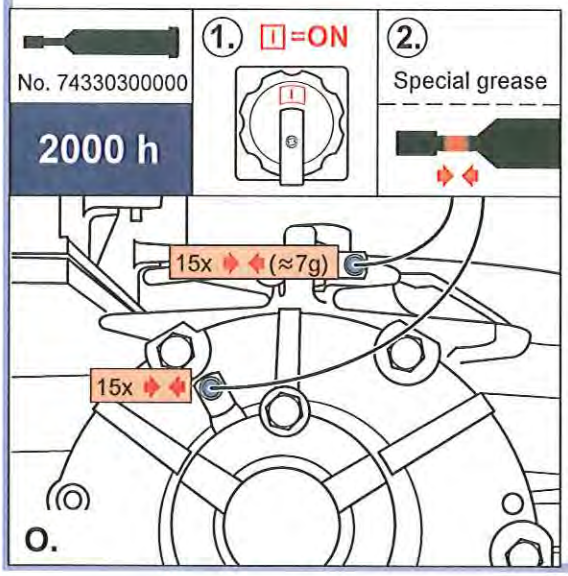

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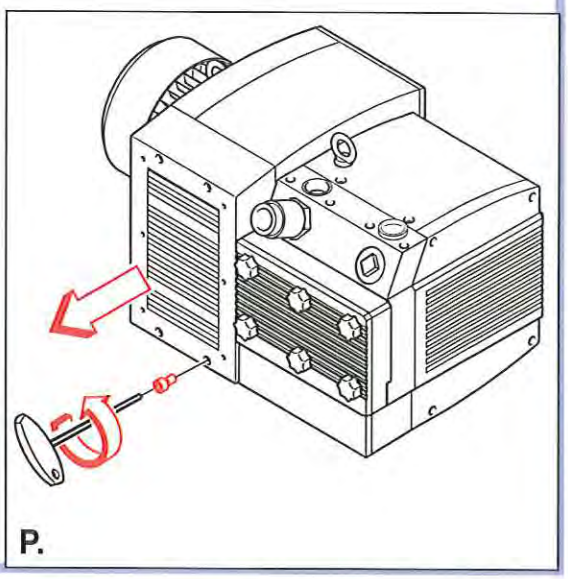

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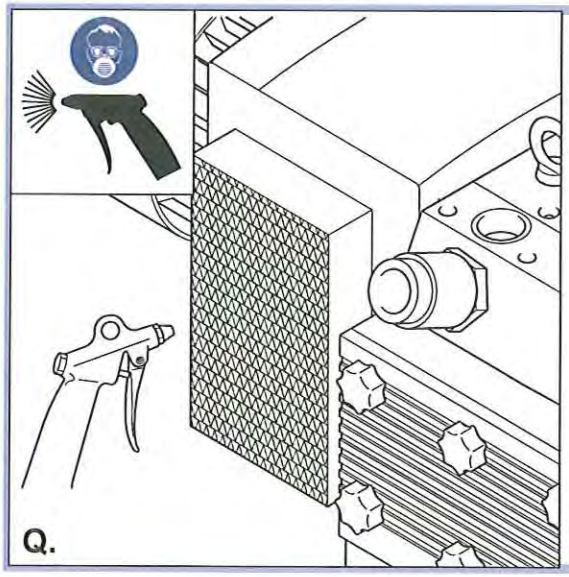

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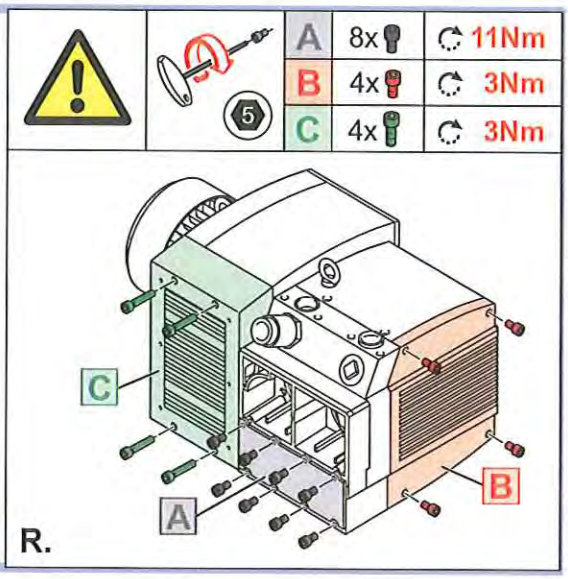


R.

BECKER

Gebr. Becker GmbH
Hölker Feld 29-31
D-42279 Wuppertal
info@becker-international.com

SERVICE

www.becker-international.com

Sales and service network

Recommended Maintenance Intervals

Pressure Pumps - Dry

BECKER
VACUUM PUMPS • COMPRESSORS

RecMI-pressure-dry.pdf

Maintenance Intervals on Becker KDT 3.140 Series Pumps

Every 50 Hours

*Check and clean air intake filters. Replace if Necessary.

9 months to Yearly

*Check discharge filter. Replace if Necessary.
*Check Vanes for minimum width (1.6"). Replace if necessary.
*Inspect vanes for improper wear. Replace if necessary.
*Inspect teflon tube seals in end shield. If the hollow center shows through, replace them.
* Examine end shield surface for excessive grease build-up. If evident, check shaft seal. If shaft seal is OK, extend the grease intervals or use less grease. Excessive grease will cause vane failure.
* Inspect grease in bearing cavity of end shield. If the grease is dried out or burnt in color, bearing needs to be grease more often. Use ONLY amblygon TA 15/2 grease
*Wipe grease off rotor shaft before re-installing the end shield.
* Grease B-side bearing if needed.

Every 3000 to 4000 Hours

*Inspect motor coupling. Replace if necessary.
*Grease bearings, while pump is running, 6 or 7 pumps of the grease gun per fitting.

4/06

SECTION - 2

Vapor Extraction System

B-1 & B-2

ROOTS™ Universal RAI Rotary Positive Blowers

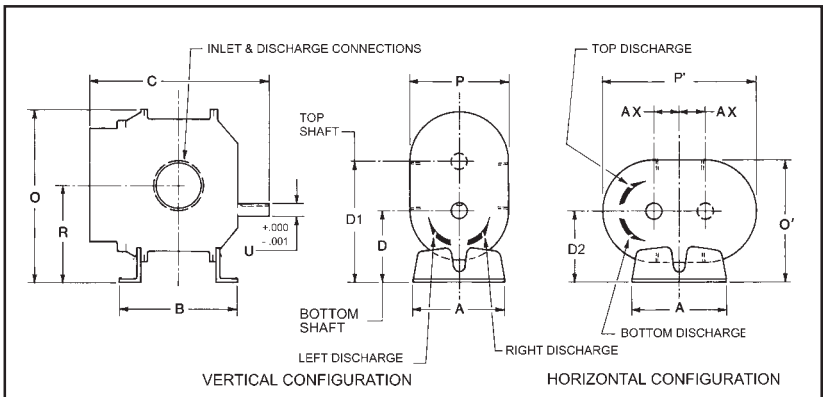
Frames 22 thru 718

OPERATING PRINCIPLE

Two figure-eight lobe impellers mounted on parallel shafts rotate in opposite directions. As each impeller passes the blower inlet, it traps a definite volume of air and carries it around the case to the blower outlet, where the air is discharged. With constant speed operation, the displaced volume is essentially the same regardless of pressure, temperature or barometric pressure.

Timing gears control the relative position of the impellers to each other and maintain small but definite clearances. This allows operation without lubrication being required inside the gas casing.

OUTLINE DRAWING & DIMENSIONAL TABLE



Frame Size	A	B	C	Drive Shaft Location			O	O'	P	P'	R	U	Keyway	Inlet & disch. Dia.	AX	Approx. Net Wt. (lbs.)
				D	D1	D2										
22	5.13	5.00	9.75	3.75	6.25	3.75	9.63	6.88	6.25	9.25	5.00	.625	.188 x .094	1.0 NPT	1.25	32
24	5.13	7.00	11.75	3.75	6.25	3.75	9.63	6.88	6.25	9.25	5.00	.625	.188 x .094	2.0 NPT	1.25	43
32	7.25	6.75	11.25	5.00	8.50	5.00	12.81	8.88	7.75	12.13	6.75	.750	.188 x .094	1.25 NPT	1.75	69
33	7.25	7.63	12.13	5.00	8.50	5.00	12.81	8.88	7.75	12.13	6.75	.750	.188 x .094	2.0 NPT	1.75	74
36	7.25	10.00	14.63	5.00	8.50	5.00	12.81	8.88	7.75	12.13	6.75	.750	.188 x .094	2.5 NPT	1.75	102
42	8.00	7.25	13.00	6.25	10.25	6.25	15.06	10.63	8.75	13.63	8.25	.875	.188 x .094	1.5 NPT	2.00	88
45	8.00	10.00	15.50	6.25	10.25	6.25	15.06	10.63	8.75	13.63	8.25	.875	.188 x .094	2.5 NPT	2.00	109
47	8.00	11.75	17.63	6.25	10.25	6.25	15.06	10.50	8.50	13.63	8.25	.875	.188 x .094	3.0 NPT	2.00	128
53	10.50	8.38	15.38	6.25	11.25	6.75	17.38	11.88	10.25	17.25	8.75	1.125	.250 x .125	2.5 NPT	2.50	143
56	10.50	11.00	18.00	6.25	11.25	6.75	17.38	12.25	11.00	17.25	8.75	1.125	.250 x .125	4.0 NPT	2.50	170
59	10.50	14.00	21.18	6.25	11.25	6.75	17.38	12.25	11.00	17.25	8.75	1.125	.250 x .125	4.0 NPT	2.50	204
65	11.00*	10.00	18.38	8.75	14.75	8.75	21.63	15.13	12.75	19.75	11.75	1.375	.312 x .156	3.0 NPT	3.00	245
615	11.00*	20.00	28.38	8.75	14.75	8.75	21.63	16.25	15.00	19.75	11.75	1.375	.312 x .156	6.0 FLG	3.00	425
711	14.00**	16.75	25.19	11.00	18.00	11.00	26.13	19.50	17.00	23.25	14.50	1.562	.375 x .188	6.0 FLG	3.50	530
718	14.00**	23.75	32.19	11.00	18.00	11.00	26.13	19.50	17.00	23.25	14.50	1.562	.375 x .188	8.0 FLG	3.50	650

BASIC BLOWER DESCRIPTION

Universal RAI blowers are heavy duty rotary blowers designed with detachable rugged steel mounting feet, which permit easy in-field adaptability to either vertical or horizontal installation requirements.

Because of the detachable mounting feet, these units can be easily adapted to any of four drive shaft positions - right hand, left hand, bottom or top. The compact, sturdy design is engineered for continuous service when operated in accordance with speed and pressure ratings.

The basic model consists of a cast iron casing, carburized and ground alloy steel spur timing gears secured to steel shafts with a taper mounting and locknut, and cast iron involute impellers. Oversized antifriction bearings are used, with a cylindrical roller bearing at the drive shaft to withstand V-belt pull. The Universal RAI features thrust control, with splash oil lube on the gear end and grease lube on the drive end. After standard tests, the unit is sprayed with a protective paint and boxed or placed on skids.

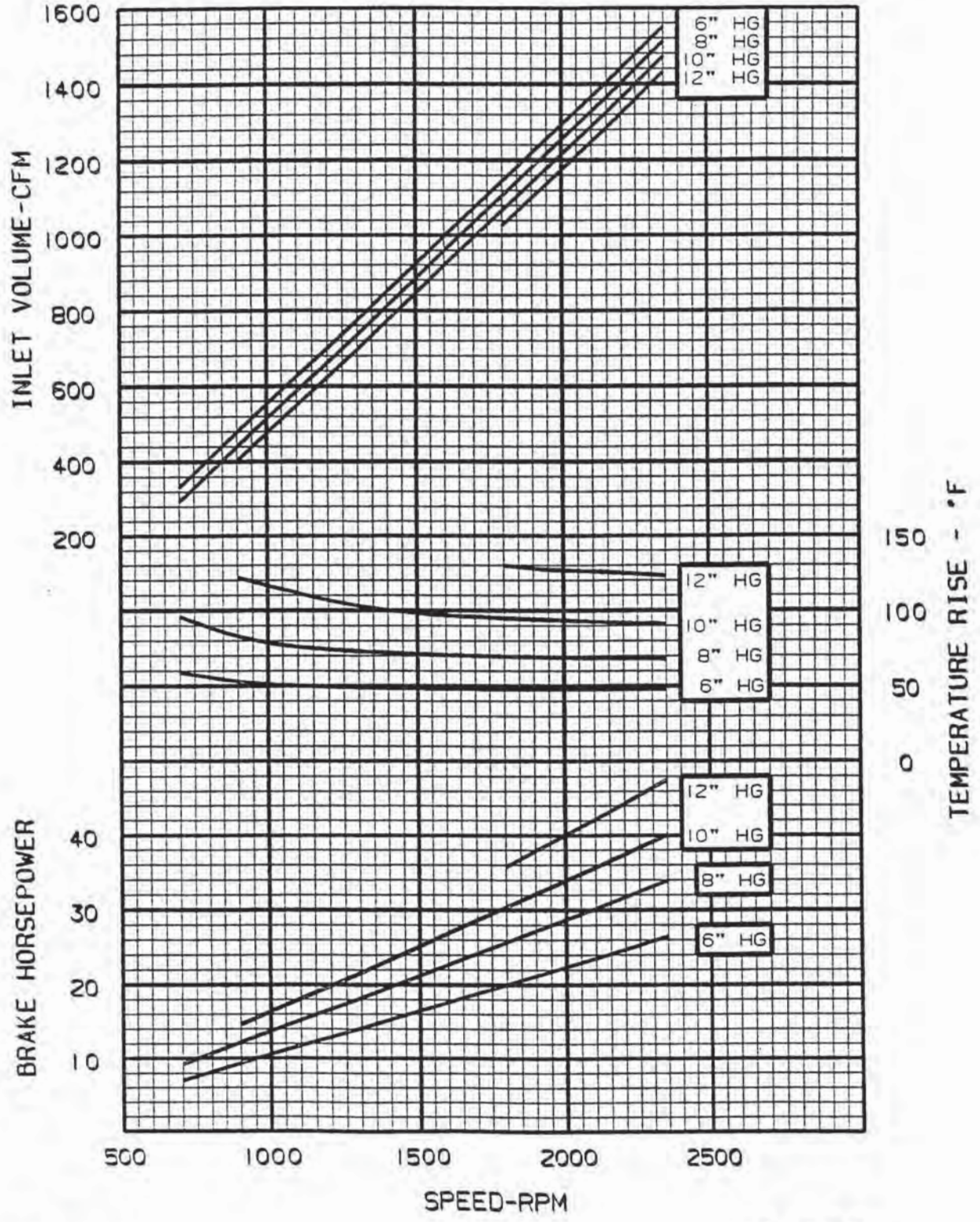
Available accessories include driver, relief valve, inlet and discharge silencer, inlet filter, check valve, extended base, V-belt or flexible coupling and drive guards.

DRESSER
Roots

DRESSER INDUSTRIES, INC.
ROOTS DIVISION
900 WEST MOUNT STREET
CONNERSVILLE, INDIANA 47331
PRINTED IN U.S.A.

PERFORMANCE BASED ON
INLET AIR = 68°F
DISCHARGE PRESSURE = 30" HG ABS.
JULY, 1994

VACUUM PERFORMANCE
FRAME 615 UNIVERSAL RAI BLOWER
MAXIMUM VACUUM=12 IN. HG
MAXIMUM SPEED=2350 RPM



/PARTS2/CRVE

VC-12-615

BLOWERS EXHAUSTERS COMPRESSORS

ROOTS™

US $3.00, Canada $4.50

Universal RAI®, URAI-DSL, URAI-G and Metric Series

Contents

Do These Things To Get The Most From Your ROOTS® blower

- ❑ Check shipment for damage. If found, file claim with carrier and notify ROOTS.
- ❑ Unpack shipment carefully, and check contents against Packing List. Notify ROOTS if a shortage appears.
- ❑ Store in a clean, dry location until ready for installation. Lift by methods discussed under INSTALLATION to avoid straining or distorting the equipment. Keep covers on all openings. Protect against weather and corrosion if outdoor storage is necessary.
- ❑ Read OPERATING LIMITATIONS and INSTALLATION sections in this manual and plan the complete installation.
- ❑ Provide for adequate safeguards against accidents to persons working on or near the equipment during both installation and operation. See SAFETY PRECAUTIONS.
- ❑ Install all equipment correctly. Foundation design must be adequate and piping carefully done. Use recommended accessories for operating protection.
- ❑ **Make sure both driving and driven equipment is correctly lubricated before start-up. See LUBRICATION.**
- ❑ Read starting check points under OPERATION. Run equipment briefly to check for installation errors and make corrections. Follow with a trial run under normal operating conditions.
- ❑ In event of trouble during installation or operation, do not attempt repairs of ROOTS furnished equipment. Notify ROOTS, giving all nameplate information plus an outline of operating conditions and a description of the trouble. Unauthorized attempts at equipment repair may void ROOTS warranty.
- ❑ Units out of warranty may be repaired or adjusted by the owner. Good inspection and maintenance practices should reduce the need for repairs.

NOTE: Information in this manual is correct as of the date of publication. ROOTS reserves the right to make design or material changes without notice, and without obligation to make similar changes on equipment of prior manufacture.

For your nearest ROOTS Office, dial our Customer Service Hot Line toll free; 1 877 363 ROOT(S) (7668) or direct 281-966-4700.

ISRB-2002 rev.0705
(formerly IOM-180-205)

DRESSER®
Roots

ROOTS® products are sold subject to the current General Terms of Sale, GTS-5001 and Warranty Policy WP-5020. Copies are available upon request.
Contact your local ROOTS Office or ROOTS Customer Service Hot Line 1-877-363-ROOT(S) (7668) or direct 281-966-4700.

Safety Precautions

It is important that all personnel observe safety precautions to minimize the chances of injury. Among many considerations, the following should be particularly noted:

- Blower casing and associated piping or accessories may become hot enough to cause major skin burns on contact.
- Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. Do not reach into any opening in the blower while it is operating, or while subject to accidental starting. Protect external moving parts with adequate guards.
- Disconnect power before doing any work, and avoid bypassing or rendering inoperative any safety or protective devices.
- If blower is operated with piping disconnected, place a strong coarse screen over the inlet and avoid standing in the discharge air stream. **CAUTION: Never cover the blower inlet with your hand or other part of body.**
- Stay clear of the blast from pressure relief valves and the suction area of vacuum relief valves.
- Use proper care and good procedures in handling, lifting, installing, operating and maintaining the equipment.
- Casing pressure must not exceed 25 PSI (1725 mbar) gauge. Do not pressurize vented cavities from an external source, nor restrict the vents without first consulting ROOTS.
- Do not use air blowers on explosive or hazardous gases.
- Other potential hazards to safety may also be associated with operation of this equipment. All personnel working in or passing through the area should be trained to exercise adequate general safety precautions.

Operating Limitations

A ROOTS blower or exhauster must be operated within certain approved limiting conditions to enable continued satisfactory performance. Warranty is contingent on such operation.

Maximum limits for pressure, temperature and speed are specified in TABLE 1 for various models & sizes of blowers & exhausters. These limits apply to all units of normal construction, when operated under standard atmospheric conditions. Be sure to arrange connections or taps for instruments, thermometers and pressure or vacuum gauges at or near the inlet and discharge connections of the unit. These, along with a tachometer, will enable periodic checks of operating conditions.

PRESSURE – The pressure rise, between inlet and discharge, must not exceed the figure listed for the specific unit frame size concerned. Also, in any system where the unit inlet is at a positive pressure above atmosphere a maximum case rating of 25 PSI gauge (1725 mbar) should not be exceeded without first consulting the ROOTS. Never should the maximum allowable differential pressure be exceeded.

On vacuum service, with the discharge to atmospheric pressure, the inlet suction or vacuum must not be greater than values listed for the specific frame size.

TEMPERATURE – Blower & exhauster frame sizes are approved only for installations where the following temperature limitations can be maintained in service:

- Measured temperature rise must not exceed listed values when the inlet is at ambient temperature. Ambient is considered as the general temperature of the space around the unit. This is not outdoor temperature unless the unit is installed outdoors.
- If inlet temperature is higher than ambient, the listed allowable temperature rise values must be reduced by 2/3 of the difference between the actual measured inlet temperature and the ambient temperature.
- The average of the inlet and discharge temperature must not exceed 250°F. (121°C).
- The ambient temperature of the space the blower/motor is installed in should not be highter than 120°F (48.8°C).

SPEED – These blowers & exhausters may be operated at speeds up to the maximum listed for the various frame sizes. They may be direct coupled to suitable constant speed drivers if pressure/temperature conditions are also within limits. At low speeds, excessive temperature rise may be a limiting factor.

Special Note: The listed maximum allowable temperature rise for any particular blower & exhauster may occur well before its maximum pressure or vacuum rating is reached. This may occur at high altitude, low vacuum or at very low speed. The units' operating limit is always determined by the maximum rating reached first. It can be any one of the three: Pressure, Temperature or Speed.

Installation

ROOTS blowers & exhausters are treated after factory assembly to protect against normal atmospheric corrosion. The maximum period of internal protection is considered to be one year under average conditions, if shipping plugs & seals are not removed. Protection against chemical or salt water atmosphere is not provided. Avoid opening the unit until ready to start installation, as corrosion protection will be quickly lost due to evaporation.

If there is to be an extended period between installation and start up, the following steps should be taken to ensure corrosion protection.

- ❑ Coat internals of cylinder, gearbox and drive end bearing reservoir with Nox-Rust VCI-10 or equivalent. Repeat once a year or as conditions may require. Nox-Rust VCI-10 is petroleum soluble and does not have to be removed before lubricating. It may be obtained from Daubert Chemical Co., 2000 Spring Rd., Oak Brook, Ill. 60521.

- ❑ Paint shaft extension, inlet and discharge flanges, and all other exposed surfaces with Nox-Rust X-110 or equivalent.

- ❑ Seal inlet, discharge, and vent openings. It is not recommended that the unit be set in place, piped to the system, and allowed to remain idle for extended periods. If any part is left open to the atmosphere, the Nox-Rust VCI-10 vapor will escape and lose its effectiveness.

- ❑ Protect units from excessive vibration during storage.

- ❑ Rotate shaft three or four revolutions every two weeks.

- ❑ Prior to start up, remove flange covers on both inlet and discharge and inspect internals to insure absence of rust. Check all internal clearances. Also, at this time, remove gearbox and drive end bearing cover and inspect gear teeth and bearings for rust.

Because of the completely enclosed unit design, location of the installation is generally not a critical matter. A clean, dry and protected indoor location is preferred. However, an outdoor location will normally give satisfactory service. Important requirements are that the correct grade of lubricating oil be provided for expected operating temperatures, and that the unit be located so that routine checking and servicing can be performed conveniently. Proper care in locating driver and accessory equipment must also be considered.

Supervision of the installation by a ROOTS Service Engineer is not usually required for these units. Workmen with experience in installing light to medium weight machinery should be able to produce satisfactory results. Handling of the equipment needs to be accomplished with care, and in compliance with safe practices. Unit mounting must be solid, without strain or twist, and air piping must be clean, accurately aligned and properly connected.

Bare-shaft Units: Two methods are used to handle a unit without base. One is to use lifting lugs bolted into the top of the unit headplates. Test them first for tightness and fractures by tapping with a hammer. In lifting, keep the direction of cable pull on these bolts as nearly vertical as possible. If lifting lugs are not available, lifting slings may be passed under the cylinder adjacent to the headplates. Either method prevents strain on the extended drive shaft.

Packaged Units: When the unit is furnished mounted on a baseplate, with or without a driver, use of lifting slings passing under the base flanges is required. Arrange these slings so that no strains are placed on the unit casing or mounting feet, or on any mounted accessory equipment. **DO NOT** use the lifting lugs in the top of the unit headplates.

Before starting the installation, remove plugs, covers or seals from unit inlet and discharge connections and inspect the interior completely for foreign material. If cleaning is required, finish by washing the cylinder, headplates and impeller thoroughly with a petroleum solvent. Turn the drive shaft by hand to make sure that the impellers turn freely at all points. Anti-rust compound on the connection flanges and drive shaft extension may also be removed at this time with the same solvent. Cover the flanges until ready to connect piping.

Mounting

Care will pay dividends when arranging the unit mounting. This is especially true when the unit is a “bare-shaft” unit furnished without a baseplate. The convenient procedure may be to mount such a unit directly on a floor or small concrete pad, but this generally produces the least satisfactory results. It definitely causes the most problems in leveling and alignment and may result in a “Soft Foot” condition. Correct soft foot before operation to avoid unnecessary loading on the casing and bearings. Direct use of building structural framing members is not recommended.

For blowers without a base, it is recommended that a well anchored and carefully leveled steel or cast iron mounting plate be provided. The plate should be at least 1 inch (25 mm) thick, with its top surface machined flat, and large enough to provide leveling areas at one side and one end after the unit is mounted. It should have properly sized studs or tapped holes located to match the unit foot drilling. Proper use of a high quality machinist’s level is necessary for adequate installation.

With the mounting plate in place and leveled, set the unit on it without bolting and check for rocking. If it is not solid, determine the total thickness of shims required under one foot to stop rocking. Place half of this under each of the diagonally-opposite short feet, and tighten the mounting studs or screws. Rotate the drive shaft to make sure the impellers turn freely. If the unit is to be direct coupled to a driving motor, consider the height of the motor shaft and the necessity for it to be aligned very accurately with the unit shaft. Best unit arrangement is directly bolted to the mounting plate while the driver is on shims of at least 1/8 inch (3mm) thickness. This allows adjustment of motor position in final shaft alignment by varying the shim thickness.

Aligning

When unit and driver are factory mounted on a common baseplate, the assembly will have been properly aligned and is to be treated as a unit for leveling purposes. Satisfactory

installation can be obtained by setting the baseplate on a concrete slab that is rigid and free of vibration, and leveling the top of the base carefully in two directions so that it is free of twist. The slab must be provided with suitable anchor bolts. The use of grouting under and partly inside the leveled and shimmed base is recommended.

It is possible for a base-mounted assembly to become twisted during shipment, thus disturbing the original alignment. For this reason, make the following checks after the base has been leveled and bolted down. Disconnect the drive and rotate the unit shaft by hand. It should turn freely at all points. Loosen the unit foot hold-down screws and determine whether all feet are evenly in contact with the base. If not, insert shims as required and again check for free impeller rotation. Finally, if unit is direct coupled to the driver, check shaft and coupling alignment carefully and make any necessary corrections.

In planning the installation, and before setting the unit, consider how piping arrangements are dictated by the unit design and assembly. Drive shaft rotation must be established accordingly and is indicated by an arrow near the shaft.

Typical arrangement on vertical units has the drive shaft at the top with counterclockwise rotation and discharge to the left. Horizontal units are typically arranged with the drive shaft at the left with counterclockwise rotation and discharge down. See Figure 4 for other various unit arrangements and possible conversions.

When a unit is DIRECT COUPLED to its driver, the driver RPM must be selected or governed so as not to exceed the maximum speed rating of the unit. Refer to Table 1 for allowable speeds of various unit sizes.

A flexible type coupling should always be used to connect the driver and unit shafts.

When direct coupling a motor or engine to a blower you must insure there is sufficient gap between the coupling halves and the element to prevent thrust loading the blower bearings. When a motor, engine or blower is operated the shafts may expand axially. If the coupling is installed in such a manner that there is not enough room for expansion the blower shaft can be forced back into the blower and cause the impeller to contact the gear end headplate resulting in damage to the blower. The two shafts must be in as near perfect alignment in all directions as possible, and the gap must be established with the motor armature on its electrical center if end-play exists. Coupling manufacturer's recommendations for maximum misalignment, although acceptable for the coupling, are normally too large to achieve smooth operation and maximum life of the blower.

The following requirements of a good installation are recommended. When selecting a coupling to be fitted to the blower shaft ROOTS recommends a taper lock style coupling to insure proper contact with the blower shaft. If the coupling must have a straight bore the coupling halves must be fitted to the two shafts with a line to line thru .001" interference fit. Coupling halves must be warmed up per coupling manufacturer's recommendations. Maximum deviation in offset alignment of the shafts should not exceed .005" (.13 mm) total indicator reading, taken on the two coupling hubs. Maximum deviation from parallel of the inside coupling faces should not exceed .001" (.03 mm) when checked at six points around the coupling.

When a unit is BELT DRIVEN, the proper selection of sheave diameters will result in the required unit speed. When selecting a sheave to be fitted to the blower shaft ROOTS recommends a taper lock style sheave to insure proper contact with the blower shaft. This flexibility can lead to operating temperature problems caused by unit speed being too low. Make sure the drive speed selected is within the allowable range for the specific unit size, as specified under Table 1.

Belt drive arrangements usually employ two or more V-belts running in grooved sheaves. Installation of the driver is less critical than for direct coupling, but its shaft must be level and parallel with the unit shaft. **The driver should be mounted on the inlet side of a vertical unit (horizontal piping) and on the side nearest to the shaft on a horizontal unit. SEE PAGE 6 - Acceptable Blower Drive Arrangement Options.** The driver must also be mounted on an adjustable base to permit installing, adjusting and removing the V-belts. To position the driver correctly, both sheaves need to be mounted on their shafts and the nominal shaft center distance known for the belt lengths to be used.

CAUTION: Drive couplings and sheaves (pulleys) should have an interference fit to the shaft of the blower (set screw types of attachment generally do not provide reliable service.) It is recommended that the drive coupling or sheave used have a taper lock style bushing which is properly sized to provide the correct interference fit required. Drive couplings, that require heating to fit on the blower shaft, should be installed per coupling manufacturer recommendations. A drive coupling or sheave should not be forced on to the shaft of the blower as this could affect internal clearances resulting in damage to the blower.

Engine drive applications often require special consideration to drive coupling selection to avoid harmful torsional vibrations. These vibrations may lead to blower damage if not dampened adequately. It is often necessary to install a flywheel and/or a torsionally soft elastic element coupling based on the engine manufacturer recommendations.

The driver sheave should also be mounted as close to its bearing as possible, and again should fit the shaft correctly. Position the driver on its adjustable base so that 2/3 of the total movement is available in the direction away from the unit, and mount the assembly so that the face of the sheave is accurately in line with the unit sheave. This position minimizes belt wear, and allows sufficient adjustment for both installing and tightening the belts. After belts are installed, adjust their tension in accordance with the manufacturer's instructions. However, only enough tension should be applied to prevent slippage when the unit is operating under load. Excessive tightening can lead to early bearing concerns or shaft breakage.

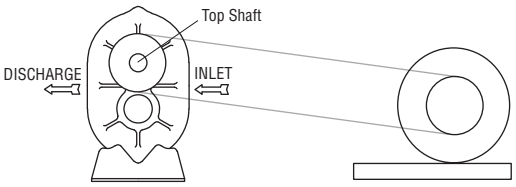
Before operating the drive under power to check initial belt tension, first remove covers from the unit connections. Make sure the interior is still clean, then rotate the shaft by hand. Place a coarse screen over the inlet connection to prevent anything being drawn into the unit while it is operating, and avoid standing in line with the discharge opening. Put oil in the sumps per instructions under **LUBRICATION.**

Piping

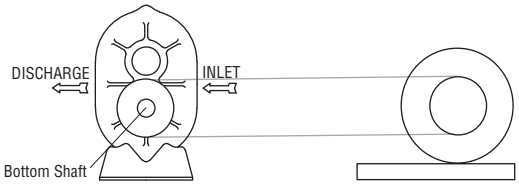
Before connecting piping, remove any remaining anti-rust compound from unit connections. Clean pipe should be no

Acceptable Blower Drive Arrangement Options

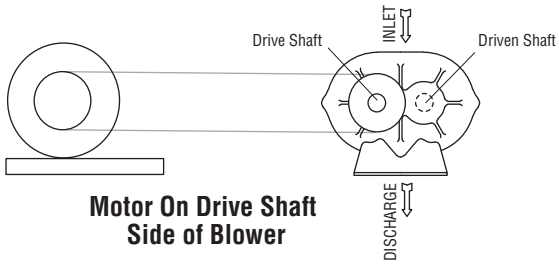
ACCEPTABLE



Motor On Inlet Side of Blower (Top Shaft)

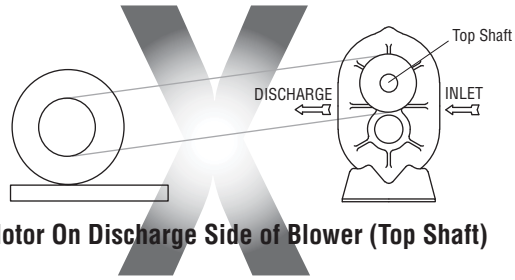


Motor On Inlet Side of Blower (Bottom Shaft)

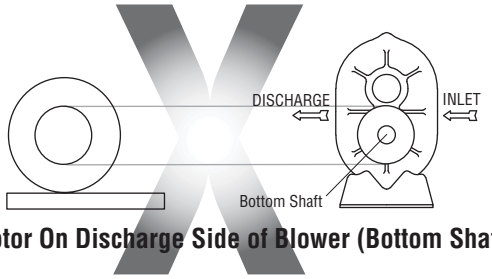


Motor On Drive Shaft Side of Blower

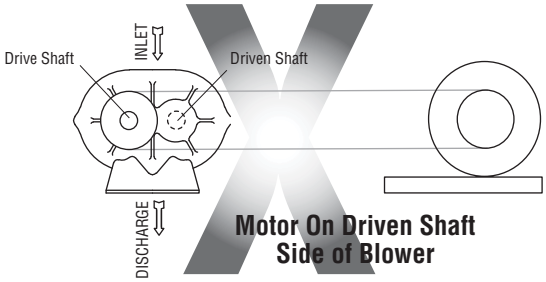
UNACCEPTABLE



Motor On Discharge Side of Blower (Top Shaft)



Motor On Discharge Side of Blower (Bottom Shaft)



Motor On Driven Shaft Side of Blower

smaller than unit connections. In addition, make sure it is free of scale, cuttings, weld beads, or foreign material of any kind. To further guard against damage to the unit, especially when an inlet filter is not used, install a substantial screen of 16 mesh backed with hardware cloth at or near the inlet connections. Make provisions to clean this screen of collected debris after a few hours of operation. It should be removed when its usefulness has ended, as the wire will eventually deteriorate and small pieces going into the unit may cause serious damage.

Pipe flanges or male threads must meet the unit connections accurately and squarely. DO NOT attempt to correct misalignment by springing or cramping the pipe. In most cases this will distort the unit casing and cause impeller rubbing. In severe cases it can prevent operation or result in a broken drive shaft. For similar reasons, piping should be supported near the unit to eliminate dead weight strains. Also, if pipe expansion is likely to occur from temperature change, installation of flexible connectors or expansion joints is advisable.

Figure 3 represents an installation with all accessory items that might be required under various operating conditions. Inlet piping should be completely free of valves or other restrictions. When a shut-off valve can not be avoided, make sure a full size vacuum relief is installed nearest the unit inlet. This will protect against unit overload caused by accidental closing of the shut-off valve.

Need for an inlet silencer will depend on unit speed and pressure, as well as sound-level requirements in the general surroundings. An inlet filter is recommended, especially in dusty or sandy locations. A discharge silencer is also normally suggested, even though Whispair units operate at generally lower noise levels than conventional rotary blowers. Specific recommendations on silencing can be obtained from your local ROOTS distributor.

Discharge piping requires a pressure relief valve, and should include a manual unloading valve to permit starting the unit under no-load conditions. Reliable pressure/vacuum gauges and good thermometers at both inlet and discharge are recommended to allow making the important checks on unit operating conditions. The back-pressure regulator shown in Figure 3 is useful mainly when volume demands vary while the unit operates at constant output. If demand is constant, but somewhat lower than the unit output, excess may be blown off through the manual unloading valve.

In multiple unit installations where two or more units operate with a common header, use of check valves is mandatory. These should be of a direct acting or free swinging type, with one valve located in each line between the unit and header. Properly installed, they will protect against damage from reverse rotation caused by air and material back-flow through an idle unit.

After piping is completed, and before applying power, rotate the drive shaft by hand again. If it does not move with uniform freedom, look for uneven mounting, piping strain, excessive belt tension or coupling misalignment.

DO NOT operate the unit at this time unless it has been lubricated per instructions.

Technical Supplement for 32, 33, 36, 42, 45, 47, 53, 56, 59, 65, 68, 615 Universal RAI-G blowers

ROOTS Universal RAI-G rotary positive gas blowers are a design extension of the basic Universal RAI blower model. URAI-G blower uses (4) mechanical seals in place of the standard inboard lip seals to minimize gas leakage into the atmosphere. The seal vent chambers are plugged. These units are intended for gases which are compatible with cast iron case material, steel shafts, 300/400 series stainless steel and carbon seal components, viton o-rings and the oil/grease lubricants. If there are any questions regarding application or operation of this gas blower, please contact factory.

Precaution: URAI-G blowers: Care must be used when opening the head plate seal vent chamber plugs (43) as some gas will escape–if it is a pressure system, or the atmospheric air will leak in-if the system is under vacuum. There is a possibility of some gas leakage through the mechanical seals. This leakage on the gear end will escape through the gear box vent, and on the drive end, through the grease release fittings. If the gas leakage is undesirable, each seal chamber must be purged with an inert gas through one purge gas hole (43) per seal . There are two plugged purge gas holes(1/8 NPT) provided per seal. The purge gas pressure must be maintained one psi above the discharge gas pressure. Also, there exists a possibility of gear end oil and drive end grease leakage into the gas stream.

The lubricants selected must be compatible with the gas.

URAI GAS Blower Oil and Grease Specifications

The specified oil should be ROOTS synthetic P/N 813-106- of the proper viscosity.

When servicing drive end bearings of a Gas blower, use the specified NLGI #2 premium grade aluminum complex* grease, ROOTS P/N T20019001, with 300°F (149°C) service temperature and moisture resistance and good mechanical stability.

*ROOTS Synthetic Oil & Grease is superior in performance to petroleum based products. It has high oxidation stability, excellent corrosion protection, extremely high film strength and low coefficient of friction. Typical oil change intervals are increased 2-3 times over petroleum based lubricants. Also, ROOTS Synthetic Oil is 100% compatible with petroleum based oils. Simply drain the oil in the blower and refill the reservoirs with ROOTS Synthetic Oil to maintain optimum performance of your ROOTS blower.

For Units with a Grease Lubricated Drive End

A simple but very effective lubrication system is employed on the drive shaft end bearings. Hydraulic pressure relief fittings are provided to vent any excess grease, preventing pressure build-up on the seals. A restriction plug and metering orifice prevent loss of lubricant from initial surges in lubricant pressure but permit venting excess lubricant under steadily rising pressures.

When servicing drive end bearings of Non Gas blower, use the specified NLGI #2 premium grade microgel grease with 250°F (121°C) service temperature and moisture resistance and good mechanical stability. ROOTS specifies Shell Darina EP NLGI Grade 2. Product Code 71522.

URAI GAS Blower Oil and Grease Specifications

The specified oil should be ROOTS synthetic P/N 813-106- of the proper viscosity.

When servicing drive end bearings of a Gas blower, use the specified NLGI #2 premium grade aluminum complex* grease, ROOTS P/N T20019001, with 300°F (149°C) service temperature and moisture resistance and good mechanical stability.

NOTE: Lithium based greases are not compatible with the ROOTS Synthetic grease used when assembling a Gas blower or the non-soap base grease used when assembling a standard URAI blower. Lithium based grease is not approved for any ROOTS blowers.

Using a pressure gun, slowly force new lubricant into each drive end bearing housing until traces of clean grease comes out of the relief fitting. The use of an electric or pneumatic grease gun could force the grease in too rapidly and thus invert the seals and should not be used.

After a long shutdown, it is recommended that the grease fittings be removed, the old grease flushed out with kerosene or #10 lubricating oil, drained thoroughly, and bearings refilled with new grease. Be sure grease relief fittings are reinstalled. Grease should be added using a hand operated grease gun to the drive end bearings at varying time intervals depending on duty cycle and RPM. Table 4 has been prepared as a general greasing schedule guide based on average operating conditions. More frequent intervals may be necessary depending on the grease operating temperature and unusual circumstances.

For Units with Splash Lubrication on Both Ends

Bearings and oil seals are lubricated by the action of the timing gears or oil slingers which dip into the main oil sumps causing oil to splash directly on gears and into bearings and seals. A drain port is provided below each bearing to prevent an excessive amount of oil in the bearings. Seals located inboard of the bearings in each headplate effectively retain oil within the sumps. Any small leakage that may occur should the seals wear passes into a cavity in each vented headplate and is drained downward.

Oil sumps on each end of the blower are filled by removing top vent plugs, Item (25), and filling until oil reaches the middle of the oil level sight gauge, Item (45 or 53), or the overflow plug (see pages 14 and 15).

Initial filling of the sumps should be accomplished with the blower not operating, in order to obtain the correct oil level. Approximate oil quantities required for blowers of the various models and configurations are listed in Table 3. Use a good grade of industrial type non-detergent, rust inhibiting, antifoaming oil and of correct viscosity per Table 2. *ROOTS synthetic oil (ROOTS P/N 813-106-) is highly recommended. ROOTS does not recommend automotive type lubricants, as they are not formulated with the properties mentioned above.

The oil level should not fall below the middle of the site gauge or overflow plug on URAI (ref. pages 14 & 15) when the blower is idle. It may rise or fall on the gauge during operation, to an extent depending somewhat on oil temperature and blower speed.

Proper lubrication is usually the most important single consideration in obtaining maximum service life and satisfactory operation from the unit. Unless operating conditions are quite severe, a weekly check of oil level and necessary addition of lubricant should be sufficient. During the first week of operation, check the oil levels in the oil sumps about once a day, and watch for leaks. Replenish as necessary. Thereafter, an occasional check should be sufficient. It is recommended that the oil be changed after initial 100 hours of operation. Frequent oil changing is not necessary unless the blower is operated in a very dusty location.

Normal life expectancy of petroleum based oils is about 2000 hours with an oil temperature of about 180°F (82°C). As the oil temperature increases by increments of 15-18°F (8°C - 10°C), the life is reduced by half. Example: Oil temperatures of 210-216°F (99°C - 102°C) will produce life expectancy of 1/4 or 500 hours. Therefore, it is considered normal to have oil change periods of 500 hours with petroleum based oils.

Normal life expectancy of ROOTS™ Synthetic Oil is about 4000 to 8000 hours with an oil temperature of about 180°F (82°C). As the oil temperature increases by increments of 15-18°F (8°C - 10°C), the life is reduced by half. Example: Oil temperatures of 210-216°F (99°C - 102°C) will produce life expectancy of 1/4 or 1000 to 2000 hours.

NOTE: To estimate oil temperature, multiply the discharge temperature of the blower by 0.80. Example: if the discharge air temperature of the blower is 200° F, it is estimated that the oil temperature is 160° F.

*ROOTS™ Synthetic Oil & Grease is superior in performance to petroleum based products. It has high oxidation stability, excellent corrosion protection, extremely high film strength and low coefficient of friction. Typical oil change intervals are increased 2-3 times over petroleum based lubricants. Also, ROOTS™ Synthetic Oil is 100% compatible with petroleum based oils. Simply drain the oil in the blower and refill the reservoirs with ROOTS™ Synthetic Oil to maintain optimum performance of your ROOTS™ blower.

Operation

Before operating a blower under power for the first time, recheck the unit and the installation thoroughly to reduce the likelihood of avoidable troubles. Use the following procedure check list as a guide, but consider any other special conditions in the installation.

- ❑ Be certain that no bolts, tools, rags, or debris have been left in the blower air chamber or piping.
- ❑ If an outdoor intake without filter is used, be sure the opening is located so it cannot pick up dirt and is protected by a strong screen or grille. Use of the temporary protective screen as described under INSTALLATION is strongly recommended.
- ❑ Recheck blower leveling, drive alignment and tightness of all mounting bolts if installation is not recent. If belt drive is used, adjust belt tension correctly.
- ❑ Turn drive shaft by hand to make sure impellers still rotate without bumping or rubbing at any point.
- ❑ Ensure oil levels in the main oil sumps are correct.
- ❑ Check lubrication of driver. If it is an electric motor, be sure that power is available and that electrical overload devices are installed and workable.
- ❑ Open the manual unloading valve in the discharge air line. If a valve is in the inlet piping, be sure it is open.
- ❑ Bump blower a few revolutions with driver to check that direction of rotation agrees with arrow near blower shaft, and that both coast freely to a stop.

After the preceding points are cleared, blower is ready for trial operation under “no-load” conditions. The following procedure is suggested to cover this initial operation test period.

a. Start blower, let it accelerate to full speed, then shut off. Listen for knocking sounds, both with power on and as speed slows down.

b. After blower comes to a complete stop, repeat above, but let blower run 2 or 3 minutes. Check for noises, such as knocking sounds.

c. After blower comes to a complete stop, operate blower for about 10 minutes unloaded. Check oil levels. Observe cylinder and headplate surfaces for development of hot spots such as burned paint, indicating impeller rubs. Be aware of any noticeable increase in vibration.

Assuming that all trials have been satisfactory, or that necessary corrections have been made, the blower should now have a final check run of at least one hour under normal operating conditions. After blower is restarted, gradually close the discharge unloading valve to apply working pressure. At this point it is recommended that a pressure gauge or manometer be connected into the discharge line if not already provided, and that thermometers be in both inlet and discharge lines. Readings from these instruments will show whether pressure or temperature ratings of the blower are being exceeded.

During the final run, check operating conditions frequently and observe the oil levels at reasonable intervals. If excessive noise or local heating develops, shut down immediately and determine the cause. If either pressure rise or temperature rise across the blower exceeds the limit specified in this manual, shut down and investigate conditions in the piping system. Refer to the TROUBLESHOOTING CHECKLIST for suggestions on various problems that may appear.

The blower should now be ready for continuous duty operation at full load. During the first few days make periodic checks to determine whether all conditions remain steady, or at least acceptable. This may be particularly important if the blower is supplying air to a process system where conditions can vary. At the first opportunity, stop the blower and clean the temporary inlet protective screen. If no appreciable amount of debris has collected, the screen may be removed. See comments under INSTALLATION. At this same time, verify leveling, coupling alignment or belt tension, and mounting bolt tightness.

Should operating experience prove that blower capacity is a little too high for the actual air requirements, a small excess may be blown off continuously through the manual unloading or vent valve. Never rely on the pressure relief valve as an automatic vent. Such use may cause the discharge pressure to become excessive, and can also result in failure of the valve itself. If blower capacity appears to be too low, refer to the TROUBLESHOOTING CHECKLIST.

Vibration Assessment Criteria

With measurements taken at the bearing locations on the housings, see chart below for an appropriate assessment guide for rotary lobe blowers rigidly mounted on stiff foundations.

In general, blower vibration levels should be monitored on a regular basis and the vibration trend observed for progressive or sudden change in level. If such a change occurs, the cause should be determined through spectral analysis.

As shown on the chart below, the level of all pass vibration will determine the need to measure discrete frequency vibration levels and the action required.

All Pass Vibration (in/sec)	Discrete Frequency Vibration (in/sec)	Action
0.45 or less	N/R	Acceptable
Greater than 0.45 but 1.0 or less	0.45 or less @ any frequency	Acceptable
	Greater than 0.45 @ any frequency	Investigate
Greater than 1.0	Less than 1.0	Investigate
	Greater than 1.0	Investigate

Troubleshooting Checklist

Trouble	Item	Possible Cause	Remedy
No flow	1	Speed too low	Check by tachometer and compare with published performance
	2	Wrong rotation	Compare actual rotation with Figure 1 Change driver if wrong
	3	Obstruction in piping	Check piping, valves, silencer to assure open flow path
Low capacity	4	Speed too low	See item 1, If belt drive, check for slippage and readjust tension
	5	Excessive pressure rise	Check inlet vacuum and discharge pressure and compare with Published performance
	6	Obstruction in piping	See item 3
	7	Excessive slip	Check inside of casing for worn or eroded surfaces causing excessive clearances
Excessive power	8	Speed too high	Check speed and compare with published performance
	9	Excessive pressure rise	See Item 5
	10	Impeller rubbing	Inspect outside of cylinder for high temperature areas, then check for impeller contact at these points. Correct blower mounting, drive alignment
	11	Scale, sludge, rust or product build up	Clean blower appropriately
Damage to bearings	12	Inadequate lubrication	Check oil sump levels in gear and drive end headplates
or gears	13	Excessive lubrication	Check oil levels. If correct, drain and refill with clean oil of recommended grade
	14	Excessive pressure rise	See Item 5
	15	Coupling misalignment	Check carefully. Realign if questionable
	16	Excessive belt tension	Readjust for correct tension
Vibration	17	Misalignment	See Item 15
	18	Impellers rubbing	See Item 10
	19	Worn bearings/gears	Check gear backlash and condition of bearings, and replace as indicated
	20	Unbalanced or rubbing impeller	Scale or process material may build up on casing and impellers, or inside impellers. Remove build-up to restore original clearances and impeller balance
	21	Driver or blower loose	Tighten mounting bolts securely
	22	Piping resonances	Determine whether standing wave pressure pulsations are present in the piping
	23	Scale/sludge build-ups	Clean out interior of impeller lobes to restore dynamic balance
	24	Casing strain	Re-work piping alignment to remove excess strain
Driver stops, or will not start	25	Impeller stuck	Check for excessive hot spot on headplate or cylinder. See item 10. Look for defective shaft bearing and/or gear teeth
	26	Scale, sludge, rust or product build-up	Clean blower appropriately
Excessive breather	27	Broken seal	Replace seals
Blow-by or excessive oil leakage to vent area	28	Defective O-ring	Replace seals and O-ring
Excessive oil leakage in vent area	29	Defective/plugged breather	Replace breather and monitor oil leakage
	30	Oil level too high	Check sump levels in gear and drive headplates.
	31	Oil type or viscosity incorrect	Check oil to insure it meets recommendations. Drain then fill with clean oil of recommended grade.
	32	Blower running hot	Recommended oil temperature can be found on page 6 of this manual. The blower must be operated within the conditions of this manual

Inspection & Maintenance: Universal RAI® series blowers

A good program of consistent inspection and maintenance is the most reliable method of minimizing repairs to a blower. A simple record of services and dates will help keep this work on a regular schedule. Basic service needs are:

- Lubrication
- Checking for hot spots
- Checking for increases or changes in vibration and noise
- Recording of operating pressures and temperatures

Above all, a blower must be operated within its specified rating limits, to obtain satisfactory service life.

A newly installed blower should be checked often during the first month of full-time operation. Attention there after may be less frequent assuming satisfactory performance. Lubrication is normally the most important consideration and weekly checks of lubricant levels in the gearbox and bearing reservoirs should be customary. Complete oil change schedules are discussed under **LUBRICATION.**

Driver lubrication practices should be in accordance with the manufacturer's instructions. If direct connected to the blower through a lubricated type coupling, the coupling should be checked and greased each time blower oil is changed. This will help reduce wear and prevent unnecessary vibration. In a belted drive system, check belt tension periodically and inspect for frayed or cracked belts.

In a new, and properly installed, unit there is no contact between the two impellers, or between the impellers and cylinder or headplates. Wear is confined to the bearings (which support and locate the shafts) the oil seals, and the timing gears. All are lubricated and wear should be minimal if clean oil of the correct grade is always used. Seals are subject to deterioration as well as wear, and may require replacement at varying periods.

Shaft bearings are designed for optimum life under average conditions with proper lubrication and are critical to the service life of the blower. Gradual bearing wear may allow a shaft position to change slightly, until rubbing develops between impeller and casing. This will cause spot heating, which can be detected by observing these surfaces. Sudden bearing failure is usually more serious. Since the shaft and impeller are no longer supported and properly located, extensive general damage to the blower casing and gears is likely to occur.

Oil seals should be considered expendable items, to be replaced whenever drainage from the headplate vent cavity becomes excessive or when the blower is disassembled for any reason. Some oil seal leakage may occur since an oil film under the lip is required for proper operation. Periodically leaked oil should be wiped off from surfaces. Minor seal leakage should not be considered as indicating seal replacement.

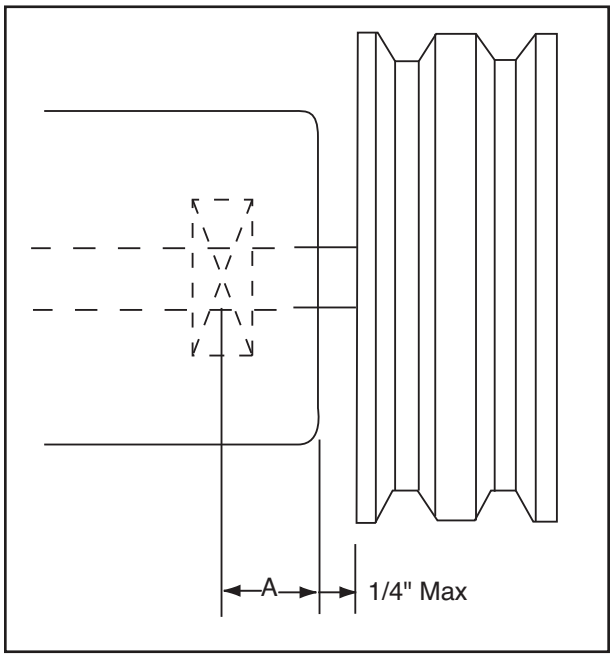
Timing gear wear, when correct lubrication is maintained, should be negligible. Gear teeth are cut to provide the correct amount of backlash, and gears correctly mounted on the shafts will accommodate a normal amount of tooth wear without permitting contact between lobes of the two impellers. However, too high an oil level will cause churning and excessive heating. This is indicated by unusually high temperature at the bottom of the gear housing. Consequent heating of the gears will result in loss of tooth-clearance , backlash and rapid wear of the gear teeth usually will develop. Continuation of this tooth wear will eventually produce impeller contacts (knocking), and from this point serious damage will be unavoidable if blower operation is continued. A similar situation can be produced suddenly by gear tooth fracture, which is usually brought on by sustained overloading or momentary shock loads.

Problems may also develop from causes other than internal parts failure. Operating clearances within a blower are only a few thousandths of an inch. This makes it possible for impeller interference or casing rubs to result from shifts in the blower mounting, or from changes in piping support. If this type of trouble is experienced, and the blower is found to be clean, try removing mounting strains. Loosen blower mounting bolts and reset the leveling and drive alignment. Then tighten mounting again, and make sure that all piping meets blower connections accurately and squarely Foreign materials in the blower will also cause trouble, which can only be cured by disconnecting the piping and thoroughly cleaning the blower interior.

A wide range of causes & solutions for operating troubles are covered in the **TROUBLE SHOOTING CHECKLIST.** The remedies suggested should be performed by qualified mechanics with a good background. Major repairs generally are to be considered beyond the scope of maintenance, and should be referred to an authorized ROOTS distributor.

Warranty failures should not be repaired at all, unless specific approval has been obtained through ROOTS before starting work. Unauthorized disassembly within the warranty period may void the warranty.

Figure 2 - Allowable Overhung Loads for V-Belt Drives Universal RAI®/URAI®-J Units



$$\text{Belt Pull lbs} = \frac{252100 \bullet \text{Motor HP}}{\text{Blower RPM} \bullet \text{Sheave Diameter}}$$

$$\text{Shaft Load (lb.in)} = \text{Belt Pull} \bullet \left(A + 1/4\text{"} + \frac{\text{Sheave Width}}{2}\right)$$

Frame Size	Dimension "A"	Max Allowable Shaft Load (lb-in.)	Min Sheave Diameter
22, 24	0.61	150	4.00
32, 33, 36	0.80	400	5.00
42, 45, 47	1.02	650	5.00
53, 56, 59	1.13	1,325	6.00
65, 68, 615	1.36	2,250	8.00
76, 711, 718	1.16	2,300	9.50

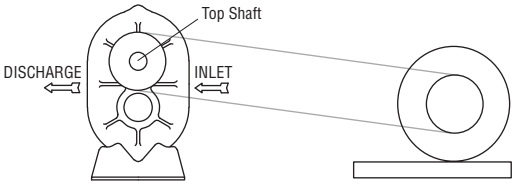
NOTE:
Arc of sheave belt contact on the smaller sheave not to be less than 170°

Driver to be installed on the inlet side for vertical units, and on the drive shaft side for horizontal units.

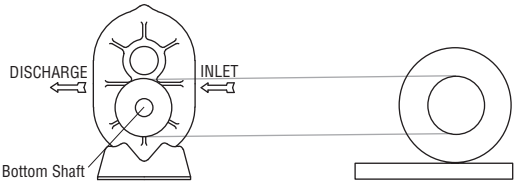
ROOTS recommends the use of two or more 3V, 5V or 8V belts and sheaves.

Acceptable Blower Drive Arrangement Options

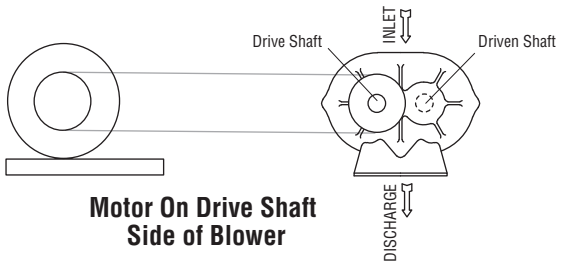
ACCEPTABLE



Motor On Inlet Side of Blower (Top Shaft)

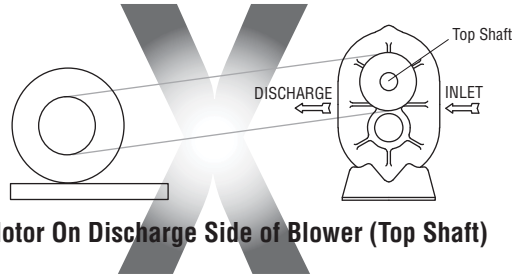


Motor On Inlet Side of Blower (Bottom Shaft)

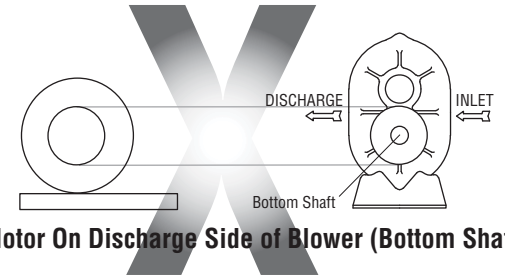


Motor On Drive Shaft Side of Blower

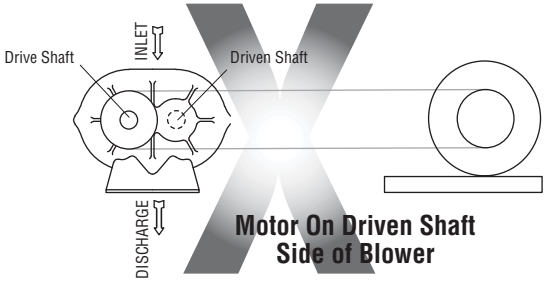
UNACCEPTABLE



Motor On Discharge Side of Blower (Top Shaft)

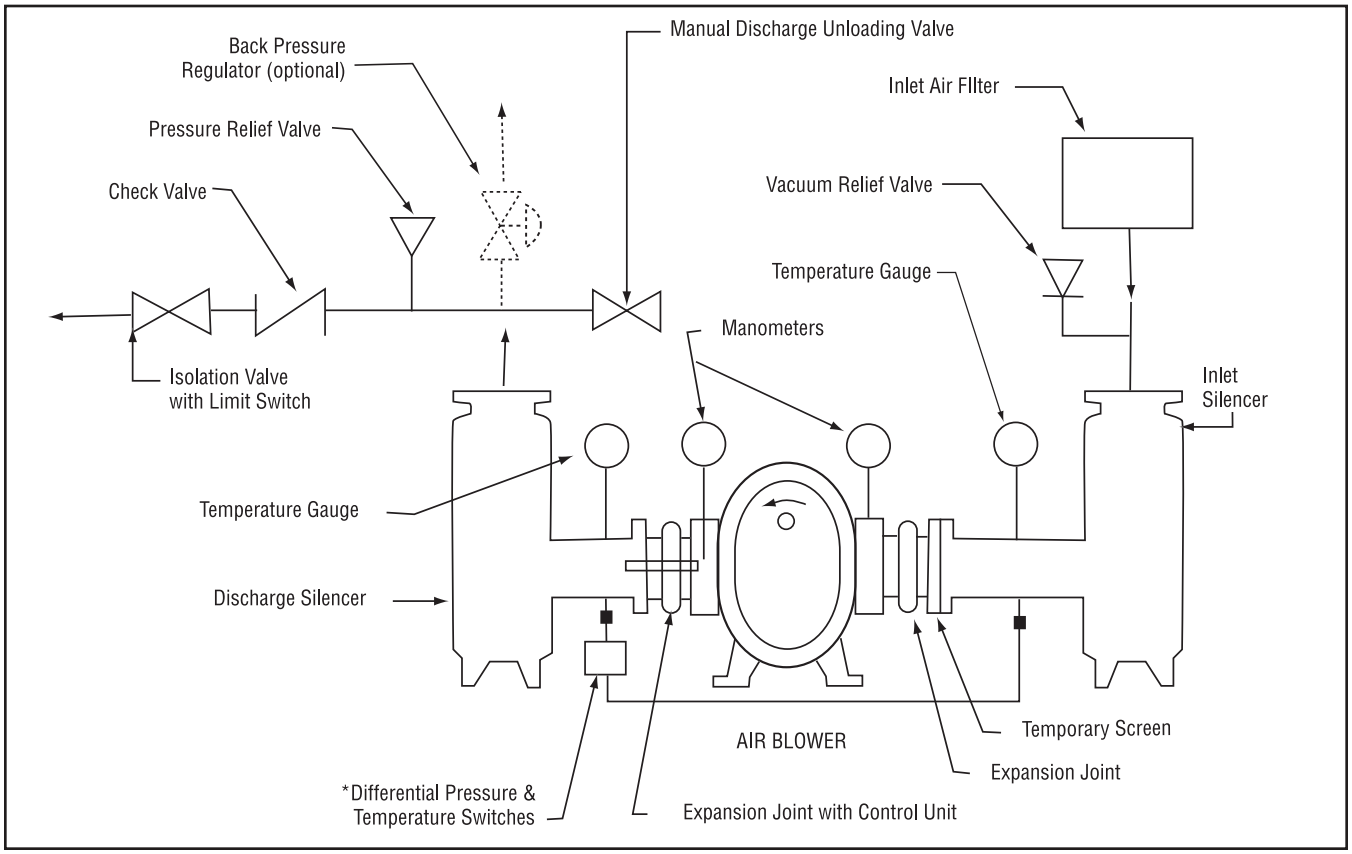


Motor On Discharge Side of Blower (Bottom Shaft)



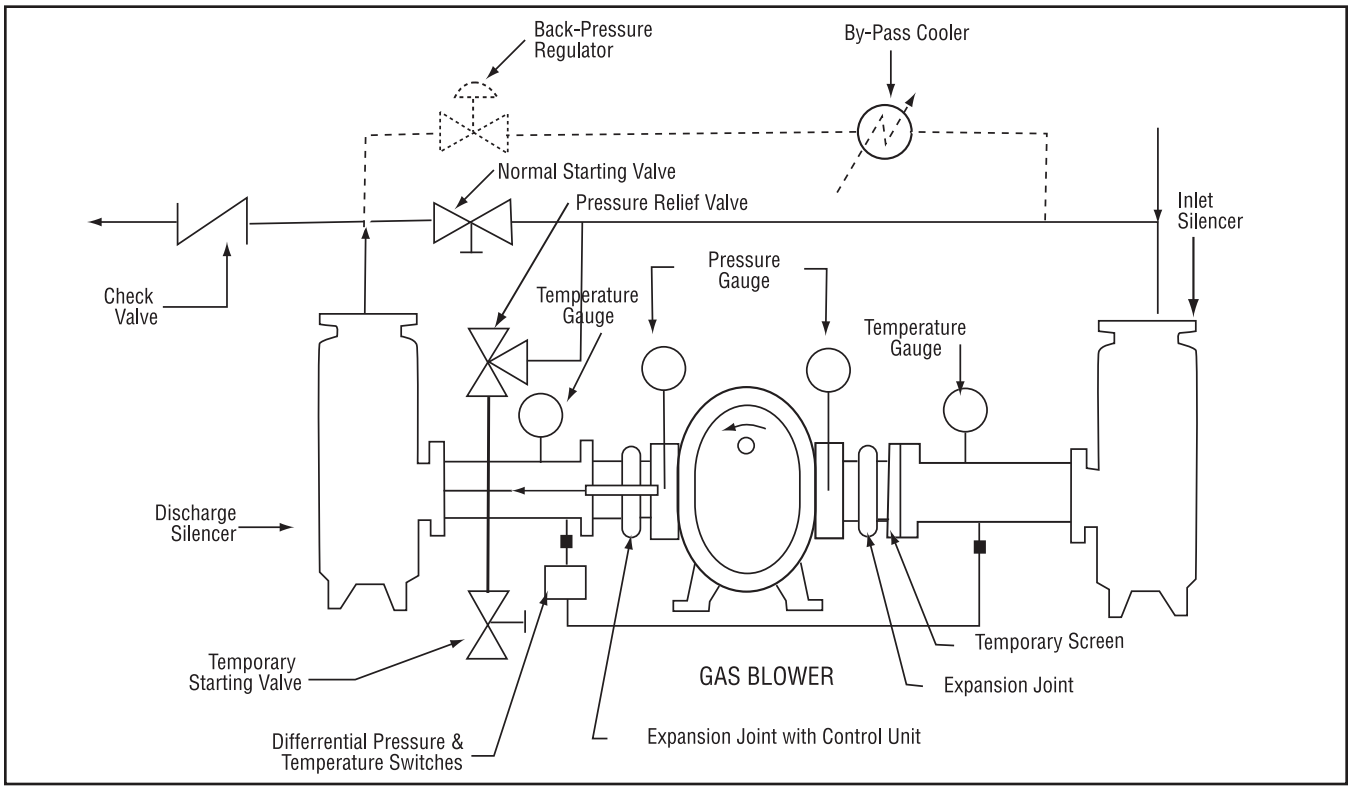
Motor On Driven Shaft Side of Blower

Figure 3a - Air Blower Installation with Accessories



Above are suggested locations for available accessories.

Figure 3b -Gas Blower Installation with Accessories



Above are suggested locations for available accessories.

Figure 4

Blower Orientation Conversion

Model	Reversible Rotation	Whispair™ Design
Universal RAI	yes	no
URAI-J Whispair™	no	yes
URAI-G	yes	no

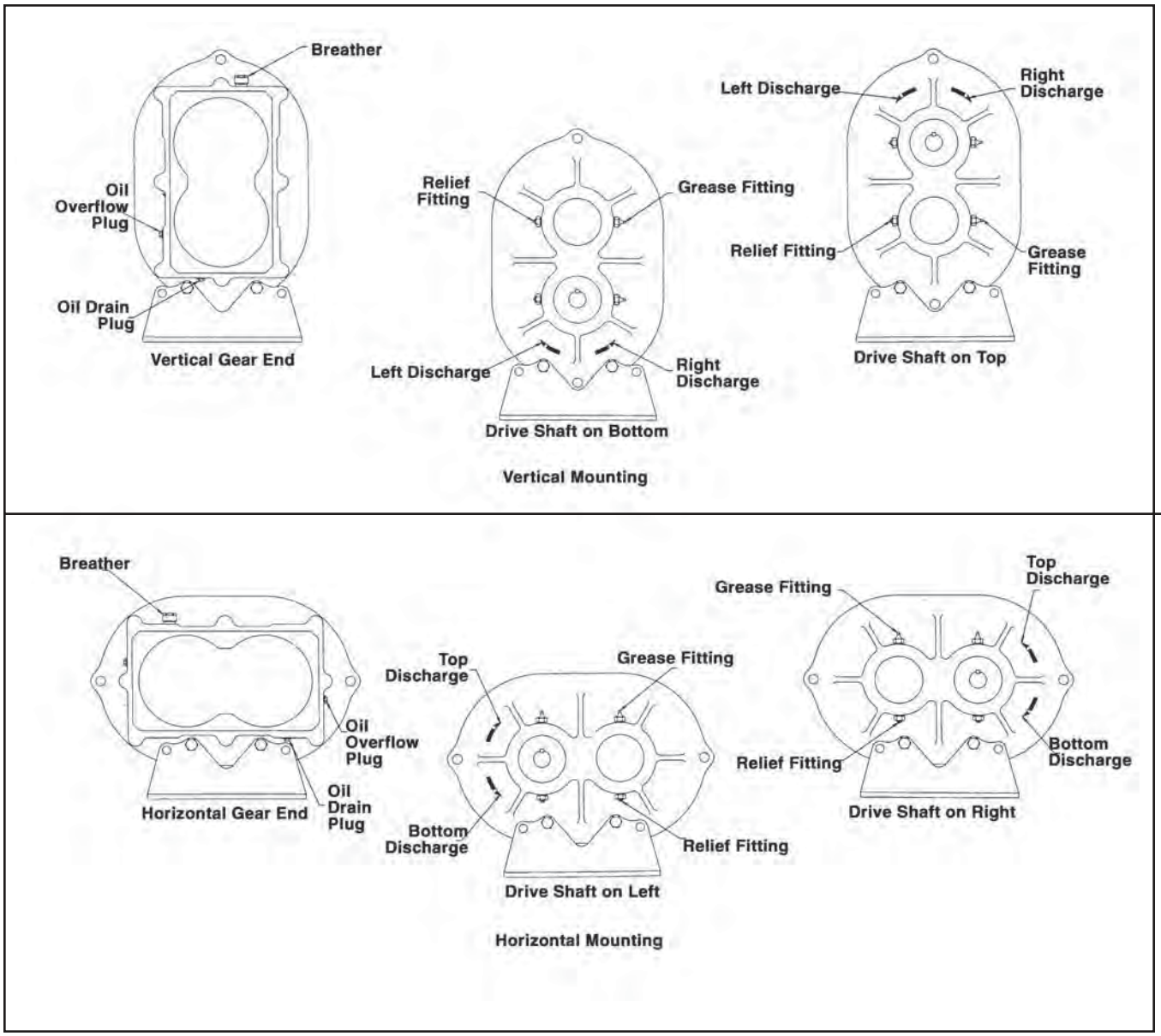
Special Note: WHISPAIR™ models are designed to operate with only one shaft rotation direction to take full advantage of the Whispair feature. Therefore, a WHISPAIR™ blower may be operated in the following combinations.

- CCW Rotation: Bottom Shaft; Right side discharge or a Left Shaft; Bottom discharge
- CCW Rotation: Top Shaft; Left side discharge or a Right Shaft; Top discharge

or

- CW Rotation: Bottom Shaft; Left side discharge or a Right Shaft Bottom discharge
- CW Rotation: Top Shaft; Right side discharge or a Left Shaft Top discharge

Blower Orientation and Lubrication Points: Grease Lubricated Drive End
Universal RAI series & URAI-G gas blowers



Drive End Breather Orientation for U-RAI series - DSL with Oil Lube

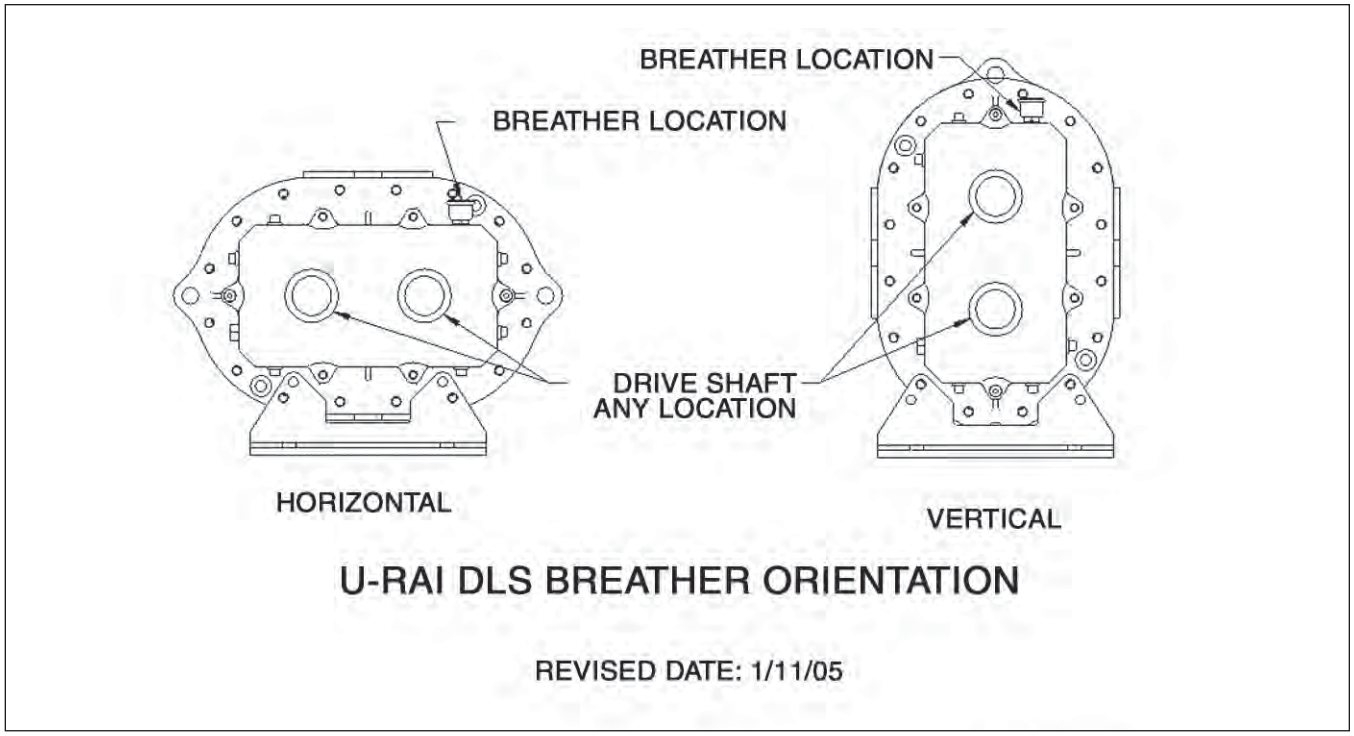


Table 1 - Universal RAI series, Universal URAI-DSI & URAI-G gas blower, Maximum Allowable Operating Conditions

Frame Size	Gear Diameter (Inch)	Speed RPM	Temp. Rise F°	(C°)	Delta Pressure PSI	(mbar)	Inlet Vacuum INHG	(mbar)
22	2.5	5275	225	(125)	12	(827)	15	(500)
24	2.5	5275	210	(117)	7	(483)	15	(500)
32	3.5	3600	240	(133)	15	1034	16	(539)
33	3.5	3600	225	(125)	12	(827)	15	(500)
36	3.5	3600	225	(125)	7	(483)	15	(500)
42	4.0	3600	240	(133)	15	(1034)	16	(539)
45	4.0	3600	225	(125)	10	(690)	16	(539)
47	4.0	3600	225	(125)	7	(483)	15	(500)
53	5.0	2850	225	(125)	15	(1034)	16	(539)
56	5.0	2850	225	(125)	13	(896)	16	(539)
59	5.0	2850	225	(125)	7	(483)	15	(500)
65	6.0	2350	250	(130)	15	(1034)	16	(539)
68	6.0	2350	240	(133)	14	(965)	16	(539)
615	6.0	2350	130	(72)	7	(483)	14	(472)
76	7.0	2050	250	(139)	15	(1034)	16	(539)
711	7.0	2050	225	(125)	10	(690)	16	(539)
718	7.0	2050	130	(72)	6	(414)	12	(405)

Table 2 - Recommended Oil Grades

Ambient Temperature °F (°C)	ISO Viscosity No.
Above 90° (32°)	320
32° to 90° (0° to 32°)	220
0° to 32° (-18° to 0°)	150
Below 0° (-18°)	100

URAI GAS Blower Oil and Grease Specifications

The specified oil should be ROOTS synthetic P/N 813-106- of the proper viscosity.

Table 3 - Approximate Oil Sump Capacities

These capacities are provided to assist in stocking the correct amount of oil. Exact sump capacities may differ slightly. See "Lubrication" section for proper filling instructions.

UNIVERSAL RAI, URAI-J, URAI-G

Frame Size	Gear End Capacity Fl. Oz. (Liters)	
	Vertical	Horizontal
22	3.4 (.1)	6.1 (.18)
24	3.4 (.1)	6.1 (.18)
32	8.5 (.25)	16.0 (.47)
33	8.5 (.25)	16.0 (.47)
36	8.5 (.25)	16.0 (.47)
42	12.7 (.37)	22.8 (.67)
45	12.7 (.37)	22.8 (.67)
47	12.7 (.37)	22.8 (.67)
53	16.0 (.47)	27.6 (.82)
56	16.0 (.47)	27.6 (.82)
59	16.0 (.47)	27.6 (.82)
65	28.3 (.84)	52.1 (1.54)
68	28.3 (.84)	52.1 (1.54)
615	28.3 (.84)	52.1 (1.54)
76	32.3 (.96)	59.5 (1.76)
711	32.3 (.96)	59.5 (1.76)
718	32.3 (.96)	59.5 (1.76)

See page 14 and 15 for illustration of vertical and horizontal configurations.

UNIVERSAL URAI series-DSL Splash Lubricated Drive End

Note that the gear end sump capacity is provided on the adjacent table.

Frame Size	Drive End Capacity Fl. Oz. (Liters)	
	Vertical	Horizontal
32	4.0 (.12)	6.5 (.19)
33	4.0 (.12)	6.5 (.19)
36	4.0 (.12)	6.5 (.19)
42	5.5 (.16)	10.8 (.32)
45	5.5 (.16)	10.8 (.32)
47	5.5 (.16)	10.8 (.32)
53	7.5 (.22)	14.8 (.44)
56	7.5 (.22)	14.8 (.44))
59	7.5 (.22)	14.8 (.44)
65	16 (0.47)	31 (0.91)
68	16 (0.47)	31 (0.91)
615	16 (0.47)	31 (0.91)

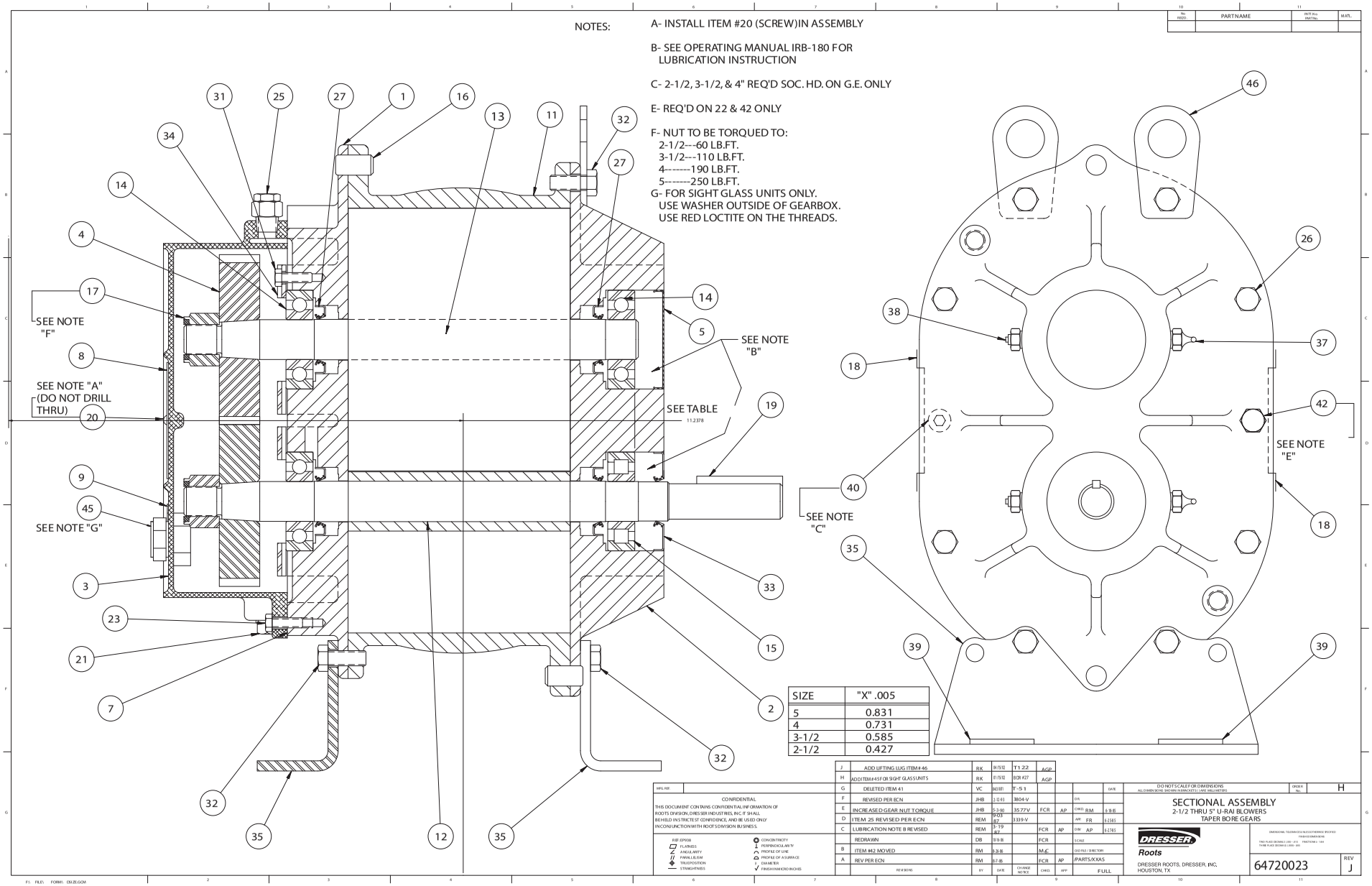
Table 4 - Universal URAI series with Grease Lubricated Drive End: Specified Bearing Greasing Intervals

Speed In RPM	Operating Hours Per Day		
	8	16	24
	Greasing Intervals in Weeks		
750-1000	7	4	2
1000-1500	5	2	1
1500-2000	4	2	1
2000-2500	3	1	1
2500-3000	2	1	1
3000 and up	1	1	1

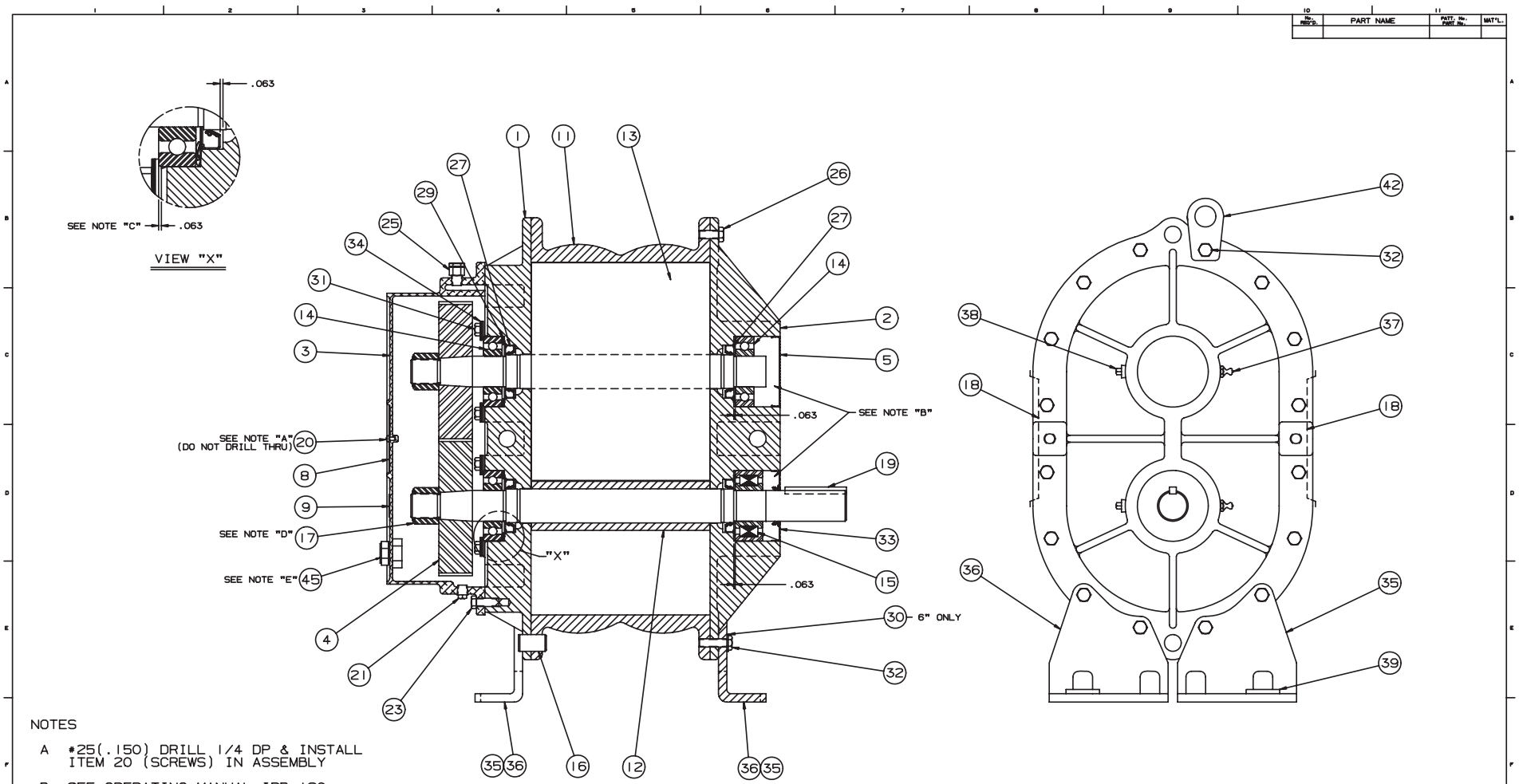
The specified grease for servicing drive end bearings of a Gas blower, use a NLGI #2 premium grade aluminum complex* grease, ROOTS P/N T20019001 with 300°F (149°C) service temperature and moisture resistance and good mechanical stability.

When servicing drive end bearings of Non Gas blower, use a NLGI #2 premium grade microgel grease with 250°F (121°C) service temperature and moisture resistance and good mechanical stability. ROOTS specifies Shell Darina EP NLGI Grade 2. Product Code 71522.

NOTE: Lithium based greases are not compatible with the ROOTS Synthetic grease used when assembling a Gas blower or the non-soap base grease used when assembling a standard URAI blower. Lithium based grease is not approved for any ROOTS blowers.



Assembly of UNIVERSAL RAI Series, Air Blowers, 2-1/2” Through 5” Gear Diameter



NOTES

A #25(.150) DRILL 1/4 DP & INSTALL ITEM 20 (SCREWS) IN ASSEMBLY

B SEE OPERATING MANUAL IRB-180 FOR LUBRICATION INSTRUCTION

C INSTALL BEARINGS AS SHOWN BEFORE SETTING END CLEARANCE

D NUT TO BE TORQUED TO:
6"---400 LB. FT.
7"---550 LB. FT.

E FOR SIGHT GLASS UNITS ONLY. USE WASHER OUTSIDE OF GEARBOX. USE RED LOCTITE ON THE THREADS.

No. REQ'D.	PART NAME	PATT. No. PART No.	MAT'L.

MFG. REF. REF. 862-600-023

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	REVISIONS	BY	DATE	CHANGE NOTICE	CHKD.	APP.
	ORIGINAL LOST/REDRAWN ON CAD	DAC	5-21-1985			DR.
E	INCREASED GEAR NUT TORQUE	REM	8-2-1988	3577-V	FCR	AGP CHKD REM 12-8-1988
D	REMOVED ITEM #43	REM	12-5-1988	3389-V		APP. FCR 7-18-1989
C	ITEM 25 REVISED	REM	7-27-1989	3339-V		AGP DRV AP 8-8-1989
B	ADDED ITEM #43	REM	7-27-1989			SCALE
A	ADDED 7"	REM	7-27-1989			DAD FILE / DIRECTORY
	REDRAWN	DB	11-29-1989			/PARTS/XXAS
						NTS

REF. SPACE
FLATNESS
ANGULARITY
PARALLELISM
TRUE POSITION
STRAIGHTNESS
CONCENTRICITY
PERPENDICULARITY
PROFILE OF LINE
PROFILE OF A SURFACE
DIAMETER
FINISH IN MICRO INCHES

55-1242-2

DO NOT SCALE FOR DIMENSIONS
ALL DIMENSIONS SHOWN IN BRACKETS [ ] ARE MILLIMETERS

ORDER No.

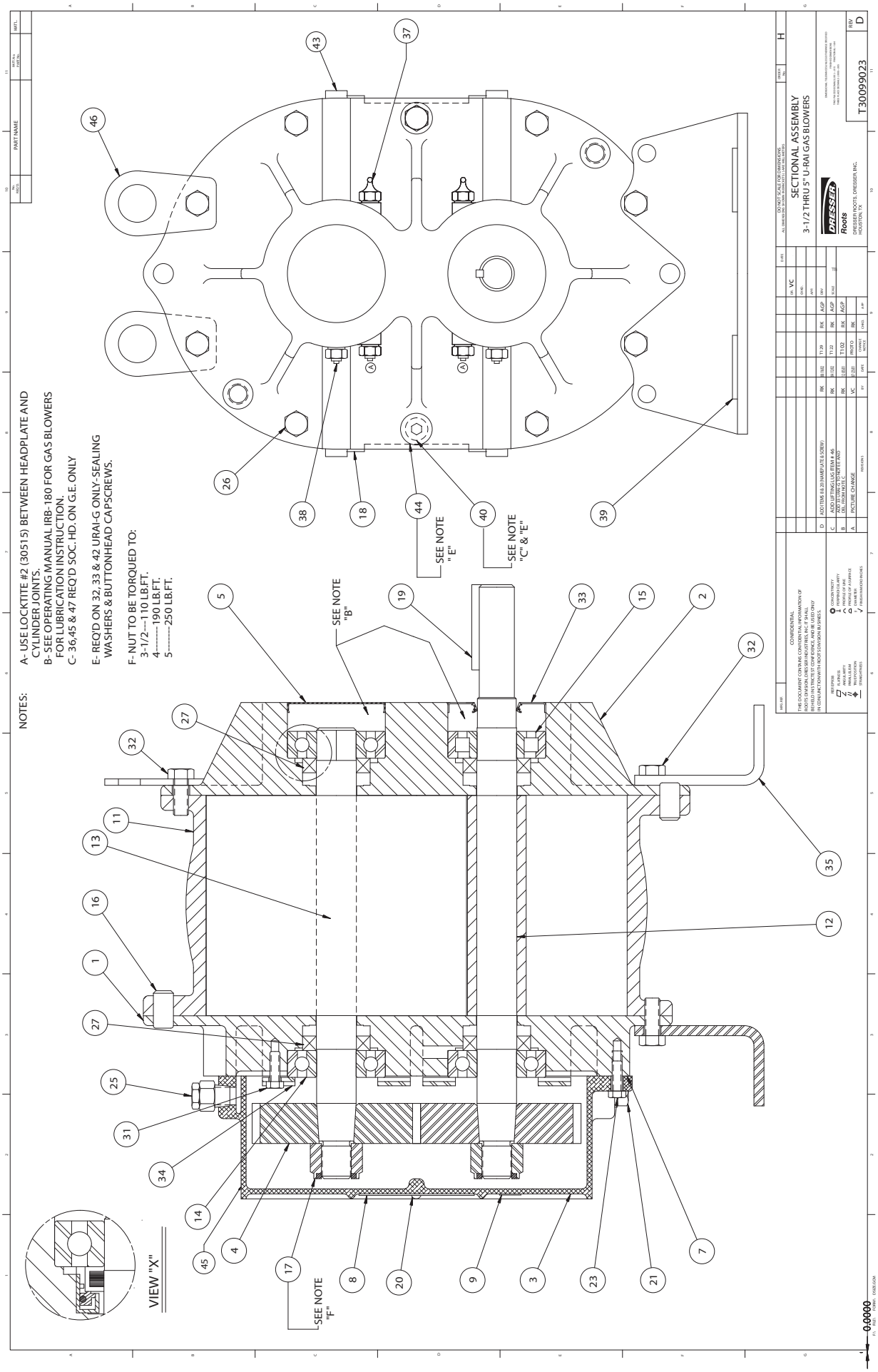
SECTIONAL ASSEMBLY
FOR 6" & 7" U-RAI BLOWER
WITH TAPER GEAR FIT

Dresser ROOTS, Dresser, Inc.
Houston, TX USA

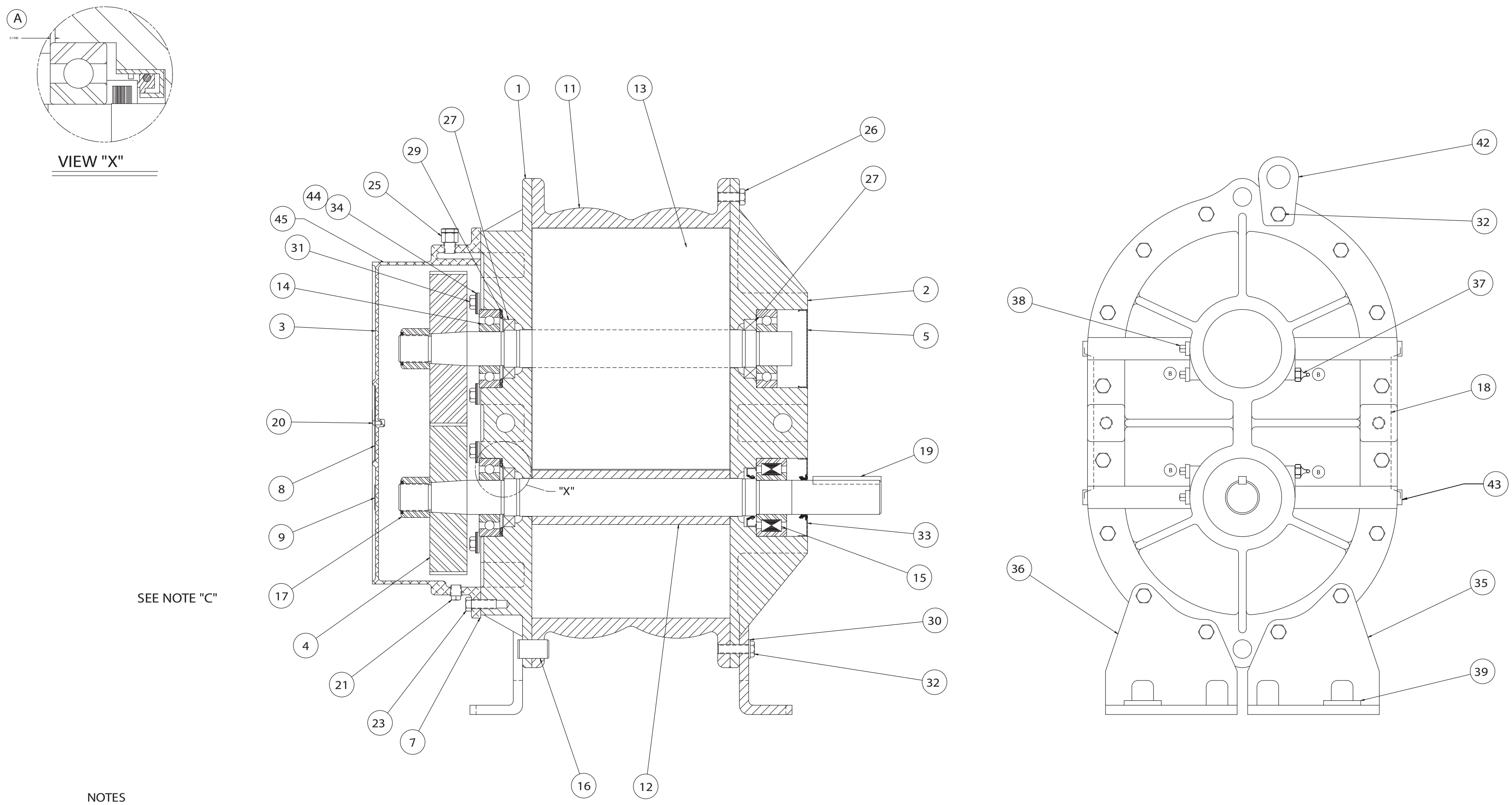
64792023 REV F

F:\FILE\FORMSIZE.SCH

Assembly of UNIVERSAL RAI Blowers, 6" and 7" Diameter



Assembly of UNIVERSAL RAI-G Series Gas Blowers, 3-1/2"Through 5" Gear Diameter



NOTES

A USE LOCKTITE #2 (30515) BETWEEN HEADPLATE AND CYLINDER JOINTS.

B SEE OPERATING MANUAL IRB-180 FOR LUBRICATION INSTRUCTION

C NUT TO BE TORQUED TO: 6"---400 LB. FT.

REF. 64792023

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C	ADD ITEMS # 8 & 20 (NAMEPLATE & SCREW)	RK	08/16/02	T129	RK	
B	PICTURE CHANGE	VC	07/25/01	PROTO	RK	
A	ADDED DIMENSION .066	VC	06/26/01	PROTO	RK	
	REVISIONS	BY	DATE	CHANGE NOTICE	CHKD.	APP.

DO NOT SCALE FOR DIMENSIONS

SECTIONAL ASSEMBLY
FOR 6" U-RAI GAS BLOWERS

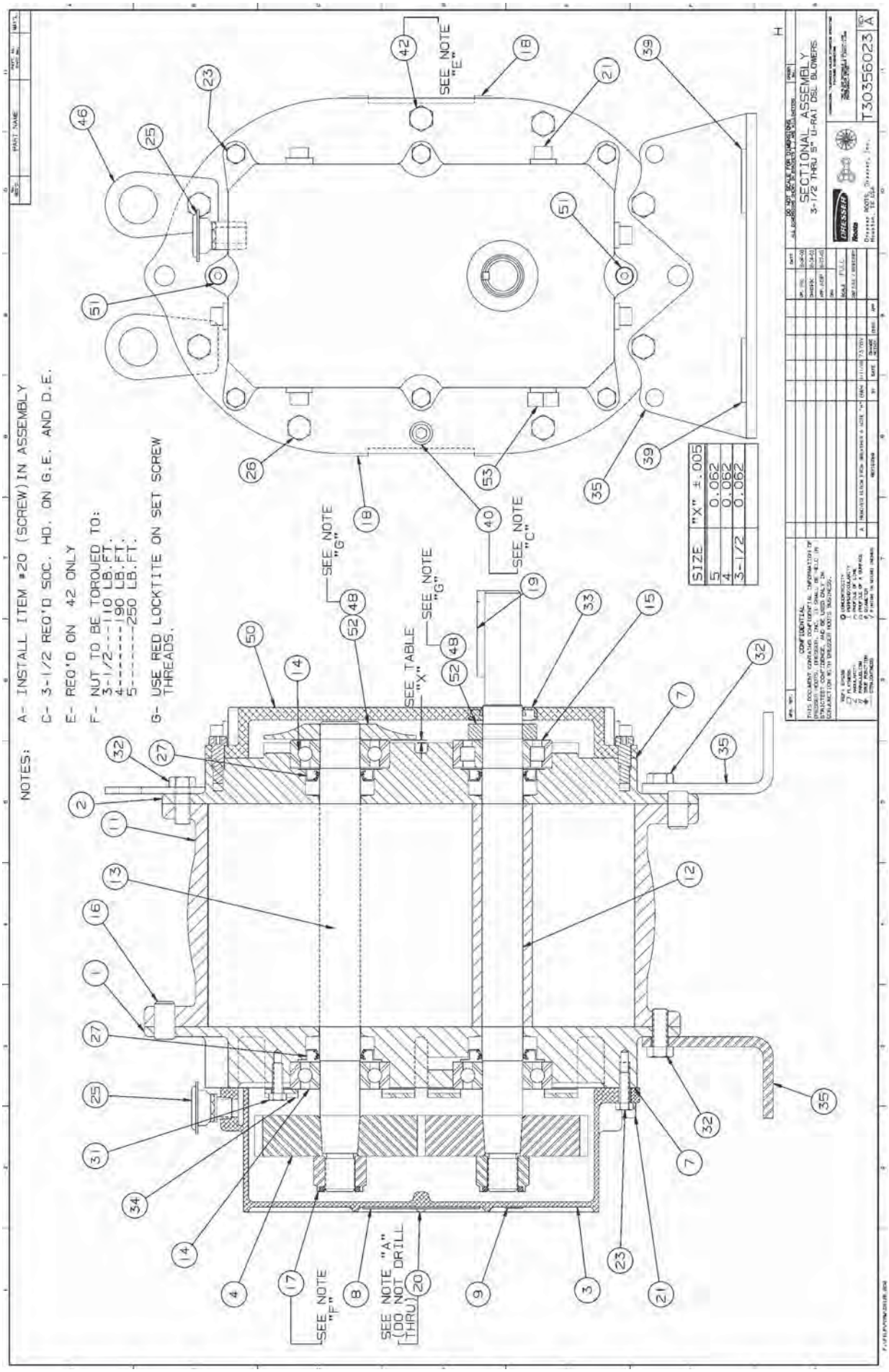
DR. VC 07/12/01
SCALE NTS

DRESSER Roots

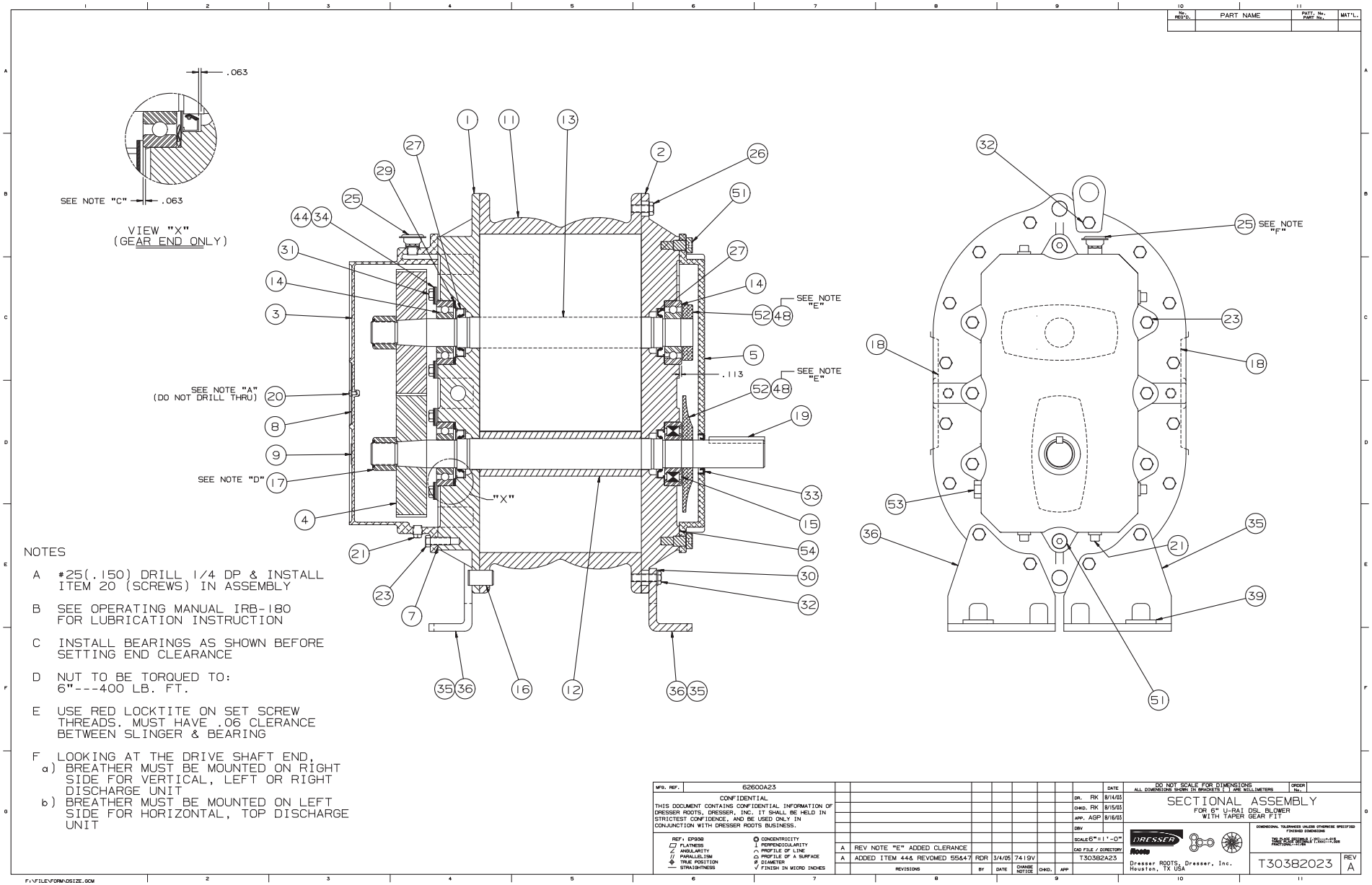
DRESSER ROOTS, DRESSER, INC. HOUSTON, TX

T30110023 REV B

Assembly of UNIVERSAL RAI Series Gas Blowers, 6" Gear Diameter



Assembly of UNIVERSAL RAI Series - DSL with Splash Lubricated Drive End 3-5" Gear Diameter



Assembly of UNIVERSAL RAI Series - DSL with Splash Lubricated Drive End 6” Gear Diameter

Universal RAI Series Blowers Parts List 2-1/2" – 5" Gear Diameter

(Refer to drawing #64720023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
5	Cover-Blind (Plug Opening)	1
7	Gasket, Gear Box	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1
21	Plug, Pipe	3
23	Screw Hex	6
25	Breather (Plug Vent)	1
26	Screw, Hex	*
27	Seal, Lip Bearing	4
31	Screw, Hex, Nylock	4
32	Screw, Hex	6
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
37	Fitting, Grease	2
38	Fitting, Relief	2
39	Washer Mounting	4
40	Screw Socket	2
42	Screw Hex	2

*Quantities vary by blower.

Universal RAI Series Blowers Parts List 6" & 7" Gear Diameter

(Refer to drawing #64792023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
5	Cover-Blind (Plug Opening)	1
7	Gasket, Gear Box	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1
21	Plug, Pipe	3
23	Screw Hex Nylock	8
25	Breather (Plug Vent)	1
26	Screw, Hex	*
27	Seal, Lip Bearing	4
31	Screw, Hex, Nylock	4
32	Screw, Hex	10
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
37	Fitting, Grease	2
38	Fitting, Relief	2
39	Washer Mounting	4

*Quantities vary by blower.

Universal RAI-DSL Series Blowers Parts List 3-1/2" – 5" Gear Diameter

(Refer to drawing #T30356023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
7	Gasket, Gear Box, DE Cover	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1
21	Plug, Pipe	3
23	Screw Hex	6
25	Breather (Plug Vent)	1
26	Screw, Hex	*
27	Seal, Lip Bearing	4
31	Screw, Hex, Nylock	4
32	Screw, Hex	6
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
39	Washer Mounting	4
40	Screw Socket	2
42	Screw Hex	2
48	DE Oil Slinger Set Screw	4
50	Drive End Cover	1
52	Drive End Oil Slinger	2
53	Oil Sight Glass	2

*Quantities vary by blower.

Universal RAI®-DSL Series Blowers Parts List 6" Gear Diameter

(Refer to drawing #T30382023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
7	Gasket, Gear Box	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1

Item #	Part Name	Qty.
21	Plug, Pipe	3
23	Screw Hex Nylock	8
25	Breather (Plug Vent)	1
26	Screw, Hex	*
27	Seal, Lip Bearing	4
31	Screw, Hex, Nylock	4
32	Screw, Hex	10
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
39	Washer Mounting	4
48	DE Oil Slinger Set Screw	4
50	Drive End Cover	1
52	Drive End Oil Slinger	2

*Quantities vary by blower.

Universal RAI Series Gas Blowers Parts List
3-1/2" & 5" Gear Diameter

(Refer to drawing #T30099023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
5	Cover-Blind (Plug Opening)	1
7	Gasket, Gear Box	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1
21	Plug, Pipe	3
23	Screw Hex	8
25	Breather (Plug Vent)	1
26	Screw, Hex	14*
27	Seal, Bearing	4
31	Screw, Hex	4
32	Screw, Hex	4
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
37	Fitting, Grease	2
38	Fitting, Relief	2
39	Washer Mounting	4
40	Screw Socket	2
42	Screw Hex	2

*Quantities vary by blower.

Universal RAI Series Gas Blowers Parts List
6" Gear Diameter

(Refer to drawing #T3011023)

Item #	Part Name	Qty.
1	Headplate Gear End	1
2	Headplate Drive End	1
3	Gearbox	1
4	Timing Gears	2
5	Cover-Blind (Plug Opening)	1
7	Gasket, Gear Box	1
7*	Gasket DE Cover	1
11	Cylinder	1
12	Impeller & Shaft Drive	1
13	Impeller & Shaft Driven	1
14	Bearing, Ball	3
15	Bearing, Roller	1
16	Pin, Dowel	4
17	Gear Nut	2
19	Key	1
21	Plug, Pipe	3
23	Screw Hex Nylock	8
25	Breather (Plug Vent)	1
26	Screw, Hex	14**
27	Seal, Bearing	4
31	Screw, Hex	4
32	Screw, Hex	10
33	Seal Lip-Drive	1
34	Clamp Plate	2
35	Foot	2
37	Fitting, Grease	2
38	Fitting, Relief	2
39	Washer Mounting	4
40	Screw Socket	2
42	Screw Hex	2
43	Plug	8
53	Oil Sight Glass	2

*DE cover gasket is not the same as the gasket used on the GE. You must specify the gasket required when ordering.
**Quantities vary by blower.

Specified Lubricants

ROOTS Synthetic Oil: ISO-VG-220 Grade

	Part Number
Quart	813-106-001
Gallon	813-106-002
Case (12 qts)	813-106-008

ROOTS Synthetic Oil: ISO-VG-320 Grade

	Part Number
Quart	813-106-004
Gallon	813-106-005
Case (12 qts)	813-106-007

ROOTS Synthetic Grease: NLGI #2

	Part Number
14.5 oz. Tube	T200019-001
5 Gallon Pail	T200019-003
Case (30 tubes)	T200019-002

UNIVERSAL RAI (URAI) AIR BLOWERS

URAI AIR BLOWERS (with Grease Lubricated Drive End)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
65102020	22	1" NPT	0.625"	32
65103020	24	2" NPT	0.625"	43
71048020	32	1.25" NPT	0.750"	69
65105020	33	2" NPT	0.750"	74
65106020	36	2.5" NPT	0.750"	102
65108020	42	1.5" NPT	0.875"	88
65109020	45	2.5" NPT	0.875"	109
65110020	47	3" NPT	0.875"	128
65112020	53	2.5" NPT	1.125"	143
65113020	56	4" NPT	1.125"	170
65114020	59	4" NPT	1.125"	204
65116020	65	3" NPT	1.375"	245
65117020	68	5" NPT	1.375"	285
65118020	615	6" Flange	1.375"	425
65120020	76	4" NPT	1.562"	400
65121020	711	6" Flange	1.562"	530
65122020	718	8" Flange	1.562"	650

Refer to Specification Sheet S-12K84

URAI-DSL AIR BLOWERS (with Dual Splash Lubrication *DSL*)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
T30378020	32	1.25" NPT	0.750"	72
T30379020	33	2" NPT	0.750"	77
T30380020	36	2.5" NPT	0.750"	105
T30352020	42	1.5" NPT	0.875"	92
T30353020	45	2.5" NPT	0.875"	113
T30354020	47	3" NPT	0.875"	132
T30359020	53	2.5" NPT	1.125"	148
T30360020	56	4" NPT	1.125"	175
T30361020	59	4" NPT	1.125"	209
T30384020	65	3" NPT	1.375"	250
T30385020	68	5" NPT	1.375"	290
T30386020	615	6" Flange	1.375"	430

Refer to Specification Sheet S-27S03

Universal RAI air blowers include detachable mounting feet which permit vertical or horizontal installation. The units are center timed for rotation in either direction. The bearings on the URAI are grease lubricated on the drive end and splash lubricated on the gear end. The URAI-DSL is splash lubricated on BOTH ends.

UNIVERSAL RAI (URAI) GAS BLOWERS

URAI-G™ GAS BLOWERS (with Grease Lubricated Drive End)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
710480G0	32	1.25" NPT	0.750"	69
651050G0	33	2" NPT	0.750	74
651060G0	36	2.5" NPT	0.750	102
651080G0	42	1.5" NPT	0.875"	88
651090G0	45	2.5" NPT	0.875	109
651100G0	47	3" NPT	0.875	128
651120G0	53	2.5" NPT	1.125"	143
651130G0	56	4" NPT	1.125	170
651140G0	59	4" NPT	1.125	204
651160G0	65	3" NPT	1.375"	245
651170G0	68	5" NPT	1.375	285
651180G0	615	6" NPT	1.375	425

Refer to Specification Sheet S-60A01

Universal RAI-G™ gas blowers include detachable mounting feet which permit vertical or horizontal installation. **Feet are different for vertical and horizontal mounting**.

The units are center timed for rotation in either direction. The bearings on the Universal RAI-GTM are grease lubricated on the drive end and splash lubricated on the gear end. ROOTS Synthetic lubricant is recommended.

UNIVERSAL RAI (URAI-J) WHISPAIR AIR BLOWERS

URAI-J WHISPAIR AIR BLOWERS (with Grease Lubed Drive End)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
74065020	33J	2" NPT	0.750"	84
74086020	36J	2.5" NPT	0.750	112
74066020	45J	2.5" NPT	0.875"	119
74087020	47J	3" NPT	0.875	138
74067020	56J	4" NPT	1.125"	180

Refer to Specification Sheet S-33A93

URAI-J-DSL WHISPAIR AIR BLOWERS (with Dual Splash Lubrication *DSL*)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
T30417020	33J	2" NPT	0.750"	87
T30418020	36J	2.5" NPT	0.750	115
T30410020	45J	2.5" NPT	0.875"	122
T30412020	47J	3" NPT	0.875	141
T30415020	56J	4" NPT	1.125"	185

Refer to Specification Sheet S-30S03

URAI-J METRIC WHISPAIR AIR BLOWERS (with Grease Lubed Drive End)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
TBD	33J	2" BSP	19 mm	84
740860M0	36J	2.5" BSP	19 mm	112
TBD	45J	2.5" BSP	24 mm	119
TBD	47J	3" BSP	24 mm	138
TBD	56J	4" BSP	28 mm	180

Refer to Specification Sheet XXXXXX

URAI-J-DSL METRIC WHISPAIR AIR BLOWERS (with Dual Splash Lubrication *DSL*)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
TBD	33J	2" BSP	19 mm	87
T304660M0	36J	2.5" BSP	19 mm	115
TBD	45J	2.5" BSP	24 mm	122
T304550M0	47J	3" BSP	24 mm	141
TBD	56J	4" BSP	28 mm	185

Refer to Specification Sheet XXXXX

Universal RAI-J air blowers incorporate the patented WhispairTM design in addition to the same features as the original URAI blowers. The URAI-J's are center timed, however the WhispairTM benefits can only be realized when the jet is located in the discharge position.

UNIVERSAL RAI METRIC (URAI-M) AIR BLOWERS

NOTE: METRIC URAI product has metric shaft diameter and connection sizes

URAI-METRIC AIR BLOWERS (with Grease Lubricated Drive End)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
651020M0	22	1" BSP	16 mm	32
651030M0	24	2" BSP	16 mm	43
710480M0	32	1 1/4" BSP	19 mm	69
651050M0	33	2" BSP	19 mm	74
651060M0	36	2 1/2" BSP	19 mm	102
651080M0	42	1 1/2" BSP	24 mm	88
651090M0	45	2 1/2" BSP	24 mm	109
651100M0	47	3" BSP	24 mm	128
651120M0	53	2 1/2" BSP	28 mm	143
651130M0	56	4" BSP	28 mm	170
651140M0	59	4" BSP	28 mm	204
T30392060	65	3" BSP	32 mm	245
T30394060	68	5" BSP	32 mm	285
T30390060	615	150 NP10	32 mm	425
T30396060	76	4" BSP	38 mm	400
T30398060	711	150 NP10	38 mm	530
T30400060	718	200 NP10	38 mm	650

Refer to Specification Sheet XXXXX

URAI-DSL-METRIC AIR BLOWERS (with Dual Splash Lubrication *DSL*)

BOM # *	FRAME SIZE	INLET/DISCH CONN.	SHAFT DIAMETER	BARE WEIGHT
T30463060	32	1 1/4" BSP	19 mm	72
T30464060	33	2" BSP	19 mm	77
T30465060	36	2 1/2" BSP	19 mm	105
T30451060	42	1 1/2" BSP	24 mm	92
T30452060	45	2 1/2" BSP	24 mm	113
T30453060	47	3" BSP	24 mm	132
T30459060	53	2 1/2" BSP	28 mm	148
T30460060	56	4" BSP	28 mm	175
T30461060	59	4" BSP	28 mm	209
T30472060	65	3" BSP	32 mm	250
T30473060	68	5" BSP	32 mm	290
T30474060	615	150 NP 10	32 mm	430

Refer to Specification Sheet XXXXX

Universal RAI air blowers include detachable mounting feet which permit vertical or horizontal installation. The units are center timed for rotation in either direction. The bearings on the URAI are grease lubricated on the drive end and splash lubricated on the gear end. The URAI-DSL is splash lubricated on BOTH ends.

CUSTOMER SERVICE

Dresser Rooots
2135 Hwy 6 South
Houston, TX 77077
Toll Free Hot Line: 1-877-363-ROOT(S) (7668)
Toll Free Fax: 1-877-357-7238
Local Fax: 281-966-4309

Roots Factory Service & Repair Centers

Dresser Roots – Houston Service Center
Dresser Roots Factory Service & Repair Center
11611B Tanner Rd.
Houston, TX 77041
Ph: 713-896-4810
Fax: 713-896-4927

Dresser Roots – Connersville Service Center
Dresser Roots Factory Service & Repair Center
900 West Mount Street
Connersville, IN 47331
Ph: 765-827-9200
Fax: 765-827-9266

Dresser Roots – United Kingdom Service Center
Dresser Roots Factory Service & Repair Center
PO Box B7
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England HD1 6RB
Ph: +44 (0) 1484 422 222
Aftermarket Direct Line: +44 (0) 1484 487 669
Aftermarket email: graeme.wadsworth@dresser.co.uk
Aftermarket Fax: +44 (0) 1484 487 657

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Dresser Roots Factory Service & Repair Center
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DRESSER
Roots

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Toll Free (US): 877-363-ROOT(S)

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Fx: +44-1484-422668

ISRB-2002 rev.0705
(formerly IOM-180-205)

website: www.rootsblower.com • US email: ROOTS@dresser.com • UK email: DMD_ROOTS@dresser.co.uk

BISCO Environmental

Nr.: 1
Date: 10-JUL-2006

DATA SHEET
Three-phase Induction Motor - Squirrel Cage

Customer	:
Motor line	: Explosion Proof CSA High Efficiency

Frame	: 284T	Service factor	: 1.15
Rated Output	: 25.0 HP (cv)	Duty cycle	: S1
Frequency	: 60 Hz	Ambient temperature	: 40 °C
Poles	: 4 poles	Altitude	: 1000 m.a.s.l
Full load speed	: 1760 rpm	Degree of protection	: IP54
Slip	: 2.22 %	Aprox. weight	: 463 lb
Voltage	: 208-230/460 V	Moment of inertia	: 4.6826 sq.ft.lb
Full load current	: 65.5-59.3/29.6 A	Noise level	: 68 dB(A)
Locked rotor amps	: 400-361/181 A		
Locked rotor current (Il/In)	: 6.10 - Code G		
No load current	: 22.9-20.8/10.4 A		
Full load torque	: 73.6 ft.lb		
Locked rotor torque	: 220 %		
Breakdown torque	: 250 %		
Design	: B		
Insulation class	: F		
Temperature rise	: 80 K		
Locked rotor time	: 35 s		

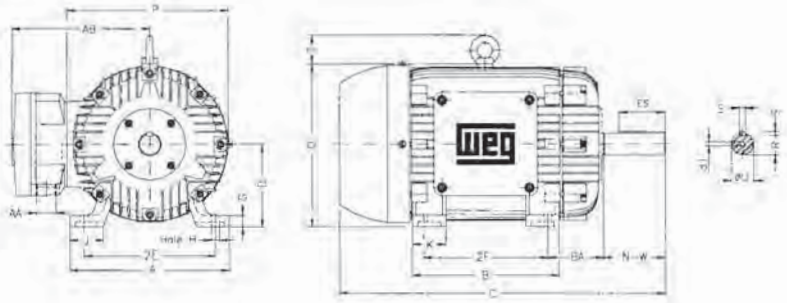
	D.E.	N.D.E.
Bearings	6311-C3	6211-Z-C3
Regreasing int.	20000 h	20000 h
Grease amount	18 g	11 g

Performance under load

Load	cos ø	Efficiency(%)
100%	0.85	92.4
75%	0.82	92.4
50%	0.72	91.7

Note:

DRAWING AND DIMENSIONS



2E	2F	H	BA	A	B	C	D
11.000	9.500	0.531	4.750	13.781	11.578	26.547	7.000
G	J	K	O	P	T	S	R
1.109	3.156	2.953	14.047	14.093	2.515	0.500	1.594
ES	N-W	U	AB	AA	d1		
3.149	4.622	1.875	11.375	NPT 1.1/2"	A4		

Performed:
John Dunn

Checked:

*The values shown are subject to change without prior notice.

Version 4.06

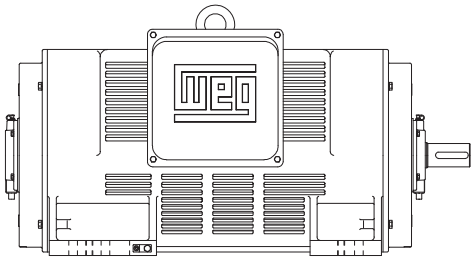
INSTALLATION AND

MAINTENANCE MANUAL FOR

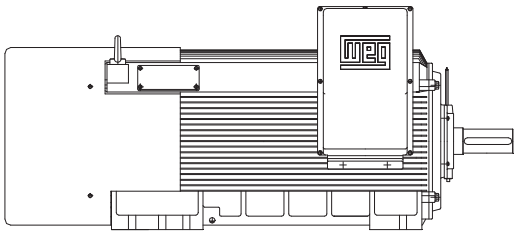
LOW AND HIGH VOLTAGE

THREE PHASE INDUCTION MOTORS

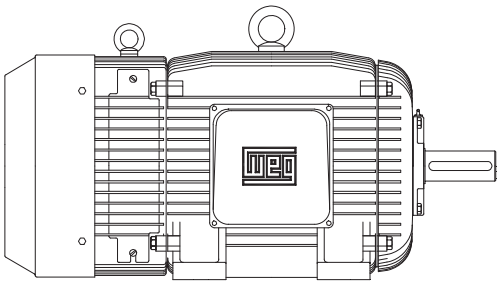
AGA Line



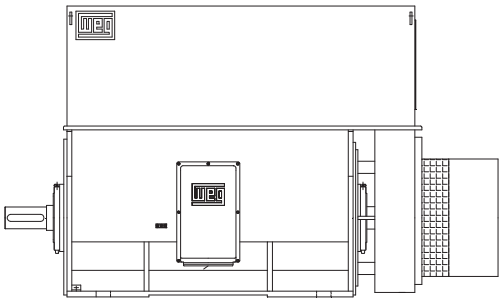
H Line



F Line



MASTER Line



---- IMPORTANT ----

READ CAREFULLY THE INSTRUCTIONS INCLUDED IN THIS MANUAL IN ORDER TO ENSURE A SAFE AND CONTINUOUS OPERATION TO THE EQUIPMENT.

673.13/1101

FOREWORD

The electric motor is an equipment widely used by man in the industrial development as most of the machines he has been inventing depend on it.

Taking into consideration the prominent role the electric motor plays on people's life, it must be regarded as a prime power unit embodying features that require special care including its installation and maintenance in order to ensure perfect operation and longer life to the unit.

This means that the electric motor should receive particular attention.

The INSTALLATION AND MAINTENANCE MANUAL FOR LOW AND HIGH VOLTAGE THREE-PHSE INDUCTION MOTORS intends to assist those who deal with electric machines facilitating their task to preserve the most important item of the unit:

The ELECTRIC MOTOR.

WEG INDÚSTRIAS S.A. - MÁQUINAS

ÍNDICE

1. INTRODUCTION

IMPORTANT:
This manual concerns all Weg three phase asynchronous squirrel cage and slip ring motors. For motors built with high number of special features, contact Weg Máquinas whenever an additional support is required.
All standard and procedures included in this manual must be followed accordingly to ensure a proper operation to the equipment as well as to ensure safety conditions to the personnel involved in the motor operation.
Following these procedures is also important for the warranty policy as explained at the end of this manual.
Therefore, we strongly recommend to any user of Weg motors to read carefully this manual before motor installation and operation. In case you still have further doubts, please contact Weg Máquinas.

2. GENERAL INSTRUCTIONS

2.1. SAFETY INSTRUCTIONS

All personnel involved with electrical installations, either handling, lifting, operation and maintenance, should be well-informed and up-to-dated concerning the safety standard and principles that govern the work and furthermore, they should be advised to heed them.
Before work commences, it is the responsibility of the person in charge to ascertain that these have been duly complied with and to alert his personnel of the inherent hazards of the job in hand.
It is recommended that these tasks be undertaken by qualified personnel and they should be instructed to:

- Avoid contact with energized circuits or rotating parts;
- Avoid by-passing or rendering inoperative any safeguards or protective devices;
- Avoid extended exposure in close proximity to machinery with high noise levels;
- Use proper care and procedures in handling, lifting, installing, operating and maintaining the equipment, and
- Follow consistently any instructions and product documentation supplied when they do such work.

Before initiating maintenance procedures, be sure that all power sources are disconnected from the motor and accessories to avoid electric shock.

2.2. UNPACKING

Prior to shipment motors are factory-tested and dynamically balanced.
The adjusting and sliding surfaces are protected with corrosion inhibitors.
Upon receipt, we recommend to check the boxes to see if any damage has occurred during transportation.
The motors are shipped with a shaft locking device to avoid any damage to the bearings. We recommended to keep this device in stock to be used on all further transportation.

If any damage, contact the carrier and Weg Máquinas. The lack of notice will void the warranty.

When lifting the boxes, it is important to observe the locals appropriate for this purpose as well as to check the weight of the box and the hoist capacity.
The motors shipped in wooden boxes must be always lifted by the eyebolts or by forklift machines and never by the shaft. The box never can be turned around. Lifting and lowering of such boxes must be done gently in order to avoid damage to the bearings.
Make a visual inspection after the unpacking has been effected. Do not remove the protecting grease from the shaft end neither the stoppers from the terminal boxes. These protecting devices should remain at their places until the installation is finished. For motors fitted with shaft locking device, this device must be removed. For motors fitted with ball bearings, rotate manually the rotor several times. If damages are noticed, contact the carrier and Weg Máquinas immediately.

2.3. STORAGE

When motors are not immediately unpacked, boxes should be stored in their normal upright position in a dry temperature place, free of dust dirt, gases and corrosive atmosphere. Any other objects should not be stacked over or against the boxes.
Motors must be storaged in places free from vibrations in order to avoid damage to the bearings. For motors fitted with space heaters, these accessories must be kept switched-on. If painting has suffered any damage, this must be repainted to avoid rusting. The same appliers to the machined surfaces when protecting grease has been wasted.
For slip ring motors, brushes must be lifted and removed from their pocket to avoid oxidation

between contacts and rings when these motors are storage for more than 2 months.

NOTE: Before operating the motor, brushes must be reset in their pocket and the fitting must be checked.

2.3.1. BEARING

When a motor is kept in stock for a period of six months or less, it is not necessary to effect a full inspection on the bearings before running it. What has to be done is to rotate manually the shaft monthly. However, when motor is kept in stock for more than six months, the bearings must be regreased, before operation, according to item 4.1.2.3 on the other hand, if motor is kept in stock for approximately 2 year or more, bearings must be disassembled, according to item 4.2.1.4 and washed with ether and checked.
All the old grease must be removed. After the reassembly, bearings must be regreased according to item 4.2.1.3 of this manual.

2.3.2. SLEEVE BEARINGS

The performance of sleeve bearings depends on its proper installation, lubrication and maintenance. Before assembling and disassembling it, read carefully the instructions of this manual. The procedure described under item 4.2.2 refers to the assembly and disassembly of bearings in motors with the rotor already mounted.

2.3.3. INSULATION RESISTANCE

When a motor is not immediately put into operation, it should be protected against moisture, high temperatures and impurities in order to avoid damage to the insulation. The winding insulation resistance must be measured before operating the motor.
If the ambient contains high humidity, a periodical inspection is recommended during storage. It is difficult to determine rules for the actual insulation resistance value of a motor as the resistance varies according to type, size, rated voltage, condition of the insulating material used and method of construction of the motor. A lot of experience is required to decide when a motor is ready for operation. Periodical records will help to take such decision.
The following guidelines show the approximate insulation resistance values that can be expected from a clean and dry motor at 40ºC temperature ambient, when test voltage is applied for a period of one minute, supplied by the curve of figure 2.1, as per NBR 5383.
The RM insulation resistance is given by the formula:

$$RM = Un + 1$$

Where:
RM - Minimum insulation resistance recommended in Mega Ohm with the winding at a temperature of 40ºC;
Un - Rated voltage of the motor in kV.

If the test is performed at a different temperature, it is necessary to correct the reading to 40ºC by using an insulation resistance variation curve in relation to temperature, given by the motor it self. If this curve is not available it is possible to use an approximate correction given by the curve of figure 2.1, as per NBR 5383 Standard.
On new motors, lower values are sometimes obtained, as solvents are present in the insulating varnishes which become volatile in a later stage during normal operation. This does not necessarily mean that the motor in not suitable for operation considering that the insulation resistance will increase after a period of operation.

On old motors, still in operation, higher values are normally obtained. The comparison with values obtained from previous tests on the same motor under identical load, temperature and humidity conditions will be a better indication of the insulation conditions in comparison to the value obtained from a single test. Any sudden or high reduction of the value requires careful attention.
The insulation resistance is normally measured with a MEGOMETER.

If the insulation resistance is lower than the values obtained by the above mentioned formula, motors must be submitted to a drying process, as per item 4.8.

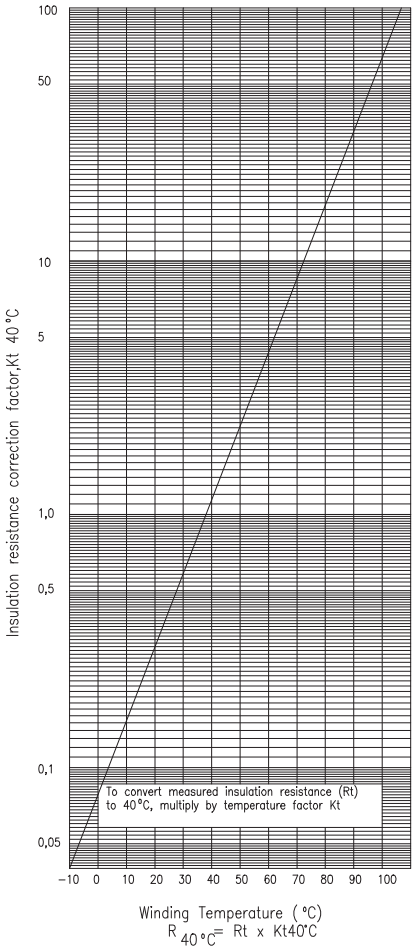


Figure 2.1.

Table 2.1. - Reference limits for insulation resistant of electric motors.

Insulation Resistance Value	Insulation Level
2MΩ or smaller	Bad
< 50MΩ	Dangerous
50...100MΩ	Abnormal
100...500MΩ	Good
500...1000MΩ	Very good
> 1000MΩ	Excellent

Table 2.2. - Polarization index (ratio between 1 and 10 minutes).

Polarization Index	Insulation Level
1 or smaller	Bad
< 1,5	Dangerous
1,5 a 2,0	Abnormal
2,0 a 3,0	Good
3,0 a 4,0	Very Good
> 4,0	Excellent

2.4. HANDLING

Use only the existing eyebolts to lift the motor. Never lift the motor by the shaft. Check the motor weight. Lifting and lowering must be done gently in order to avoid damage to the bearings. The eyebolts attached to bearing housing, heat exchanger, endbells, etc, should be used to handle these components only.

3. INSTALLATION

Electric motors should be installed in locations of easy access for inspection and maintenance. If the surrounding atmosphere contains humid, corrosive or flammable substances or particles, it is essential to ensure an adequate degree of protection. The installation of motors in ambient where there are vapours, gases or dusts, flammable or combustible materials, subject to fire or explosion, should be done in accordance with ABNT NBR, NEC Art. 500 (National Electrical Code) and UL-674 (Underwriters Laboratories, Inc.) Standard.
Under no circumstances, motors can be enclosed in boxes or covered with materials which may impede or reduce the free circulation of cooling air. Motors fitted with external cooling must be located at least 50mm from the ground to permit free air circulation. The air inlet and outlet should never be obstructed or reduced by conductors, pipes or other objects. The installation site should permit conditions of air renewal at a rate of 30m³ per minute for each 100kW motor output.

3.1. MECHANICAL ASPECTS

3.1.1. FOUNDATIONS

The motor base must be level and free from vibrations. For this reason, concrete foundation is recommended.
The type of base to be built will depend on the nature of the soil at the installation site or on the floor capacity.
When designing the motor foundation, it must be taken into consideration the fact that the motor might, occasionally, be submitted to a torque higher than the rated torque. If such designing is not correctly made, vibration problems can occur to the unit (foundation, motor and driven machine).

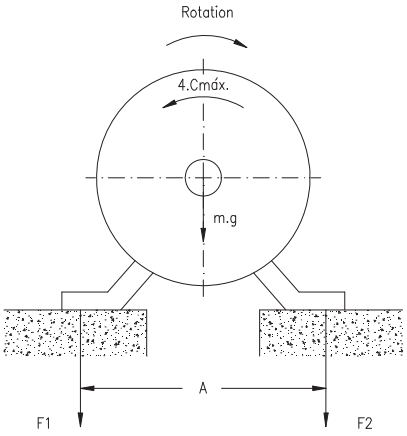
NOTE: On the concrete base, a metallic plate to support the leveling bolt must be provided.

Based on figure 3.1, the forces over the foundation can be calculated by the following formulas:

$$F_1 = +0.5.m.g. + \frac{(4C\max)}{(A)}$$

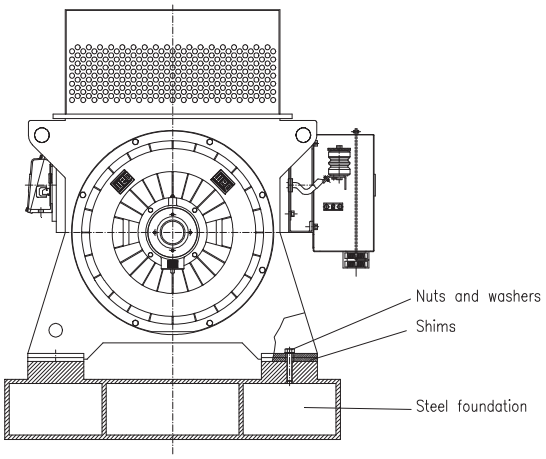
$$F_2 = +0.5.m.g. - \frac{(4C\max)}{(A)}$$

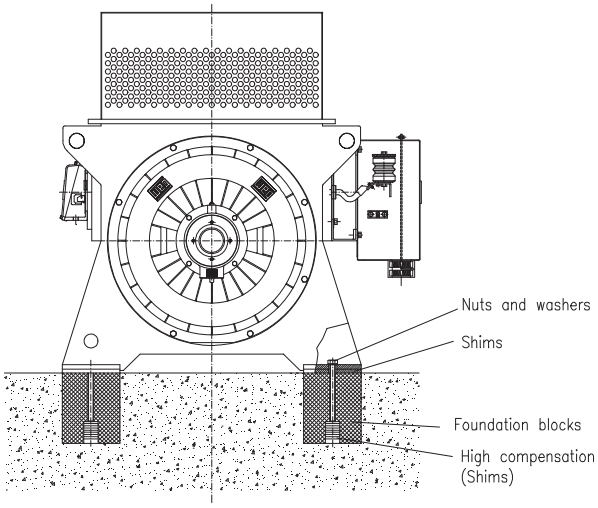
Where:
F1 and F2 - Forces on the base (N).
g - Gravity acceleration (9.81m/s²).
m - Motor weight (N).
Cmax - Breakdown torque (Nm).
A - Taken from motor dimensional drawing (m).

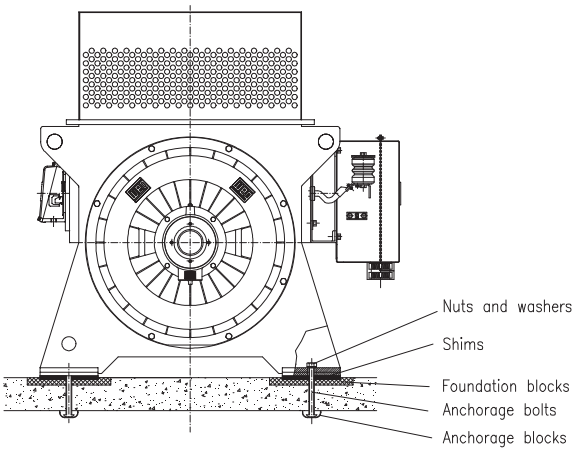


NOTE: The drawing above shows the forces over the motor when running clockwise. For counter clockwise rotation, forces are reversed (F1, F2, 4.Cmax.).

Steel or iron blocks, plane surfaces blocks with anchorage devices can be fitted in the concrete foundation to fix the motor feet as suggested in figure 3.2. It is important that all the structure equipment are made in such a way that they can transmit any force or torque which may occur during the operation.







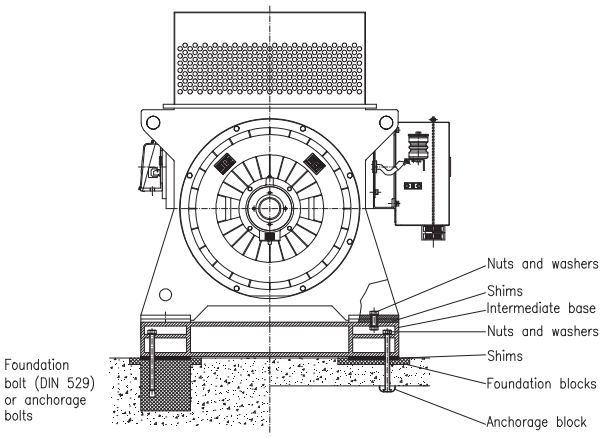


Figure 3.2. Motor Fixation Types.

3.1.1.1. TYPES OF BASES

a) Concrete bases

As mentioned above, the concrete bases are the most commonly used for the fixation of these motors.

The type and size of the foundation - as well as other fixing devices for this purpose will depend on the type and size of the motor.

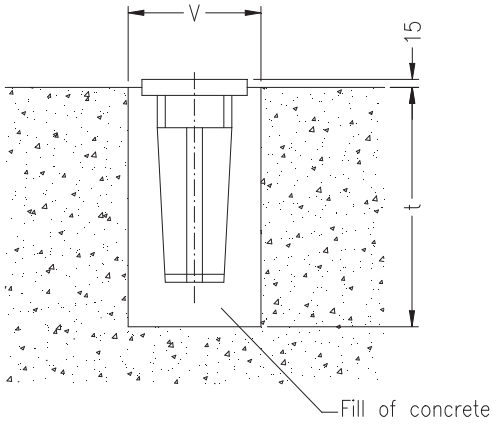
The motors can be mounted on a concrete base with four foundation blocks. See dimensions of the installation components in the table below. Installation and examples:

Hole diameter in the motor feet	Foundation block		Fastening bolts (DIN 933)		Tapered pins (DIN 258)	
	Number	Dimension	Number	Dimension	Number	Dimension
28	4	M24	4	M24 x 60	2	14 x 100
36	4	M30	4	M30 x 70	2	14 x 100
42	4	M36	4	M36 x 80	2	14 x 100
48	4	M42	4	M42 x 90	2	14 x 100

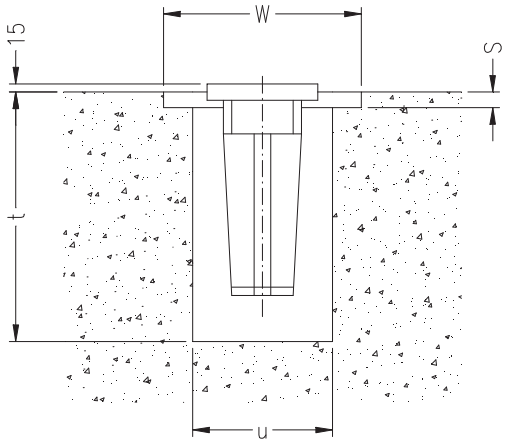
Table 3.1 - Anchorage measurements (example of installation).

Thread	Mounting dimensions				
	s	t	u	v	w
M26 and M30	50	450	220	265	315
M36	70	539	240	300	350
M42	70	600	270	355	400

Example 1



Example 2



Examples of preparation:
Remove all dirt from the foundation blocks in order to ensure a perfect anchorage between the foundation blocks and the motor. Fix the foundation blocks at the motor feet by means of bolts.
Provide shims of different thickness (total trickiness of about 2mm) between the motor feet and the foundation base to ensure a further accurate alignment vertically.
Inside the feet holes, the fastening bolts must be covered with a metal sheet or presspan in order to center the foundation blocks exactly to the feet holes and perform an accurate alignment horizontally.
Place shims or leveling bolts under the foundation blocks in order to obtain a perfect motor leveling and alignment between the motor and the driven machine. After introducing the concrete, make an accurate control of the alignment. Eventual small corrections can be done by washers or metal plates or by means of a new adjustment of the fastening bolt clearences. Tighten now firmly all fastening bolts.
Make sure all motor feet surfaces are supported uniformly without damaging motor frame. After completing the test, introduce two tapered pins for correct fastening. For this purpose, use the pre-drilled holes in the feet.

b) Slide rails
When drive system is done by pulleys, the motor should be mounted on slide rails and the lower part of the belt must be pulling.
The rail that stays near the drive pulley is positioned in such a manner that the adjusting bolt be between the motor and the driven machine. The other rail must be positioned with the bolt in the opposite position, as shown in fig. 3.3. The motor is bolted to the rails and set on the base.
The drive pulley is then aligned in such a way that its center be in the same level of the driven pulley center.
Motor and driven machine shafts must be in a parallel position.
The belt should not be excessively stretched, see fig. 3.9.After the alignment, rails are to be fixed.

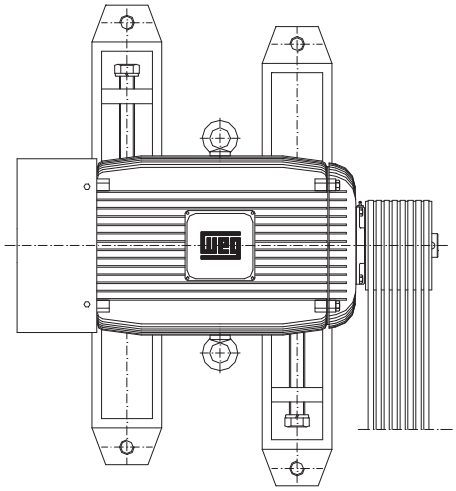


Figure 3.3.

c) Metallic bases
The metallic bases must have a flat surface under motor feet in order to avoid frame deformation. The bearing housing surface should be so determined that under the feet of the motor one can place shim plates of approximately 2mm thickness.
Motor should not be removed from their common metallic bases for alignment, the metallic bases should be leveled on the actual foundation.
When a metallic base is used to adjust the height of the motor shaft end with the machine shaft end, it should be leveled on the concrete base.
After the base has been leveled, foundation studs tightened, and the coupling checked, the metal base and the studs are then cemented.

3.1.2. ALIGNMENT/LEVELING

The electric motor must be accurately aligned with the driven machine, particularly in cases of direct coupling. An incorrect alignment can cause bearing defects, vibrations and even shaft breaking.
The best way to ensure correct alignment is to use dial indicator placed on each coupling half, one reading radially and the other axially.
In this way, simultaneous readings can be informed and one can check any parallel (fig. 3.4a) or concentricity deviations (fig. 3.4b) by rotating the shaft. The dial indicator should not exceed 0.05mm. If the operator is sufficiently skilled, he can obtain alignment with clearance gauge and a steel ruler, providing that the couplings be perfect and centered (fig. 3.4c)

A measurement at 4 different points of the circumference should not give a reading difference larger than 0.03mm.

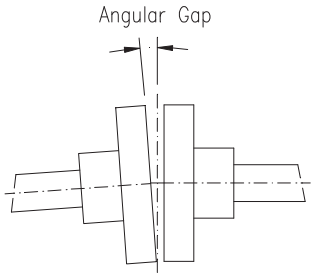


Figure 3.4a- Angular alignment (parallelism).

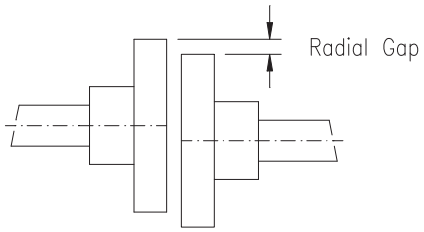


Figure 3.4b - Radial alignment (concentricity).

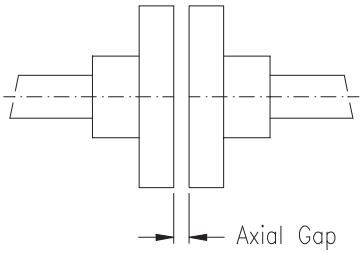


Figure 3.4b - Radial alignment (concentricity).

On the alignment/leveling it is important to take into consideration the effect of the temperature over the motor and driven machine. The different expansion levels of the coupled machines can modify the alignment/leveling during motor operation.
After the set (motor and base) is perfectly aligned either at cold or at hot, motor must be bolted, as shown in fig. 3.5. There are instruments which use visible laser ray added by specific computer programs that can perform and ensure high precision alignment.

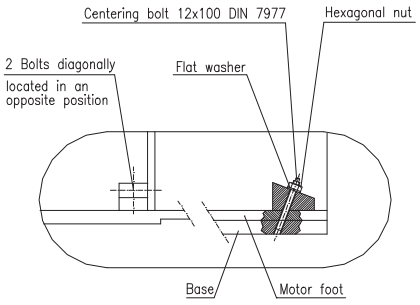


Figure 3.5.

NOTE: Bolts, nuts and washers can be supplied with the motor, if required.

3.1.3. COUPLINGS

a) Direct coupling
Whenever possible, it is recommended to use direct coupling due to lower cost, less space required, no belt slippage and lower accident risk.
In case of speed ratio drives, it is also common to use direct coupling with a gearbox.

IMPORTANT: Align carefully the shaft ends using, whenever possible, flexible coupling.

Clearance values recommended for direct coupling		
Clearance	Poles	
	2	≥ 4
Radial	0,03mm	0,05mm
Axial	3 to 4mm	3 to 4mm
Angular	0,10mm	0,10mm

b) Gearbox coupling
Poorly aligned gearbox couplings normally cause jerking motions which provoke vibration to the coupling and to the motor. Therefore, due care must be given to correct shaft alignment, perfectly parallel in cases of straight gears, and at the correct angle for bevel or helical gears.
Perfect gear arrangements can be checked by inserting a strip of paper on which the teeth marks will be traced after a single rotation.

c) Belt and pulley coupling
Belt transmission is the most commonly used when a speed ratio is required.

ASSEMBLY OF PULLEYS: The assembly of pulleys on shafts featured with keyway and threaded hole must be done by inserting it halfway up to the keyway merely by manual pressure.
On shafts without threaded hole it is recommended to heat up the pulley to about 80ºC (fig. 3.6).

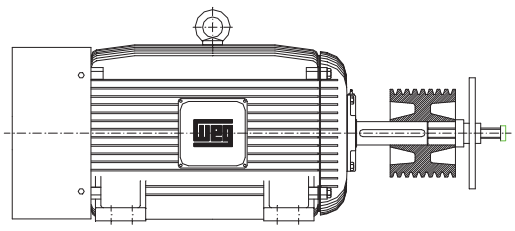


Figure 3.6. - Assembly or pulleys.

DISASSEMBLY OF PULLEYS: for disassembly of pulleys it is recommended to use the devices shown in figure 3.7 in order not to damage the key neither shaft surface.

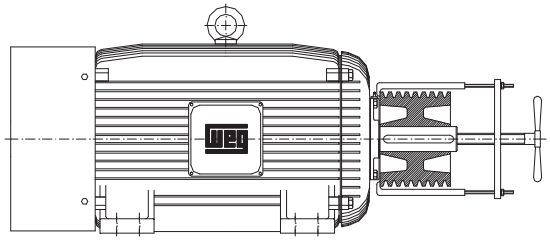
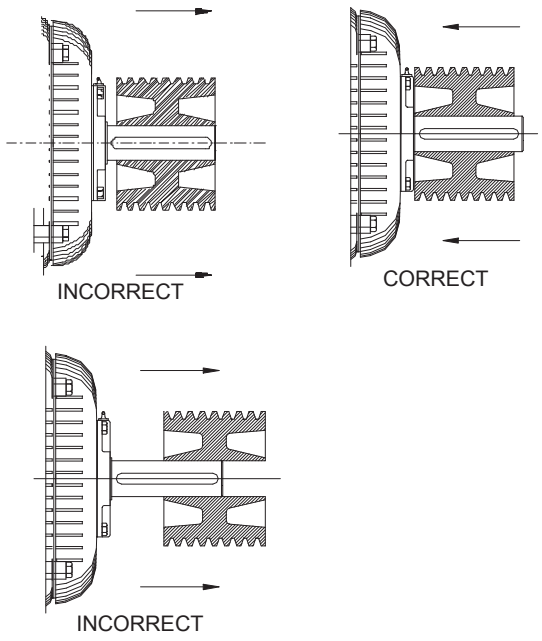


Figure 3.7. - Disassembly of pulleys.

Hammers should be avoided when fitting pulleys and bearings. The fitting of bearings with the aid of hammers causes spots in the bearing races. These initially small spots increase with usage and can develop to a stage that completely damage the bearing. The correct positioning of a pulley is shown in figure 3.8.



RUNNING: Avoid unnecessary thrusts on the bearings by ensuring that the shafts are parallel and the pulleys perfectly aligned (figure 3.9).

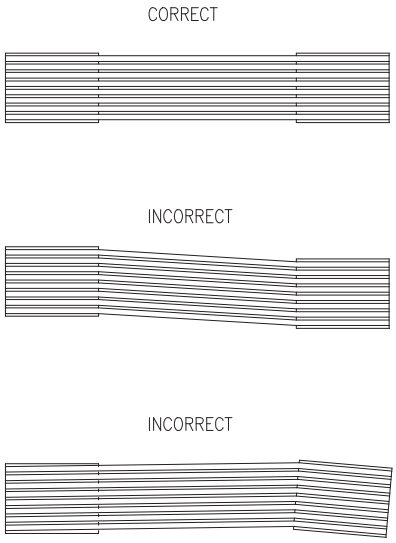


Figure 3.9 - Correct pulley alignment.

Laterally misaligned pulleys, when running, transmit alternating knocks to the rotor and can damage the bearing housing. Belt slippage can be avoided by applying a resin type material such as rosin.
Belt tension is only required to avoid slippage during operation (figure 3.10). Excessively small pulleys should be avoided; these cause shaft flexion as belt traction increases with the decrease of pulley size.

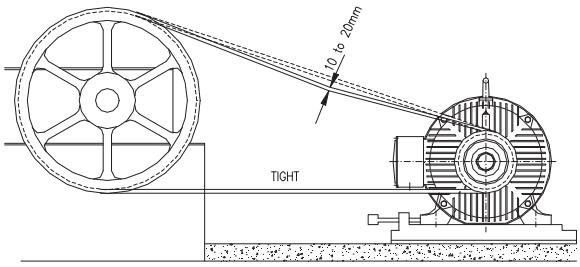


Figure 3.10 - Belt tension

NOTE: A belt with excessive tension increases the force on the shaft end causing vibrations and fatigue leading to a possible shaft rupture.
When specific pulleys are required, contact Weg Máquinas in order to insure a correct designing.

Due to the existing tensions on the belts, there is a reaction acting as radial load over the motor shaft end.
The data to calculate such reaction (radial force) are:
- Output transmitted [kW] (P);
- Motor speed [rpm] (RPM);
- Diameter of driven pulley [mm] (DPMV);
- Diameter of driven pulley [mm] (DPMT);
- Distance between centers [mm] (I);

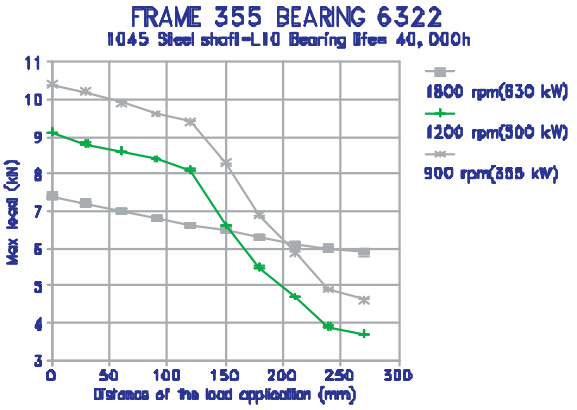
- Friction coefficient [-] (MI) - (normally 0.5);
- Slip coefficient [-] (K);
- Belt contact angle on smaller pulley [RAD] (alfa);
- FR: Radial force acting over the shaft end [N] (FR).

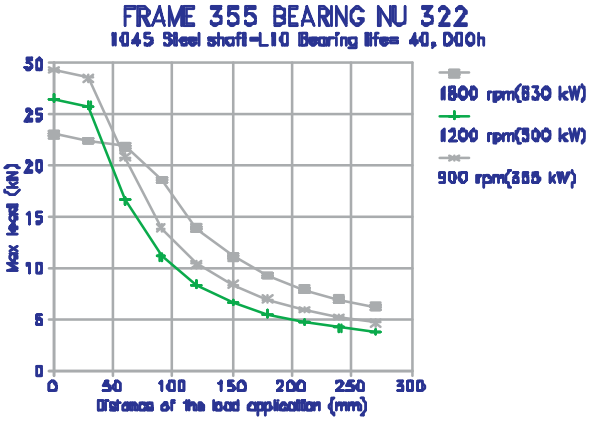
$$ALFA = \pi - \left(\frac{DPMV - DPMT}{1} \right)$$

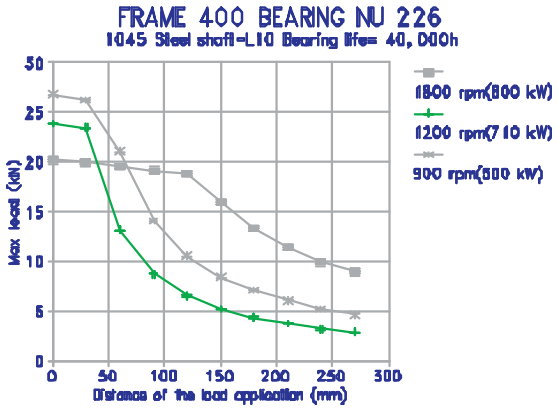
$$K = 1.1x \left[\frac{\varepsilon(MIxALFA)+1}{\varepsilon(MIxALFA)-1} \right]$$

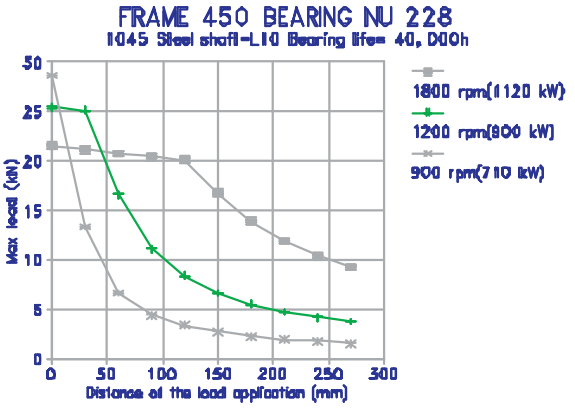
$$FR = \frac{18836{,}25\chi N}{DPMTxRPM} x \frac{\sqrt{K^2 x[1-COS(ALFA]+1.21x[1+COS(ALFA)]}}{2}$$

The following graph indicate the maximum radial thrusts acceptable by motor bearings up to frame 450. Frame 500 and largeh will require an analysis by Weg Máquinas.









NOTE: Always use couplings and pulleys duly machined and balance with concentric and equidistant holes.
Avoid, in all cases, oversized keys as these can cause unbalancing.
In case these instructions are not followed accordingly, vibration levels will occur.

3.1.3.1. COUPLING ARRANGEMENT FOR SLEEVE BEARING MOTORS - AXIAL CLEARANCE

Motors fitted with sleeve bearings should be directly coupled to the driven machine or even using a gearbox. Pulley/belt coupling is not recommended.
These sleeve bearing motors have three identification marks on the shaft end. The central mark (red painted) indicated the magnetic center; the other two indicate the limits for the rotor axial displacement
When coupling the motor, the following aspects must be considered:

- Bearing axial clearance which is shown on the chart below for each bearing size.
- Axial displacement of the driven machine, if any.

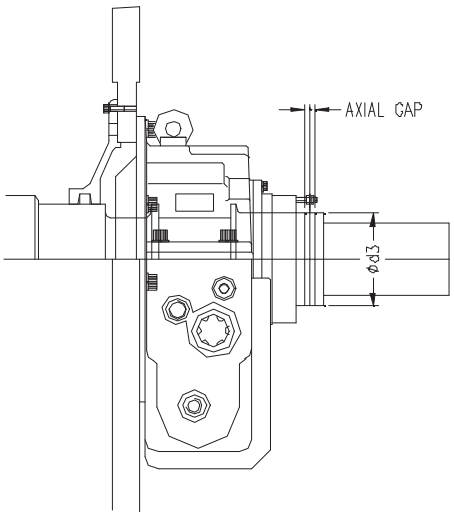
Maximum axial clearance allowed by the coupling.

Clearances applied to sleeve bearings for motor supplied by Weg Máquinas	
Bearing size	Total axial clearance in mm
9	3 + 3 = 6
11	4 + 4 = 8
14	5 + 5 = 10
18	7,5 + 7,5 = 15
22	12 + 12 = 24
28	12 + 12 = 24

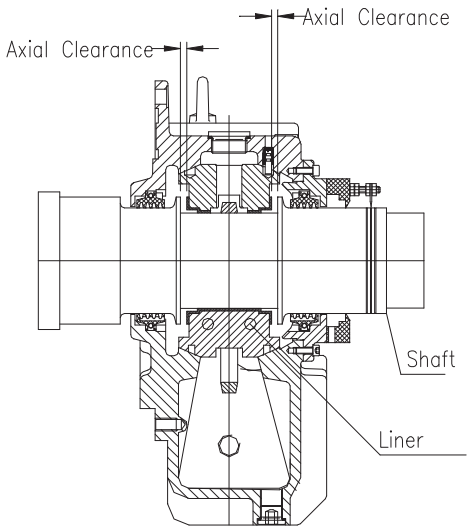
The motor must be coupled in such a way that the arrow attached to the bearing frame be positioned exactly on the central mark (red painted) while motor is in operation.
During motor starting or even under operation, rotor should move freely between the two external lots if the driven machine creates any axial force on the motor shaft. Under no circumstance, motor can operate continuously with axial force on the bearing.

Sleeve bearings normally used by Weg Máquinas are not designed to withstand axial forces continuously.

Figure below shows part of the drive end bearing highlighting a basic configuration of the shaft/bearing set as well as axial clearances.



The figure below shows part of the bearing frame where the arrow indicates the magnetic center and the three marks on the shaft.



3.2. ELECTRICAL ASPECTS

3.2.1. SUPPLY SYSTEM

Proper electric power supply is very important. All the wires and protection system must ensure an excellent quality of electric power supply on the motor terminals within the following parameters:
- Voltage: It can fluctuate within a range of more or less 10% in relation to rated value.
- Frequency: It can fluctuate within a range of more or less 15% in relation to rated value.
- Voltage/frequency: It can occur a combined fluctuation of more or less 10%.

3.2.2. CONNECTION

In order to connect the supply conductors, remove the covers of the rotor and stator terminal boxes (if any).
Cut the sealing rings (standard motors are not supplied with cable glands) according to the diameter to be used.
Insert the conductors into the rings. Cut the supply conductors to desired length, disbarkt the ends and assemble the terminals on them. Connect the metallic covering of the conductors (if any) to the common grounding.
Cut the grounding terminal to size and connect it to the existing connector in the terminal box and/or frame.
Fasten all connections firmly.

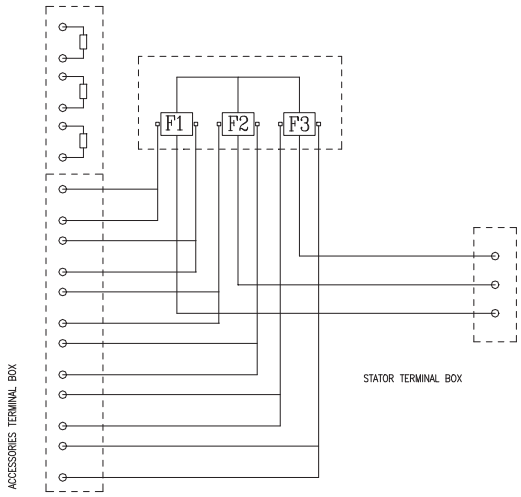
NOTE: Do not use, for terminal fastening, eel washers or other material which do not have excellent electric conductivity characteristics.

It is recommended to apply a grease protection on all connections before performing the connection. Insert all sealing rings into the respective grooves. Screw the terminal box cover carefully, ensuring that the sealing rings are correctly introduced.

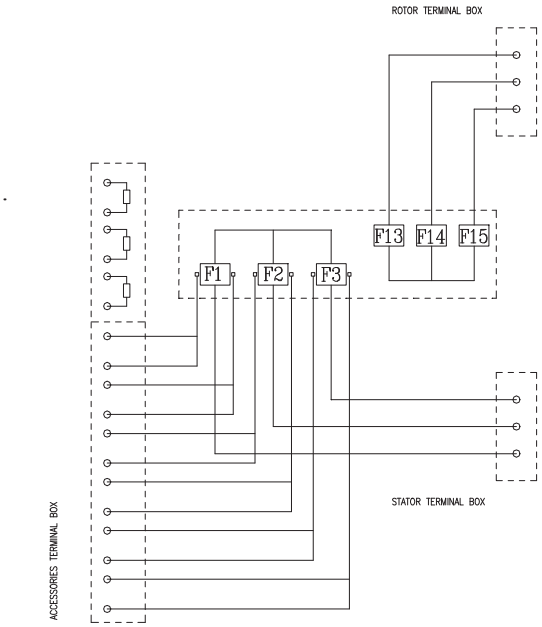
3.2.3. GENERAL CONNECTION DIAGRAMS

We are presenting below orientative connection diagrams for squirrel cage and slip ring induction motors as well as motors supplied with lighting arrestors and surge capacitors:

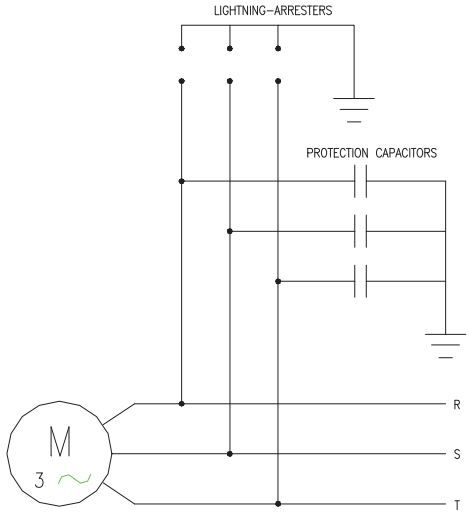
General connection diagram for squirrel cage motors:



General connection diagram for slip ring motors:



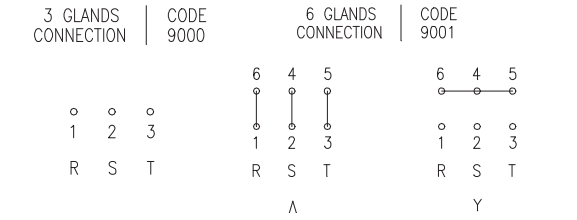
General connection diagram for motors supplied with lightning arrestors and capacitors:

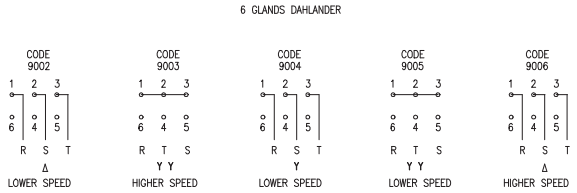


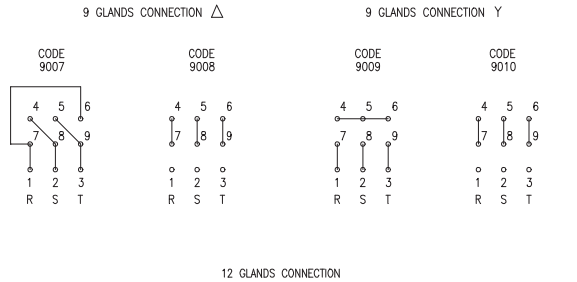
3.2.4. CONNECTION DIAGRAMS FOR STATORS AND ROTORS

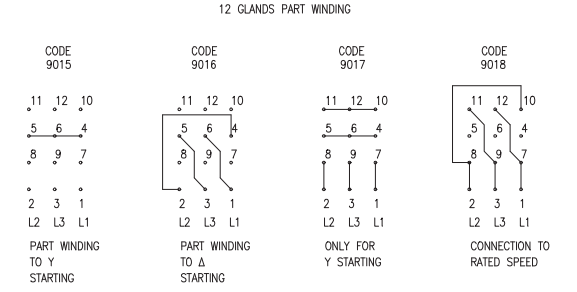
The following connection diagrams show the number of terminals and how they have to be connected.
There is a nameplate on the motor indicating the connection diagram code that must be used.

CONNECTION DIAGRAMS FOR STATORS:

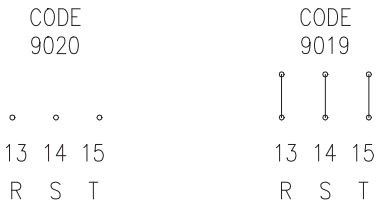








CONNECTING DIAGRAM ROTOR



3.2.5. STARTING METHODS FOR ELECTRIC MOTORS

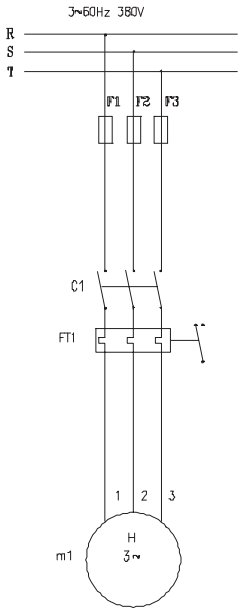
A) DOL STARTING.

Whenever possible, three-phase squirrel cage motors should be started directly at full voltage through a contactor.

DOL is the easiest method of starting; only feasible, however, when the starting current does not affect the power supply.

Normally, the starting current of induction motors is six to seven times the rated current. Note that high starting current can cause supply disturbances to other consumers due to voltage drops in the main power supply.

	Starting	Duty
C1	Close	Close



This situation can be corrected with one of the following options:

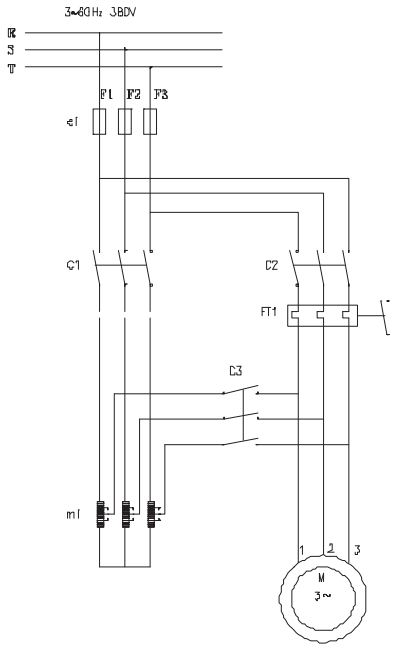
a) The power supply rated current is so high that the starting current is not proportionally high;
b) Motor is started under no-load conditions with a short starting cycle and, as a consequence, a low starting current with a transient voltage drop tolerable to other consumers;
c) When duly authorized by the regional Hydro Company (utility);

B) STARTING WITH A COMPENSATING SWITCH.

If DOL starting is not feasible, either due to restrictions imposed by the utility or due to the installation itself, reduced voltage indirect starting methods can be used in order to reduce the starting current.

The single line connection diagram (b) shows the basic components of a compensating switch featuring a transformer (usually an auto-transformer) with a series of taps corresponding to the different values of the reduced voltage. Only three motor terminals are connected to the switch, being the others interconnected as per diagram for the indicated voltage.

	Starting	Duty
C1	Close	Open
C2	Open	Close
C3	Close	Open



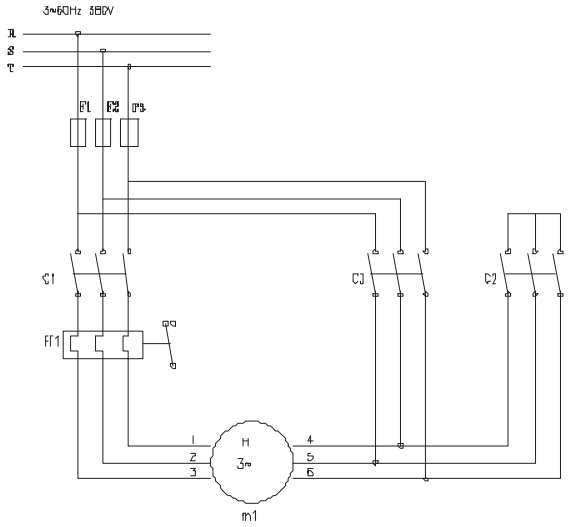
C) WYE-DELTA STARTING.

For wye-delta starting it is important that the motor allows dual-voltage connections, and the higher voltage must be equal to the lower multiplied by 3.

For example:

The wye-delta connection is normally used only for low-voltage motors due to availability of control and protection devices:

	Starting	Duty
C1	Close	Close
C2	Close	Open
C3	Open	Close

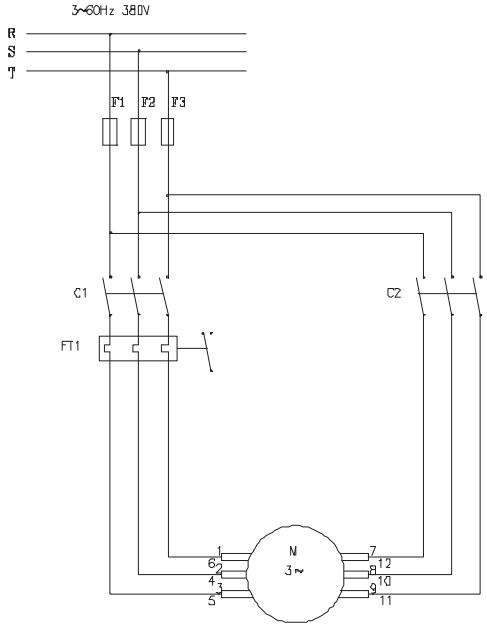


D) PART WINDING START (12 LEADS)

Motor with part winding. The starting is made using only fifty percent of the winding.

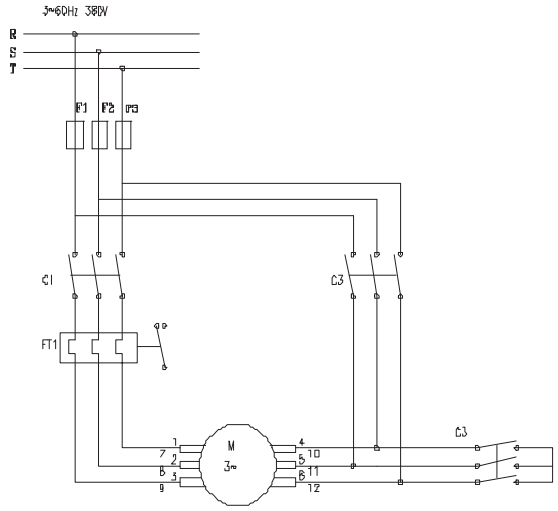
d1) Part-winding start (12 leads).

	Starting	Duty
C1	Close	Close
C2	Open	Close



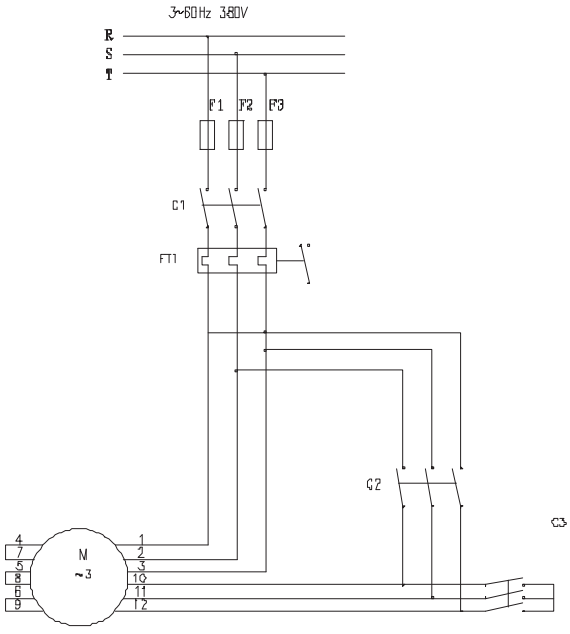
d2) (Y/Δ) Lower voltage.

	Starting	Duty
C1	Close	Close
C2	Open	Close
C3	Close	Open



d3) (Y/Δ) Higher voltage.

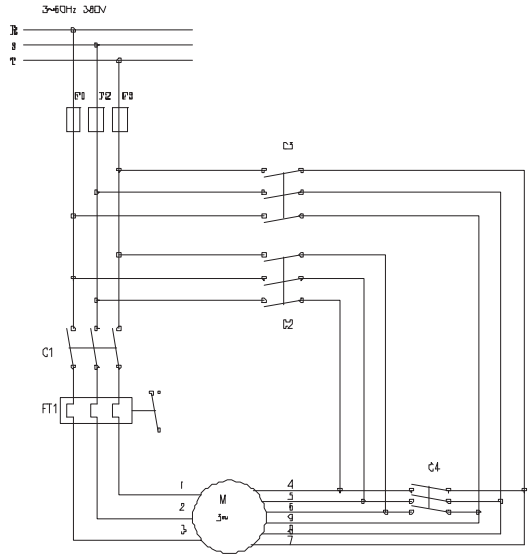
	Starting	Duty
C1	Close	Close
C2	Open	Close
C3	Close	Open



E) SERIES-PARALLEL STARTING.

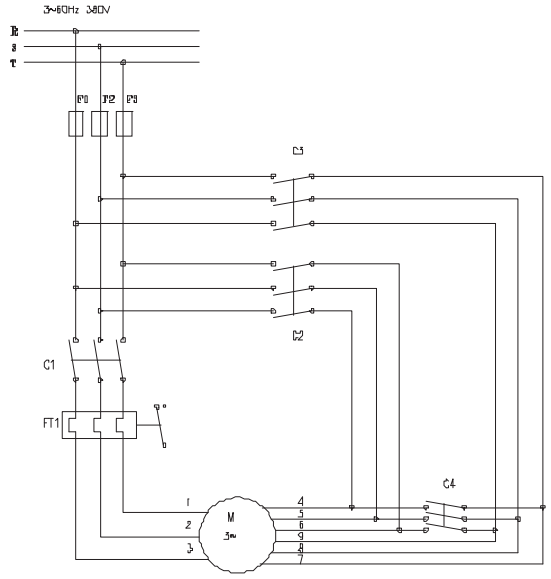
e1) Series-parallel starting ΔΔ/ΔΔ (12 leads).

	Starting	Duty
C1	Close	Close
C2	Open	Close
C3	Open	Close
C4	Close	Open



e2) Series-parallel starting ΔΔ/ΔΔ (9 leads).

	Starting	Duty
C1	Close	Close
C2	Open	Close
C3	Open	Close
C4	Close	Open



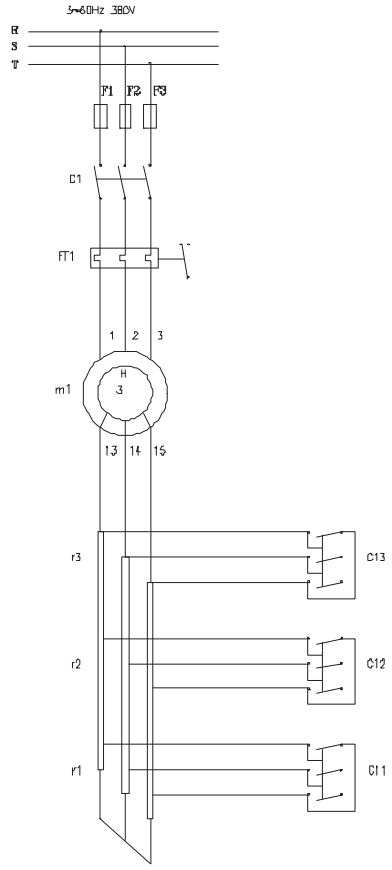
F) STARTING OF SLIP RING MOTORS WITH RHEOSTAT

For starting of slip ring motors an external rheostat is connected to the rotor by means of a set of brushes and slip rings (connection diagram F).

The extra rotor resistance is held in the circuit during the starting to reduce the starting current and increase torque. Furthermore, it is possible to regulate the external resistance so as to have a starting torque equal to, or close to the motor breakdown torque.

NOTE: Every time customers intend to use other than DOL, inform WEG Máquinas in advance so we can analyse the starting torques required by the load .

	Starting	Duty
C1	Close	Close



Symbols:
C1, C2, C3 = contactors
C1, F2, F3 = fuses
FT1 = overload relay

3.2.6. MOTOR PROTECTION

Motors have, in principle, two types of protection: protection against overload/locked rotor, and short circuits.

Motors in continuous use should be protected from overloading by means of a device incorporated into the motor, or by independent device, usually a fixed or adjustable thermal relay equal or inferior to the value derived from multiplying the rated power supply current at full load by:

- 1.25 for motors with a service factor equal or superior to 1.15 or
- 1.15 for motors with service factor equal to 1.0.

Electric motors are fitted, under customers request, with overheating protective devices (in case of overload, locked rotor, voltage drop, inadequate motor ventilation) such as a thermostat (thermal probe), thermistors, RTD s. These overheating protective devices do not require other independent devices.

3.2.6.1. TEMPERATURE LIMITS FOR WINDINGS

The temperature of the winding hottest point must be kept below the thermal class limit.

The total temperature corresponds to the sum of ambient temperature plus temperature rise (T) plus the difference between average temperature of the winding and the hottest point.

By standard, maximum ambient temperature is 40°C. any temperature above this is considered special.

The temperature values and the permissible total temperature at the hottest point are given in the chart below:

Insulation class		**B**	**F**	**H**
Ambient temperature	°C	40	40	40
T = Temperature rise (resistance method)	°C	80	100	125
Difference between hottest point and average temperature	°C	10	15	15
Total: Hottest point temperature	°C	130	155	180

THERMOSTAT (Thermal probe):

These are bimetallic thermal detectors with normally closed silver contacts and they trip at pre-determined temperatures. Thermostats are series-connected or independent according to the connection diagram.

THERMISTORS (PTC or NTC):
They are thermal detectors composed of semi-conductors PTC which sharply change their resistance when reaching a set temperature. They are series-connected or independent according to the connection diagram

NOTE: Thermostats and thermistors are connected to a control unit that cuts off the motor power supply or switches on an alarm system, in response to the thermistors reaction.

RESISTANCE TEMPERATURE DETECTORS (RTD's):
RTD's are resistance thermal detectors usually made of platinum.
Basically, RTD's operate on the principle that the electrical resistance of a metallic conductor varies linearly with the temperature. The detector terminals are connected to a control panel, usually fitted with a temperature gauge.
Normally Weg Motors are supplied with one RTD per phase and one per bearing where these protective devices are regulated for alarm and subsequent switch-off. For extra safety reasons, it is possible to fit two RTD's per phase.
Table 3.2 shows a comparison between the protection systems.

NOTE:

1) If required by the application, other protective devices must be used besides the ones indicated above.
2) Table 3.3 shows the temperature values in relation to the measured Ohmic resistance.
3) It is recommended to adjust the relays according to table 3, that is:

Class F:
Alarm: 140°C.
Tripping: 155°C.
Class H:
Alarm: 155°C.
Tripping: 180°C.
The alarm and tripping values can be defined based on experience. However, they can not exceed the values given previously.

TABLE 3.2 - Comparison between Motor Protection Systems.

Causes of overheating	Current-based protection		Protection with thermal probe in the motor
	Fuse only	Fuse and thermal protector	
1. Overload with 1.2 times the rated current.	unprotected	totally protected	totally protected
2. Duty cycles S1 to S8, EB 120.	unprotected	partially protected	totally protected
3. Brakings, reversion and operation with frequent starts.	unprotected	partially protected	totally protected
4. Operation with more than 15 starts p/hour.	unprotected	partially protected	totally protected
5. Locked rotor.	partially protected	partially protected	totally protected
6. Fault on one phase.	unprotected	partially protected	totally protected
7. Excessive voltage fluctuation.	unprotected	totally protected	totally protected
8. Frequency fluctuation on power supply.	unprotected	totally protected	totally protected
9. Excessive ambient temperature.	unprotected	totally protected	totally protected
10. External heating caused by bearings, belts, pulleys etc.	unprotected	unprotected	totally protected
11. Obstructed ventilation.	unprotected	unprotected	totally protected

Table 3.3 - Variation of Platinum RTD's.

ºC	0	1	2	3	4	5	6	7	8	9
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51
10	103.90	104.29	104.68	105.07	105.46	105.95	106.24	106.63	107.02	107.40
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.28
30	111.67	112.06	112.45	112.83	113.22	113.61	113.99	114.38	114.77	115.15
40	115.54	115.93	116.31	116.70	117.08	117.47	117.85	118.24	118.62	119.01
50	119.40	119.78	120.16	120.55	120.93	121.32	121.70	122.09	122.47	122.86
60	123.24	123.62	124.01	124.39	124.77	125.16	125.54	125.92	126.31	126.69
70	127.07	127.45	127.84	128.22	128.60	128.98	129.37	129.75	130.13	130.51
80	130.89	131.27	131.66	132.04	132.42	132.80	133.18	133.56	133.94	134.32
90	134.70	135.08	135.46	135.84	136.22	136.60	136.98	137.36	137.74	138.12
100	138.50	138.88	139.26	139.64	140.02	140.39	140.77	141.15	141.53	141.91
110	142.29	142.66	143.04	143.42	143.80	144.17	144.55	144.93	145.31	145.68
120	146.06	146.44	146.81	147.19	147.57	147.94	148.32	148.70	149.07	149.45
130	149.82	150.20	150.57	150.95	151.33	151.70	152.08	152.45	152.83	153.20
140	153.58	153.95	154.32	154.70	155.07	155.45	155.82	156.19	156.57	156.94
150	157.31	157.69	158.06	158.43	158.81	159.18	159.55	159.93	160.30	160.67

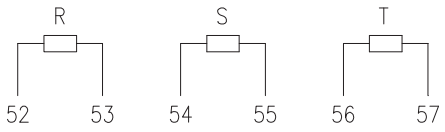
NOTE: When motors are supplied with accessories T-box, the connection terminals for thermal protectors and other accessories are fitted in this T-box.

GENERAL IDENTIFICATION OF TERMINALS, STATOR, ROTOR AND ACCESSORIES

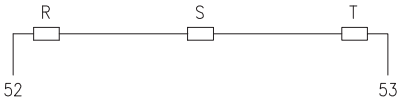
01 to 12 = Stator.
13 to 15 = Rotor.
16 to 19 = Space heater.
20 to 27 = RTD (PT100)in winding.
36 to 43 = Thermistors (PTC) in winding.
52 to 59 = Thermostats in winding (Klixon, Compela).
68 to 71 = RTD's in the bearings.
72 to 75 = Thermistors in the bearings.
76 to 79 = Thermostats.
80 to 82 = Thermometer.
92 to 93 = Brakes.
94 to 99 = Current transformers.

CONNECTION DIAGRAM OF THERMOSTATS (Klixon, Compela)

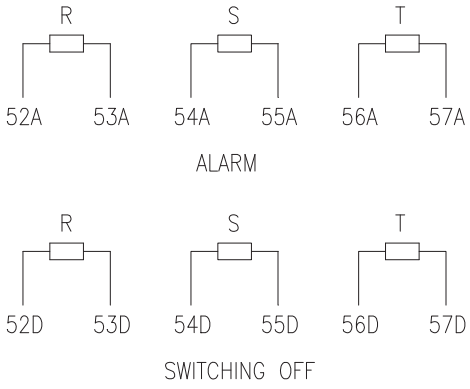
IN WINDING (one per phase) – CODE 9029



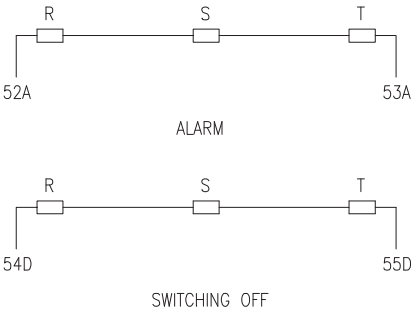
IN WINDING (one per phase series connected) – CODE 9030



IN WINDING (two per phase) – CODE 9031

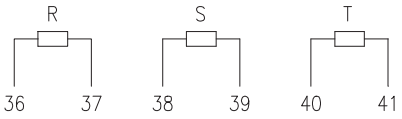


IN WINDING (two per phase series connected) – CODE 9032

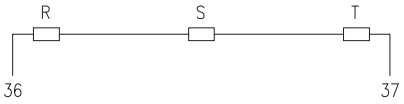


CONNECTION DIAGRAM OF THERMISTORS (PTC)

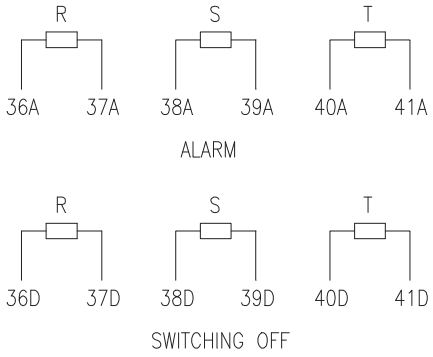
IN WINDING (one per phase) – CODE 9025



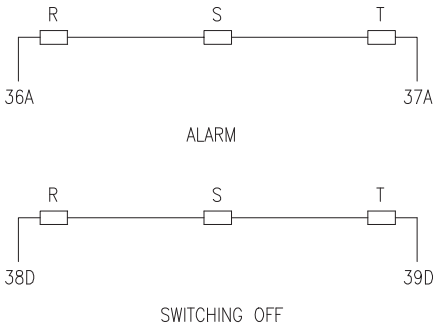
IN WINDING (one per phase series connected) – CODE 9026



IN WINDING (two per phase) – CODE 9027

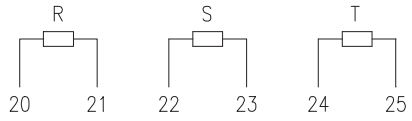


IN WINDING (two per phase series connected) – CODE 9028

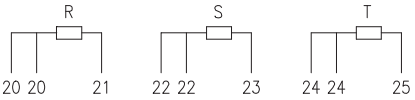


CONNECTION DIAGRAM OF RTD'S (PT100)

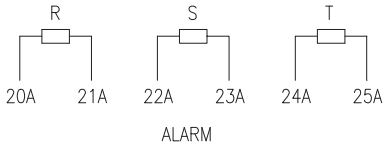
IN WINDING (one per phase) – CODE 9021

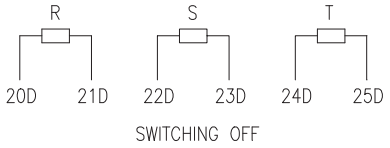


NO ESTATOR (um por fase com tres fios) – CODIGO 9022

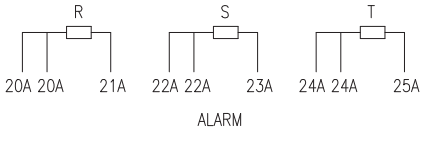


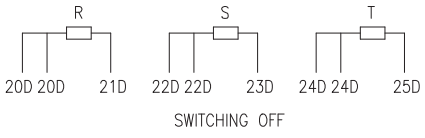
IN WINDING (two per phase) – CODE 9023





IN WINDING (two per phase with three wires) – CODE 9024





CONNECTION DIAGRAM IN THE BEARINGS

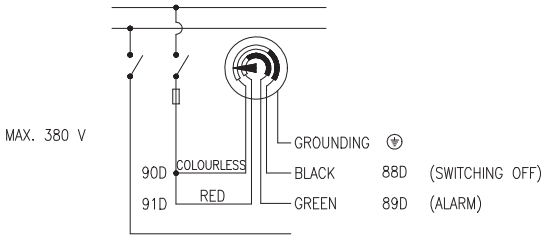
PT100 (one per bearing) – CODE 9033

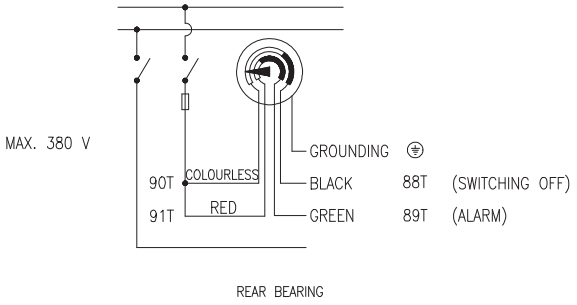
PT100 (one per bearing with three wires) – CODE 9034

PTC (one per bearing) – CODE 9035

KLIXON,COMPELA (one per bearing) – CODE 9036

THERMOMETER (one per bearing) – CODE 9037

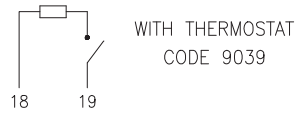




3.2.7. SPACE HEATERS

When motors are fitted with space heaters to avoid water condensation during long periods o standstill,
the space heaters must be connected so that they are energized immediately after the motor is switched-off and are energized immediately after the motor is switched-on. A dimensional drawing and a specific nameplate existing on the motor indicate the supply voltage and the characteristics of the space heaters installed.

CONNECTION DIAGRAM OF SPACE HEATERS



3.3. COMMISSIONING

3.3.1. PRELIMINARY INSPECTION

Before starting a motor for the first time, or after long period of standstill, check the following items:

1) Is the motor clean? Were all packing materials and cleaning materials removed?
2) Make sure the supply voltage and frequency correspond to those indicated on the nameplate.
3) Ascertain that the endbell and bearing-housing fastening bolts are firmly tightened.
4) Make sure the motor is correctly aligned (as per item 3.1.2).
5) Are the bearings correctly lubricated (as per item 4.2).
6) Are the rotor terminals connected? (Only for slip ring motors).
7) Are the thermal protector conductors, the rounding terminal and the space heaters connected?
8) Is the insulation resistance of the rotor and stator according to the prescribed value ? (as per item 2.3.3).
9) Were all objects such as tools, measuring instruments and alignment devices removed from the area of the motor?
10) Are the brush-holders in order? Are the brushes making contact? (see item 4.6).
11) Are all motor fixing bolts duly tightened?
12) When the motor is started at no load, does it rotate freely without abnormal noise? Is the direction of rotation correct? (To reverse the rotation, invert any of two terminal leads of the power supply).
13) Is the motor ventilation OK? Note the direction of rotation of unidirectional motors.

NOTES:

1) The gap between brush holder and Slip ring surfaces should be between 2mm to 4mm.
2) Brush pressure on the slip ring should be in accordance with the specified value, and the brush incidence to the contact surface should be perpendicular.
3) If the load (operation rated current) applied to the motor are not in accordance with the rated characteristics of such motor (above or below), the brushes specification must be analyzed in relation to the actual load requirements. Check data given in item 4.6.
4) Before changing rotation direction of two-pole motors, contact Weg Máquinas for analysis.
5) The "H" line motors with special noise level are built with unidirectional fan (all RPM´s). To reverse rotation direction, contact Weg Máquinas in order to analyze the fan.
6) The "Master" line motors are also built with unidirectional fans. So if rotation direction has to be reversed, contact Weg Máquinas in order to analyze the fan.

WARNING:
The non observation of the items described above can lead to serious problems to motor performance, causing excessive wear to brushes and slip rings (for wound rotor motors), overheating and possible damage to motor windings. These problems are not covered under the warranty terms included in this manual.

3.3.2. PARTIDA INICIAL

THREE-PHASE SQUIRREL CAGE ROTOR MOTOR
After careful examination on the motor, follow the normal sequence of starting operation listed above.

THREE-PHASE SLIP RING MOTORS
The starting method must follow the manufacturer instructions for starting methods.
On motors with permanent contact brushes, the starting rheostat remains in the "run" position while the motor is running. Special speed control rheostat designed for permanent connection to resistance contacts within a given range of settings are an exception to the above.

FIX BRUSH-HOLDER SYSTEM
(permanent contact of brush with slip ring)
Brushes must be correctly set against the slip ring.

ADJUSTABLE BRUSH-HOLDER SYSTEM
(manual or automatic)
Brushes must be in contact and correctly set against the slip rings.
After complete motor acceleration, make sure that the brush lifting system has worked.

3.3.3. OPERATION

Run the motor coupled to the load for a period of at least one hour to check if abnormal noises or sign of overheating occur. If there will be excessive vibrations in the unit between the

initial operation condition and the condition after thermal stability, alignment and leveling must be rechecked. Compare the line current drawn with the value shown on the nameplate.
Under continuous duty without load fluctuation, this should not exceed the rated current times the service factor, also shown on the nameplate. All measuring instruments and devices should be continuously checked in order to correct any abnormal operation, if required.

3.3.4. SHUTDOWN PROCEDURE

Before proceeding any task on the motor, it is extremely important to observe the following: to touch any moving part on a running motor, even switched-off, is a danger to life.

a) Three-phase squirrel cage motors:
It suffices to open stator circuit switch, and with the motor stopped, reset the auto-transformer, if any, to the "start" position;

b) Three-phase slip ring motors:
Open the stator circuit switch. When the motor is stopped, reset the rheostat to the "start" position.

3.4. ACOUSTICAL PROPERTIES

Day by day, electrical motors are increasingly used in offices and homes. Under these circumstances, it is essential that motors operate silently and safe without contributing to ambient discomfort. The solution lies in the ever closer collaboration of the user and the motor manufacturer.
The proper planning of home, office and factory acoustics requires a knowledge of the sources of motor noises and how they affect the ambient noise level wherever motors are located.
The following parts of a motor can generate noise within the audio-frequency range:
1. Cooling system.
2. Brushes.
3. Bearings.
4. Magnetic circuit.

The part of the motor mainly responsible as noise source depends on its size, speed, degree of mechanical protection (casing) and of the driven machine design. Cooling system noise is airborne and usually affects only the noise level in the ambient where motor is installed. How ever, it is a different matter if the noise source is in the bearings or in the magnetic circuit. In this case, the noise is due to mechanical vibration of the part itself, or of the entire motor, and the sound is spreaded through the foundation, walls or ducts. This type of sound propagation, via structural components of an installation, can be reduced by installing the motor on suitable designed vibration dampers. It is important to note that improper dampers can even increase vibration.
The graphs in figures 3.11 to 3.18 show noise reduction attainable with different devices. The illustrations below each graph represent imaginary motors.
The dotted line indicates the noise level without any steps have been taken to reduce noise; the continuous line shows noise level after the suggested measures have been taken

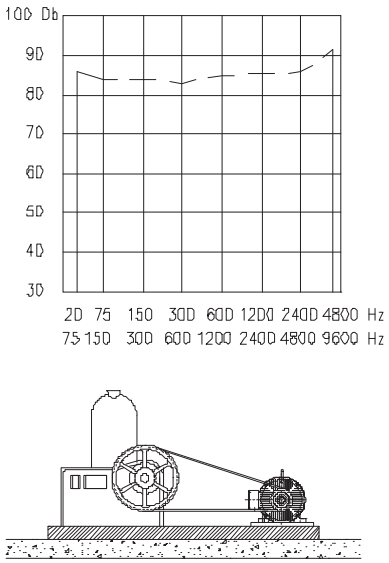
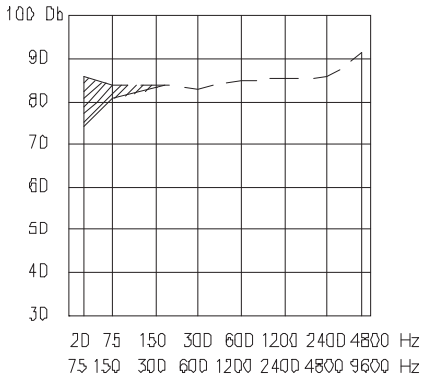


Figure 3.11 - Motor without dampers



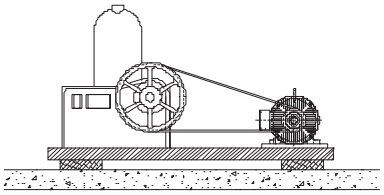
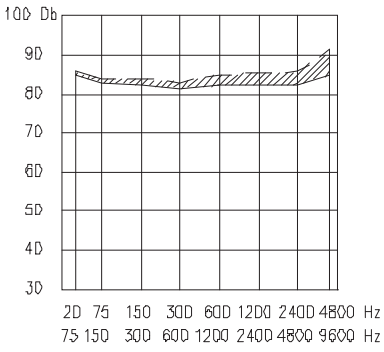


Figure 3.12 - Motor mounted on dampers.



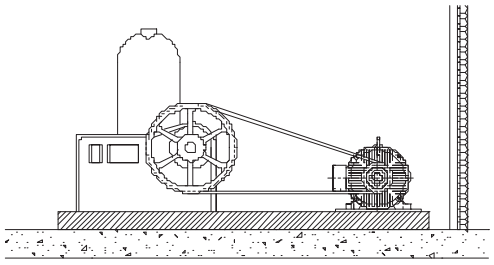
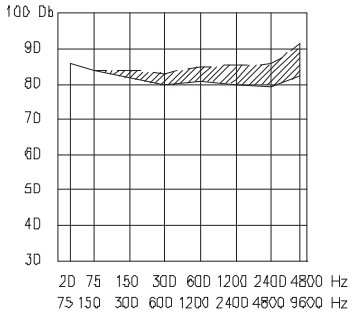


Figure 3.13 - Motor without dampers but with wall covered with sound absorbent material



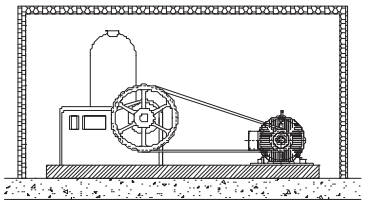


Figure 3.14 - Motor installed in a cubicle covered with absorbent material

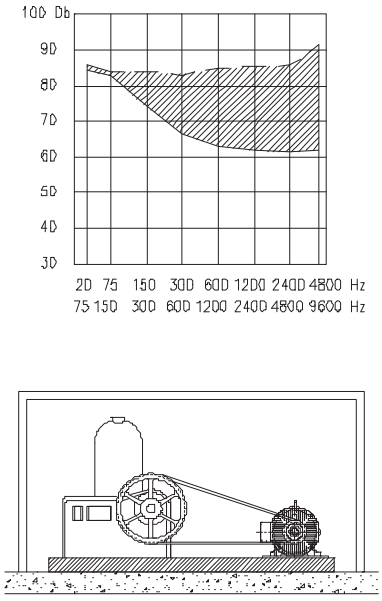


Figure 3.15 - Motor enclosed in solid-walled cubicle. Wall material is of high density

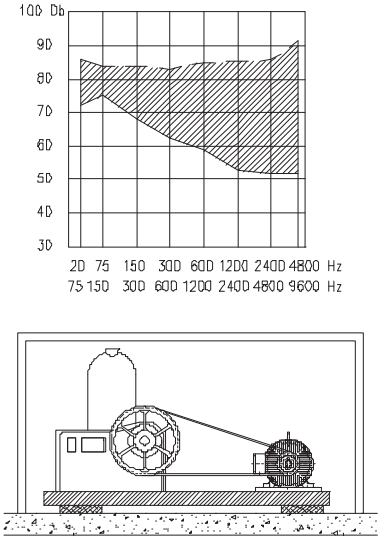


Figure 3.16 - Motor in solid-walled cubicle and additionally mounted on dampers

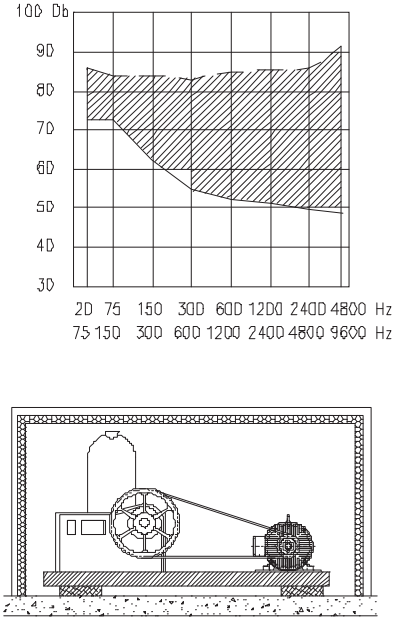


Figure 3.17 - Motor in solid-walled cubicle covered by absorbent material and mounted on dampers

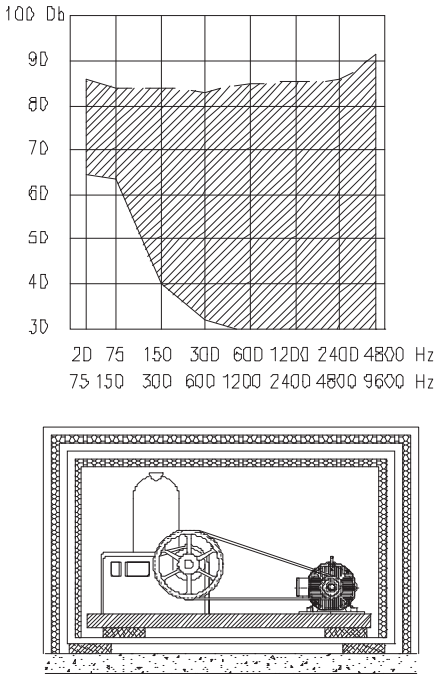


Figure 3.18 - Motor in double solid-walled cubicle with internal surfaces covered with absorbent material and mounted on a double set of dampers.

3.5. MOTOR USED ON HAZARDOUS AREA – EXPLOSIVE GAS ATMOSPHERES

Motors designed for hazardous areas are fitted with additional safety features which are defined in specific standards for each type of hazardous location, based on its classification.
The general requirements for electrical apparatus for hazardous locations are described in the following Brazilian and foreign standards, respectively:
NBR 9815 = Electrical apparatus for explosive gas atmospheres.
General requirements (specifications)
IEC 79-0 = Electrical apparatus for explosive gas atmospheres.
EN 50014 = Electrical apparatus for potentially explosive atmosphere.
General requirements

3.5.1. GENERAL CARE WITH ZHAZARDOUS LOCATION MOTORS

Before installing, operating or carrying out maintenance services on electric motors used on hazardous locations, care must be taken on the following:
- The standards listed below, applied to each case, must be studied and understood;
- All requirements included in the applicable standards must be understood accordingly.

Exe – Increased Safety: IEC 79-7 / NBR 9883 / EN 50019.
Exp. – Pressurized: IEC 79-2 / NBR 5420.
Exn – Non sparking: IEC 7915.

3.5.2. ADDITIONAL CARE RECOMMENDED FOR HAZARDOUS LOCATION MOTORS

- Before carrying out maintenance services, inspections or repairs on the motor, make sure it is de-energized and completely stopped;
- All motor protections must be correctly installed and duly adjusted before starting the operation;
- Make sure motors are properly grounded;
- Connection terminals must be properly connected so as to avoid poor contacts which can result in overheating or sparking.

NOTE: All other recommendations referring to storage, handling, installation and maintenance included in this manual and applied to the motor in question must also be followed accordingly.

4. MAINTENANCE

A well-programmed maintenance of electric motors can be summed up as a periodical inspection of insulation levels, temperature rise (winding and bearings), wears, bearing lubrication and useful life, and occasional checking of fan air flow, vibration levels, brushes and slip rings wears.
In case one of the above items are not followed accordingly, you might have unexpected stops of the equipment. Inspection cycles depend on the type of the motor and conditions under which it operates.
Frame must be kept clean, free of dust, dirt or oil in order to make the cooling process easier.

Transportation care:
On any transportation, motors fitted with roller or ball bearings must have their shaft locked in order to avoid bearing damage.
To lock the shaft use the shaft locking device shipped together with the motor. See item 2.2.

4.1. CLEANLINESS

Motors should be kept clean, free of dust, dirt and oil. Soft brushes or clean cotton rags should be used to clean the motors. A jet of compressed air should be used to remove non-abrasive dust from the fan cover and any accumulated grime from the fan and cooling fins. The heat exchanger tubes (if any) must be kept clean and free of any obstructing object to facilitate the air circulation. For the cleanliness of the tubes, a stick with a round brush at the ends can be used which, inserted in such tubes, removed all accumulated dirt.

NOTE: To perform such cleanliness, remove the ND endbell of the heat exchanger and insert the brush into the tubes.

In order to effect this cleanliness, a stick can be used which, inserted into the tubes, remove all the accumulated dust. If motor is fitted with air-water heat exchanger, a periodical cleanliness is inside the radiator tube is required to remove any dirt condensation.
On slip ring motors, brushes and brush-holders should never be cleaned with compressed air, but with vacuum cleaner or any cotton rag soaked in a suitable solvent (see item 4.4. and 4.5).
Oil or damp impregnated impurities can be removed with rags soaked in a suitable solvent.
Terminal boxes of IP54 protection motors should also be cleaned; their terminals should be free of oxidation, in perfect mechanical condition, and

all unused space dust-free. For aggressive environment, IP(W)55 protection motors are recommended.

4.1.1. PARTIAL MAINTENANCE

- Drain the condensed water.
- Clean the inside of the terminal boxes.
- Make a visual inspection of the winding insulation.
- Clean the slip rings (see 4.4 and 4.5).
- Check the condition of the brushes.
- Clean the heat exchanger.

4.1.2. COMPLETE MAINTENANCE

- Clean the dirty windings with a soft brush.
- Grease, oil and other impurities which adhered on the winding can be removed with a rag soaked in alcohol. Dry the windings with a jet of compressed air.
- A jet of compressed air should be used to clean the bearings and the air ducts in the stator and rotor cores.
- Drain the condensed water and clean the inside of the terminal boxes as well as the slip rings.
- Measure the insulation resistance (see table 2.1).
- Clean the brushes/brush holders according to items 4.4 and 4.5.
- Clean the heat exchanger accordingly.

NOTE: When motor is fitted with air inlet and/or air outlet filters, these should be cleaned with a jet of compressed air. If the dust is difficult to be removed with a jet of compressed air, then they should be washed in cold water with neutral detergent. After that, dry them in horizontal position.

4.2. LUBRICATION

4.2.1. GREASE LUBRICATED BEARINGS

The purpose of this maintenance is to lengthen bearing life.

MAINTENANCE INCLUDES:

a) Attention to the overall status of the bearings;
b) Cleaning and lubrication;
c) Inspection in details of the bearings.

Motor noise should be measured at regular intervals of one to four months. A well-tuned ear is perfect capable of distinguishing unusual noises, even with rudimentary tools such as a screw driver, etc. For a more reliable analysis of the bearings, sophisticated equipment is required.

Bearing temperature control is also part of routine maintenance. The temperature rise of grease lubricated bearings as recommended under item 4.2.1.2 should not exceed 60ºC (T = 60°C/max. ambient = 40°C, absolute temperature = T + ambient) measured at the external bearing cap.

Constant temperature control can be done by means of external thermometers or by embedded thermal elements.

Alarm and tripping temperatures for ball bearings can be set for 90°C and 100°C respectively.

Weg motors are normally supplied with grease lubricated ball or roller bearings.
Bearings should be lubricated to avoid metallic contact of the moving parts, and also for protection against corrosion and wear. Lubricant properties deteriorate in the course of time and due to mechanical operation and, furthermore, all lubricants are subject to contamination under working conditions. For this reason, lubricants must be renewed or replaced from time to time.

4.2.1.1. LUBRICATION INTERVALS

WEG motors are supplied with Polyurea-based POLIREX EM grease (Supplier: ESSO) enough for the running period given on the data sheet and bearing nameplate..
Lubrication intervals depend on the size of the motor, speed, working conditions, type of grease used and working temperature. The lubrication period and type of bearings are indicated on the motor nameplate.

Motors kept in stock should be relubricated every six months. Once a month, shaft must be in order to have the grease homogenized.

Table 1

MAXIMUM LUBRICATION INTERVAL FOR HORIZONTALLY MOUNTED MOTORS													
ROLLER BALL BEARINGS													
Bearings	Poles	Lubrication Interval (hours)		Amount of Grease (grams)	Bearings speed limit (rpm)		Bearings	Poles	Lubrication Interval (hours)		Amount of Grease (grams)	Bearings speed limit (rpm)	
		60 Hz	50 Hz		100%	75%			60 Hz	50 Hz		100%	75%
6204	8 or +	12000	13200	5	15000	11250	6216	8 or +	8000	9000	20	4500	3375
	6	10200	11300					6	6600	7500			
6205	8 or +	11100	12300	5	13000	9750	6316	4	4800	5600	35	3800	2850
	6	9500	10500					2	750	1800			
6206	8 or +	10500	11600	5	11000	8250	6218	8 or +	7700	8700	25	4000	3000
	6	9000	9900					6	6300	7200			
6306	4	7100	7800	10	9500	7125	6318	4	4500	5300	45	3600	2700
	2	4500	5100				6220	2	-	650	35	3600	2700
							6220	8 or +	7500	8400	35	3600	2700
6307	4	6800	7500	10	8500	6375		6	6000	6900			
	2	4100	4800				6320	4	4200	5000	50	2800	2100
6208	8 or +	9600	10700	10	8500	6375	6222	8 or +	7200	8300	40	2800	2100
	6	8100	9200					6	5900	6800			
6308	4	6300	7200	10	7500	5625	6322	4	3900	4800	60	2400	1800
	2	3800	4500				6224	8 or +	7100	8000	45	2600	1950
6209	8 or +	9300	10400	10	7500	5625		6	5600	6500			
	6	8000	8900				6324	4	3500	4500	75	2200	1650
6309	4	6200	6900	15	6700	5025	6226	8 or +	6600	7700	50	2400	1800
	2	3500	4200					6	5300	6200			
6210	8 or +	9000	10100	10	7100	5325	6326	4	2700	4100	85	2200	1650
	6	7700	8600				6228	8 or +	6200	7100	55	2200	1650
6310	4	5900	6600	15	6000	4500		6	4800	5700			
	2	2900	3900				6328	4	2000	3600	95	2000	1500
6211	8 or +	8900	9800	15	6300	4725	6230	8 or +	5700	6800	65	2000	1500
	6	7400	8300					6	4400	5300			
6311	4	5700	6500	20	5600	4200	6230	4	1500	3000	105	1800	1350
	2	2400	3800				6232	8 or +	5400	6300	70	1900	1425
6212	8 or +	8600	9600	15	5600	4200	6332	6	4100	5000	120	1700	1275
	6	7200	8100				6234	8 or +	5100	6000	85	1800	1350
6312	4	5400	6200	20	5300	3975	6334	6	3800	3800	130	1600	1200
	2	2100	3300				6238	8 or +	4500	5300	95	1600	1200
6214	8 or +	8300	9300	15	5000	3750	6338	6	2600	3900	160	1400	1050
	6	6900	7800				6244	8 or +	3600	4500	130	1300	975
6314	4	5100	5900	30	4500	3375	6344	6	1400	2700	205	1200	900
	2	1400	2600				6252	8 or +	2000	3300	195	1100	825
6315	2	1050	2100	30	4300	3225							

NOTE: - Standard lubrication interval applied to 40°C ambient temperature and types of grease according to table 4.1;
- For vertically mounted motors, lubrication interval must be reduced by half;
- Bearing average temperature considered T = 90°C;
- For ambient temperature other than 40°C, use the following corrections:
  Tamb = 45°C (lubrication interval at 40°C) x 0.6;
  Tamb = 50°C (lubrication interval at 40°C) x 0.36.

Table 2

MAXIMUM LUBRICATION INTERVAL FOR HORIZONTALLY MOUNTED MOTORS													
LOCKED BALL BEARINGS													
Bearing	Pole	Lubrication Interval (hours)		Amount of Grease (grams)	Bearing speed Limit (rpm)		Bearing	Pole	Lubrication Interval (hours)		Amount of Grease (grams)	Bearing speed Limit (rpm)	
		60 Hz	50 Hz		100%	75%			60 Hz	50 Hz		100%	70%
NU310	4	4700	5300	15	5600	4200	NU224	8 or +	5600	6500	45	2400	1800
NU212	8 or +	6900	7700	15	5000	3750		6	4200	5100			
	6	5700	6500				NU324	4	1700	2700	75	1900	1425
NU312	4	4100	5000	20	4000	3000	NU226	8 or +	5300	6000	50	2200	1650
NU214	8 or +	6600	7400	15	4500	3375		6	3600	4800			
	6	5400	6200				NU326	4	1400	2300	85	1800	1350
NU314	4	3500	4700	30	3600	2700	NU228	8 or +	5000	5700	55	2000	1500
NU216	8 or +	6300	7200	20	4000	3000		6	3000	4400			
	6	5300	6000				NU328	4	1050	1800	95	1800	1350
NU316	4	3000	4200	35	3200	2400	NU230	8 or +	4500	5400	65	1900	1425
NU218	8 or +	6200	6900	25	3600	2700	NU330	6	2600	3800	105	1700	1275
	6	5000	5700				NU232	8 or +	3900	5000	70	1800	1325
NU318	4	2700	3800	45	2800	2100	NU332	6	2300	3300	120	1500	1125
NU220	8 or +	6000	6800	35	3200	2400	NU234	8 or +	3500	4800	85	1800	1325
	6	4800	5600				NU334	6	1800	2900	130	1600	1200
NU320	4	2400	3300	50	2400	1800							
NU222	8 or +	5700	6600	40	2800	2100							
	6	4500	5400										
NU322	4	2000	3000	60	2000	1500							

NOTE: - Standard lubrication interval applied to 40°C ambient temperature and types of grease according to table 4.1;
- For vertically mounted motors, lubrication interval must be reduced by half;
- Bearing average temperature considered T = 90°C;
- For ambient temperature other than 40°C, use the following corrections:
  Tamb = 45°C (lubrication interval at 40°C) x 0.6;
  Tamb = 50°C (lubrication interval at 40°C) x 0.36.

MAXIMUM LUBRICATION INTERVAL FOR HORIZONTALLY MOUNTED MOTORS						
SPHERICAL ROLLER BEARINGS						
BEARING	AMOUNT OF GREASE (GRAMS)	BEARING SPEED LIMIT (RPM)		POLE	LUBRICATION INTERVAL (HOURS)	
		100%	75%		60 Hz	50 Hz
23032	75	1700	1275	12 or +	2400	3000
				10	1800	2400
				8	1300	1700
				6	700	1100
23036	105	1400	1050	12 or +	1800	2400
				10	1500	1800
				8	1000	1400
				6	-	800
23040	130	1200	900	12 or +	1500	2000
				10	1200	1500
				8	750	1100

NOTE: - Standard lubrication interval applied to 40°C ambient temperature and types of grease according to table 4.1;
- For vertically mounted motors, lubrication interval must be reduced by half;
- Bearing average temperature considered T = 90°C;
- For ambient temperature other than 40°C, use the following corrections:
  - Tamb = 45°C (lubrication interval at 40°C) x 0.6;
  - Tamb = 50°C (lubrication interval at 40°C) x 0.36.

SOME TYPICAL GREASES FOR CERTAIN APPLICATIONS			
SUPPLIER	APPLICATION	GREASE	TEMPERATURE FOR CONSTANT OPERATION (ºC)
ESSO	NORMAL	POLYREX EM (POLYUREA BASE)	(-30 a +170)
		UNIREX N2 (LITHIUM BASE)	(-30 a +165)
SHELL		(*)ALVÂNIA R3 (LITHIUM BASE)	(-35 a +130)
KLÜBER	LOW TEMPERATURES	ISOFLEX NBU15 (BARIUM COMPLEX)	(-60 a +130)

Table 4.1 shows some types of grease.

NOTE: (*) If use the grease ALVÃNIA R3, do the correction:
LUBRICATION INTERVAL (ALVÂNIA R3) = Normal Lubrication Interval x 0.65

4.2.1.2. QUALITY AND QUANTITY OF GREASE

Correct lubrication is important for proper bearing operation. It means to say the grease must be applied correctly and in sufficient amount. On the other hand, insufficient or excessive greasing are prejudicial.
Excessive greasing causes overheating due to high resistance encountered by the rotating parts and, in particular, by the compacting of the lubricant and its eventual loss of lubricating qualities.
This can cause leakage with the grease penetrating into the motor winding, commutator rings or brushes.
A lithium based grease is commonly used for the lubrication of electric motor bearings as it is of good mechanical stability, insoluble in water and has a melting point of approximately 200ºC. This grease should never be mixed with sodium or calcium based grease.

Never mix greases with different base components.
Example: A calcium based grease must not be mixed with a polyurea based grease.

4.2.1.3. COMPATIBILITY

The compatibility of different types of grease can create occasional problems. When the properties of the mixture remain within the individual property range of the greases, we can say the greases are compatible. To avoid any possible incompatibility grease problem we recommend to perform an appropriate lubrication which can be summarized as follows: after removing the old grease and caring out a complete cleanliness of the grease cavity, new grease must be pumped in. When this procedure is not allowed, pump in new grease by pressure. This must be repeated until a new grease is drained out through the grease relief.
As a general rule, greases with same soponification type are compatible. However depending on the mixture rate, they can then be recommended to mix different types of grease before contacting a service agent and/or WEG.
Same and basic oils can not be mixed as they will not produce a homogeneous mixture. In this case, either a hardening or a softening (or drop of the resulting mixture melting point) can occur.

Standard grease used on WEG motors is Polyurea-based POLIREX EM (Supplier: ESSO). The specification of this grease as well as lubrication intervals are supplied on the bearing nameplate attached to motor frame.

4.2.1.4. LUBRICATING INSTRUCTIONS

All high and low voltage motors are fitted with grease fitting for the bearing lubrication.
The lubrication system was designed to allow, when regreasing, the removal of all grease from the bearings races through a grease relief which at the same time impedes the entry of dust or other contaminants harmful to the bearing.
This grease relief also avoids injury to the bearings from the already known problem of over-greasing. It is advisable to relublicated while the motor is running so as to allow the renewal of grease in the bearings housing.
If this procedure is not possible due to existing parts near the nipple (pulleys, etc), which can be harmful to the operator, the following procedure should be followed:
- Inject about half the estimated amount of grease and run the motor at full speed for approximately one minute;
- Switch off the motor and inject the remaining grease.

The injection of all the grease with the motor stopped can cause penetration of a portion of the lubricant into the motor through the internal seal of the bearing housing.

NOTE: Grease fittings must be clean before greasing the motor in order to avoid entry of any foreign bodies into the bearing. For lubrication, use only a manual grease gun.

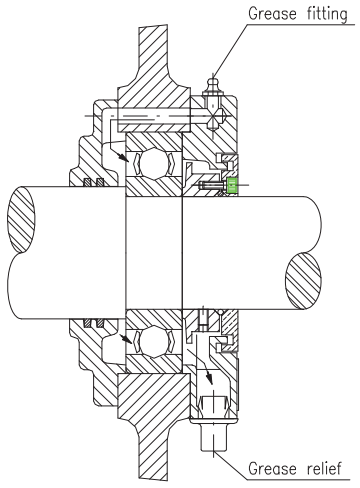


Figure 4.1.
- Bearings and lubrication system.

BEARING LUBRICATION STEPS

1) Remove the grease relief cover.
2) Clean the area around the grease fitting with a clean cotton fabric.
3) With the motor running, add grease with a manual grease gun until the lubricant commences to expelle from the grease relief, or insert the amount of grease recommended in Tables herewith indicated.
4) Leave the motor running enough time to drain all excess of grease.

4.2.1.5. REPLACEMENT OF BEARINGS

After removing the bearing cap, avoid demage to the cores by filling the air gap between the rotor and the stator with stiff paper of a proper thickness. Providing suitable tooling is employed, disassembly of bearings is not difficult. (See bearing extractor with 3 grips in fig. 4.2).

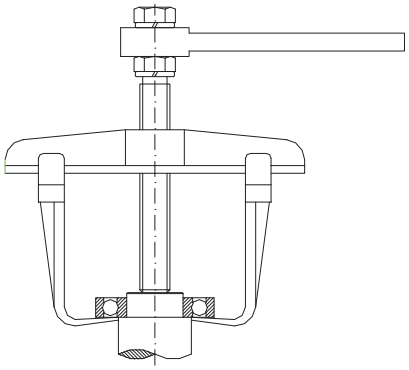


Figure 4.2 - Bearing Extractor.

The extractor grips must be applied to the sidewall of the inner ring to be stripped, or to an adjacent part.
To ensure perfect functioning and no injury to the bearing parts, it is essential that the assembly be done under conditions of complete cleanliness and by skilled personnel. New bearings should not be removed from their packages until they are assembled. Prior to fitting a new bearing, ascertain that the shaft has no rough edges or signs of hammering.
During assembly, bearings cannot be subjected to direct blows. To make the assembly easier, it is recommended to heat up (inductive heater) the bearing. The aid used to press or strike the bearings should be applied to the inner ring.

4.2.2. ASSEMBLY/DISASSEMBLY OF SLEEVE BEARINGS

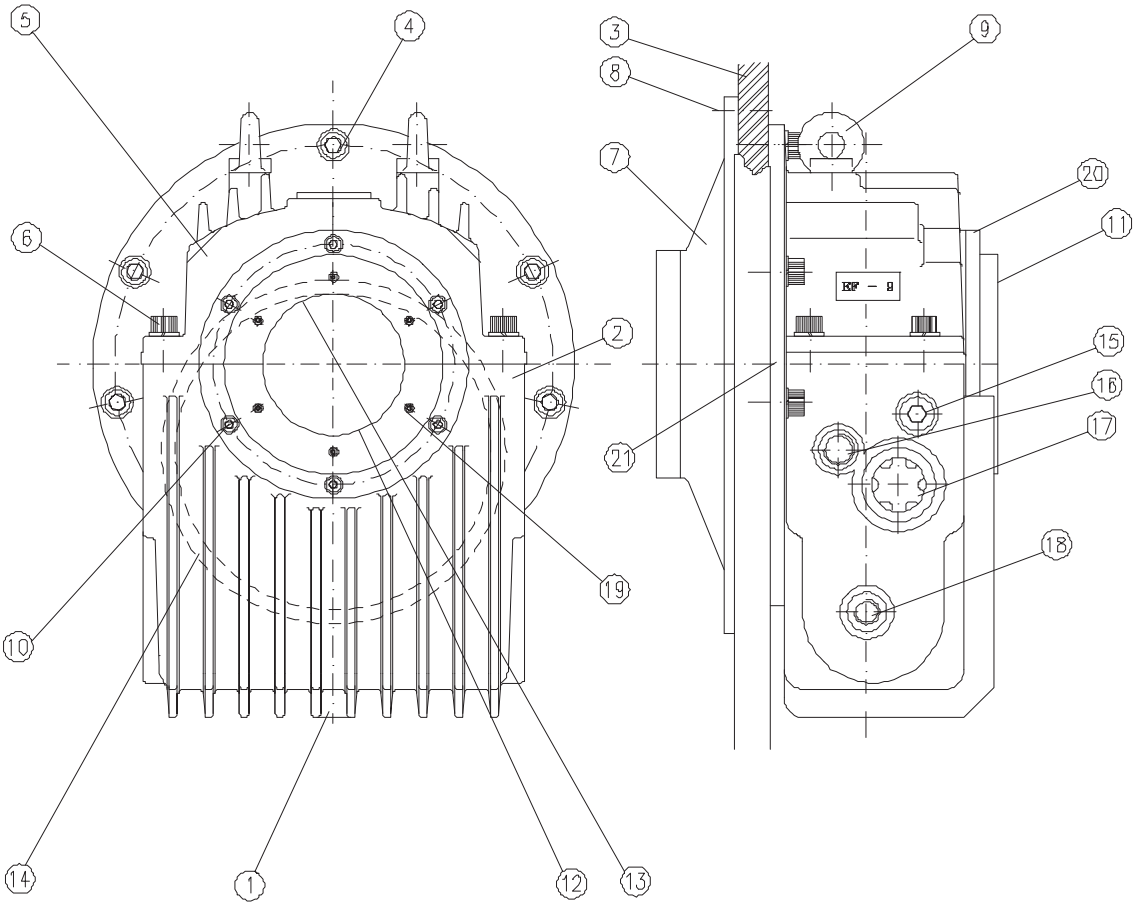
4.2.2.1. GENERAL INSTRUCTIONS

Sleeve bearing performance is dependent on proper installation, lubrication and maintenance. Before assembling the bearing carefully read all instructions contained herein to become familiar with the complete bearing assembly procedure.
A proper maintenance of sleeve bearings include periodical checking of the level and actual condition of the lubricating oil, checking of noise level and vibration of the bearings, follow-up of the operating temperature, and fastening of the fixing and assembly bolts. The frame must be kept clean, free from dust, oil and dirt to facilitate cooling system.
Threaded holes for connecting the thermometer, oil sight glass, oil inlet, and immersion heater, or cooling coil (for oil sump thermometer or circulating pump with adapter) are provided on either side, so that all connections can be made on the right or left side of the bearing housing as required.
The oil drain plug is located centrally on the underside of the bearing housing.
In case of circulating oil lubrication, the outlet connection should be screwed into the threaded hole of an oil sight glass.
If the bearing is electrically insulated, the spherical liner seat surfaces in the housing are lined with a non-conducting material.
Do not remove this lining.
The antirotation pin is also insulated and the shaft seals are manufactured from a special non-conducting material.
Temperature monitoring instruments with contact to the bearing liner should be insulated appropriately (i.e., insulated protection tubes, synthetic fittings, etc.)
Water-cooled bearings are provided with the cooling coil installed. Care must be taken to protect the connections from damage when handling the housing prior to installation.

4.2.2.2. DISASSEMBLY OF THE SLEEVE BEARING SYSTEM (TYPE "EF")

To disassemble the bearing liner and all associated parts from the bearing housing, carry out the following instructions. Carefully store all disassembled parts in a safe location (see fig. 4.3.).

Figure 4.3.



1) Drain plug;
2) Bearing housing;
3) Motor frame;
4) Fixing bolts;
5) Bearing housing cap;
6) Bearing housing cap split line bolt;
7) Machine seal;
8) Machine seal bolt;
9) Lifting eyebolt;
10) External cover bolts;
11) External cover;
12) Bearing liner - bottom half;
13) Bearing liner - top half;
14) Oil ring;
15) Oil inlet;
16) Connection for temperature sensor;
17) Oil sight glass or oil outlet for
18) Lubrication;
19) Drain for pipe;
20) External protection bolts;
21) Labyrinth seal carrier;
22) Labyrinth seal carrier - bottom half.

Drive end side:

- Throughly clean the exterior of the bearing housing. Loosen and remove the oil drain plug (1) at the bottom of the bearing housing. Drain the oil from the bearing housing.
- Loosen and remove the bolts (4) connecting the frame cover (3) to the flange of the bearing housing cap (5). Remove the frame cover.
- Loosen and remove the bolts (6) at the split line of the bearing housing (2) and bearing housing cap (2 and 5).
- Use the lifting eyebolts (9) to lift (by hand or hoist) the bearing housing cap (5) straight up, so that the cap is completely disengaged from the lower halves of the stationary baffle (11) labyrinth seals labyrinth seal carrier (20), machine seal bearing housing and the bearing liner (12).
- Pull the bearing housing cap forward out of and away from the bearing area.
- Loosen and remove the bolts (19) securing the upper half of the stationary baffle. Loosen and remove the bolts (10) securing the upper half of the seal carrier (20) to the bearing housing cap.
- Lift (by hand or hoist) the upper half of the bearing liner (13) and remove it.
- Loosen and remove the bolts at the split line of the oil ring (14). Carefully disengage the dowels holding the oil ring halves together and remove the oil ring.
- Remove the garter springs that encircle the labyrinth seals. Lift off the upper half of each seal, then rotate the lower half of each seal out of the grooves in the seal carrier and bearing housing.
- Disconnect and remove RTD's, thermocouples, or any other temperature detecting instruments that enter the lower half of the bearing liner.
- Using a hoist or jack, raise the shaft slightly so that the lower half of the bearing liner can be rolled out of the bearing housing.

IMPORTANT: To make that feasible it is necessary that bolts 4 and 6 of the other bearing half be loose.

- Roll out (be careful not to use excessive force) the lower half of the bearing liner and remove it.
- Loosen and remove the bolts (19) securing the bottom half of the stationary baffle (11) to the seal carrier. Loosen and remove the bolts (10) securing the bottom half of the seal carrier (21) to the bearing housing. Remove the seal carrier.
- Loosen and remove the bolts (4) securing the bearing housing (2) to the motor frame.
- Loosen and remove the bolts (8) securing the machine seal (7) to the bearing housing. Remove the machine seal.
- Thoroughly clean and inspect all individual parts which have been removed. Clean the interior of the bearing housing.
- To reassemble the bearing system, follow the preceding instructions in the reverse order.

NOTE: Festening torque of the bearing fixing bolts to the motor = 10 Kgfm.

Non drive end side:

- Thoroughly clean the exterior of the bearing housing. Loosen and remove the oil drain plug at the bottom of the bearing housing. Drain the oil from the bearing housing.
- Loosen and remove the bolts (19) connecting the frame cover to the flange of the bearing housing cap (11). Remove the frame cover.
- Loosen and remove the bolts (4) securing the end cover (5) to the bearing housing and to the bearing housing cap. Remove the end cover.
- Loosen and remove the bolts (6) at the splitine of the bearing housing and bearing housing cap (2 and 5).
- Use the lifting eyebolts (9) to lift (by hand or hoist) the bearing housing cap (5) straight up, that the cap is completely disengaged from the lower halves of the labyrinth seal and bearing housing (2) and the bearing liner (12).
- Lift (by hand or hoist) the upper half of the bearing liner (13) and remove it.
- Loosen and remove the bolts at the split line of the oil ring (14). Carefully disengage the dowels holding the oil ring halves together and remove the oil ring.
- Remove the garter spring that encircles the labyrinth seal. Lift of the upper half of the seal, then rotate the lower half of the seal out the groove in the bearing housing.
- Disconnect and remove RTD's, thermocouples, or any other temperature detecting instruments that enter the lower half of the bearing liner.
- Using a hoist or jack, raise the shaft slightly so that the lower half of the bearing liner (12) can be rolled out of the bearing housing.
- Roll out (be careful not to use excessive force) the lower half of the bearing liner (12) and remove it.
- Loosen and remove the bolts (4) securing the bearing housing (2) to the motor frame.
- Remove the bearing housing. Loosen and remove the bolts (8) securing the machine seal (7) to the bearing hosing (2). Remove the machine seal (7).

- Thoroughly clean and inspect all individual parts which have been removed. Clean the interior of the bearing housing.

To reassemble the Bearing System, follow he preceding instructions in the reverse order.

NOTE: Festening torque of the bearing fixing bolts to the motor = 10 Kgfm.

4.2.2.3. SLEEVE BEARING ASSEMBLY

Check contact face and mounting recess of the bracket making sure it is clean and properly machined. Inspect shaft to ensure it is smooth (R_a 0.4, equivalent to 32 micro-inch finish, or better), within the dimensions and tolerances given by RENK and free of burr or any rough spots.
After removing the upper part of the housing (2) and the bearing liner (12 and 13) the interior of the housing and the running surfaces of the liner are to be cleaned thoroughly and checked for any damage caused in transit.
With the shaft slightly, locate the bearing base into the mounting recess of the machine end shield and bolt into position.
Apply oil to spherical seats in the housing base and the shaft and rotate the bottom liner half (12) into position. Special care must be taken so that the axial surfaces of the locating bearing are not damaged.
After the split faces of the bottom liner half and the housing base are aligned, lower the shaft into place. With a slight hammer blow against the housing base settle the liner into its seating so that the liner axis and shaft axis are parallel. The slight hammer blow produces a high frequency vibration which reduces the static friction between the liner and the housing and allows the correct adjustment of the liner. The self-alignment feature of the bearing is to compensate for normal shaft deflection during the assembling procedure only.
The loose oil ring is installed next. The ring must be handled with special care as safe operation of the bearing is also dependent on the effective and safe functioning of the oil ring. The bolts must be tightly fastened. Split misalignment must be avoided and any burrs or edges carefully removed in order to ensure smooth running of the ring. In any maintenance care must be taken that the ring is not distorced and its geometrical shape is maintained.

The outside of the two liner halves is stamped with identification numbers or marks near the split line. Make sure that these marks align and the split faces are clean when placing the top liner half into position. Incorrect fitting may lead to heavy damage to the bearing liners.
Check to ensure that the loose oil ring can still rotate freely on the shaft. With the top liner half in place, install the seal on the flange side (see paragraph "Shaft Seals").
After coating the split faces with a nonhardening sealing compound, place the housing cap into position. Care must be taken that the seal fits properly into the groove. Ensure also that the antirotation pin is seated without any contact with the corresponding hole in the liner.

NOTE: Housing or liner may be interchanged as complete assemblies only. Individual halves are not interchangeable.

4.2.2.4. SETTING OF THERMAL PROTECTIONS (PT100)

Each bearing is fitted with a Pt100 temperature detector installed directly in the bearing liner near the point where the load is applied. This device must be connected to a controlling panel with the purpose of detecting overheating and protect the bearing when operating under high temperature.

IMPORTANT: The following temperature must be set on the bearing protecting system:

ALARM 100ºC.
TRIPPING OFF 120ºC.

4.2.2.5. WATER COOLING SYSTEM

When using water cooling system, the oil reservoir at the bearing is equipped with a cooling coils through which the water circulates. This circulating water must present at the bearing inlet a temperature smaller or equal to the ambient one in order to make the cooling possible.
The water pressure must be 0.1 bar and the water flow must be 0.7 L/s. The pH must be neutral.

NOTE: When connecting the cooling coils, leaks in or on the bearings housing and oil reservoir must be avoided so that lubricating oil is not contaminated.

4.2.2.6. LUBRICATION

The oil change of the bearings must be effected every 8000 operating hours, or every time the oil modifies its characteristics. Viscosity and oil pH must be checked periodically.

Oil level must be checked daily which must be kept approximately at the center of the oil level sight glass.

The bearing must be filled with the prescribed type of oil through the oil port after removing the pipe plug.
All holes and threads not used are to be closed by pipe plugs. Also check all connections for oil leaks.
Filling the bearing with lubricant beyond the middie of the oil sight glass (II) does not impair the function of the bearing, but there is a possibility that excess oil may leak out through the shaft seals.

IMPORTANT:
The cares taken with bearing lubrication will determine the life for such bearings as well as the assurance of motor operation. For this reason, it is essential to follow these recommendations:

- The oil selected must have a viscosity suitable for the bearing operating temperature. This must be checked during eventual oil change or during periodical maintenances.
- If the bearing is filled with oil bellow the required oil level, or if the oil level is not checked periodically, insufficient lubrication may lead to damage to the bearing liner. The minimum oil level is reached when the oil can just be seen in the oil sight glass when the machine is not in operation.

4.2.2.7. SHAFT SEALS

The two halves of the floating labyrinth seal are held together by a garter spring. They must be inserted into the groove of the carrier ring in such a way that the stop pin is always in the corresponding recess in the upper half of the housing or carrier ring. Incorrect installation destroys the seal.

The seal is to be carefully cleaned and coated with a nonhardening seating compound on the faces in contact with the grooves. The drain holes in the lower part of the seal must be clean and disobstructed. When installing the bottom half of the seal, press it lightly against the underside of the shaft.
An additional sealing is installed inside the motor to prevent sugging of oil due to low pressure generated by the motor cooling system.

4.2.2.8. OPERATION

The operation of motors fitted with sleeve bearings is similar to motors fitted with roller bearings.
It is recommended that the oil circulating system be accompanied carefully and also the first hours of operation.
Before the start-up, check the following:

- If the oil used has been prescribed accordingly.
- Characteristics of the lubricating oil.
- Oil level.
- Alarm and tripping off temperatures set for the bearings (100ºC for alarm and 120 C for tripping off).

During the first start-up, check for vibrations or noises. In case bearing operation is not quiet and not uniform, motor is to be stopped at once.
Motor must operate for several hours until the bearing temperature is fixed within the limits previously indicated. If a temperature overheating occurs, motor must be stopped immediately and the temperatures detectors checked.
When bearing operating temperature is reached check for any oil leakage by the plugs joints or by the shaft end.

4.3. AIR GAP CHECKING (Large ODP motors)

After disassembly and assembly of the motor it is necessary to check the air gap measurement between the stator and the rotor by using appropriate gauges. The gap variation at any two vertically opposite points must be less than 10% of the average air gap measurement.

4.4. SLIP RINGS (For slip ring motors)

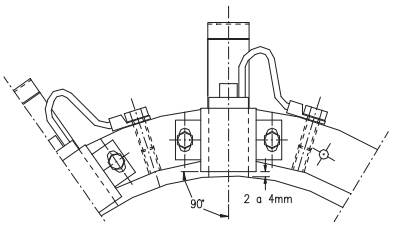
Rings must be accurately centered as at high speed the mechanical vibrations cause contact faults, which in turn cause sparking. Rings must also be kept clean and polished.
As a general rule, cleaning should be done monthly in order to remove the dust accumulated between the rings (see item 4.10). Stained or slightly rough ring surfaces can be polished with fine sandpaper. Oval or rough surfaced rings will require machining and

repolishing to avoid wear problems to brushes and brush-holders.

4.5. BRUSH HOLDERS

Brush holders must be set radially to the slip ring and adjusted approximately 4mm away from the contact surface to avoid brush rupture or injury (Fig. 4.4).

CORRECT



INCORRECT

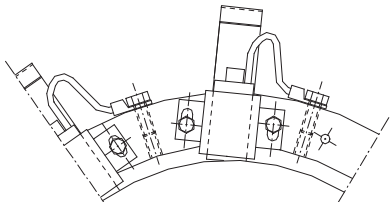


Figure 4.4. - Air gap between brush holder and ring contact surface.

OBS.: Brushes must be checked weekly to ensure free sliding inside the brush-holder.

4.6. BRUSHES (For slip ring motors)

There is a factory-specified brush type for each electric motor fitted with slip rings.

NOTA: *In case motor is operating below its rated output (low load) or intermittent load, the set of brushes (brush type and quantity) must be adjusted to the actual operating conditions, avoiding in this way motor damage. This adjustment must be done with the help of Weg Máquinas.*

Never use assorted brushes of different types on the same rings. Any change of brush type must be authotized by WEG Máquinas, as different brushes cause performance alterations to the machine in operation.

Brushes should be constantly checked during operation. Any brush presenting signs of wear should be exceeding the mark indicated figure 4.5, immediately replaced.
At the time of replacement and whenever feasible, all brushes should be replaced. Having replaced the first one, the second brush should be replaced after a suitable running-in-period.
Replacement brushes should be sanded to set perfectly on the ring surface curvature (min. 75%).

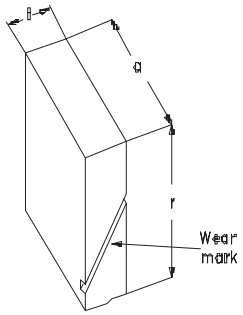


Figure 4.5

On machines that always rotate in the same direction, the brushes should be set in a single direction only. During the backward movement of the shaft the brushes must be lifted (fig.4.6)

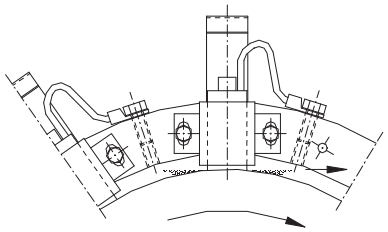


Figure 4.6

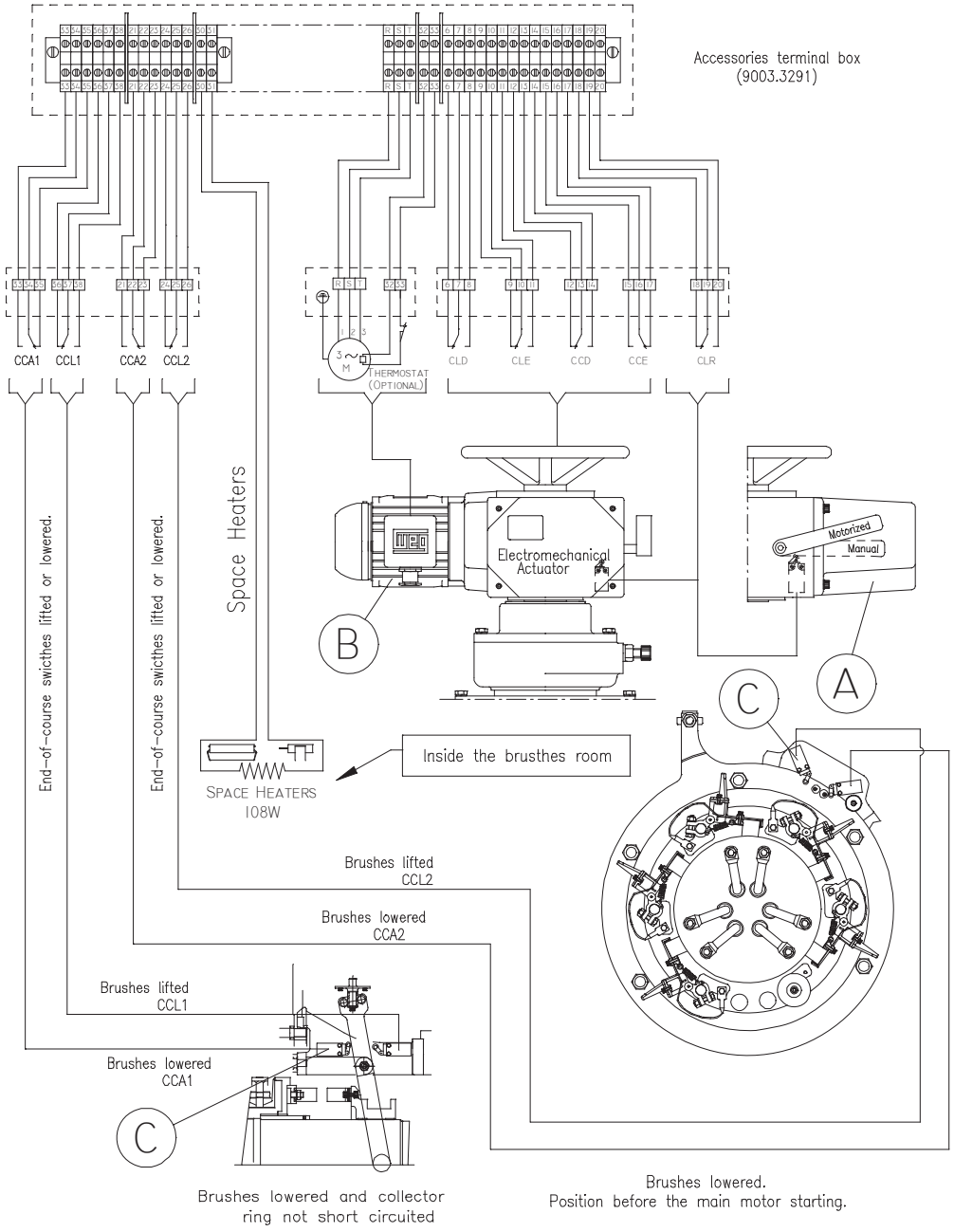
Brush pressure control is done by dynamometer. "Tired" springs should be replaced.

4.7. LIFTABLE BRUSH HOLDERS

4.7.1. CONNECTION DIAGRAM

MOTORIZED OPERATION:
Condition: Lifted brushes and short circuited collector ring.
In order to assure the brushes are lowered, the switches:
CCL1 - contacts 34 and 35,
CCL2 - contacts 22 and 23,
CCE - contacts 13 and 14, must have the contacts simultaneously closed (logic "AND").
At this logic the motor is in ready to run.

Description of components:
A - Electromechanical Actuator ATIS
Type: MAI-25.B3.d9-25.10-F10-2CC-2CT-IP65
B - Three Phase induction motor FS 71
6 pole, 0.25kW, Mounting B3L, IPW55
Flange C105-DIN 42948
Voltage and frequency as per client request.
C - End-of-course
Type XCK-P121 - Telemecanique



Condition: Lifted brushes and short circuited collector ring.

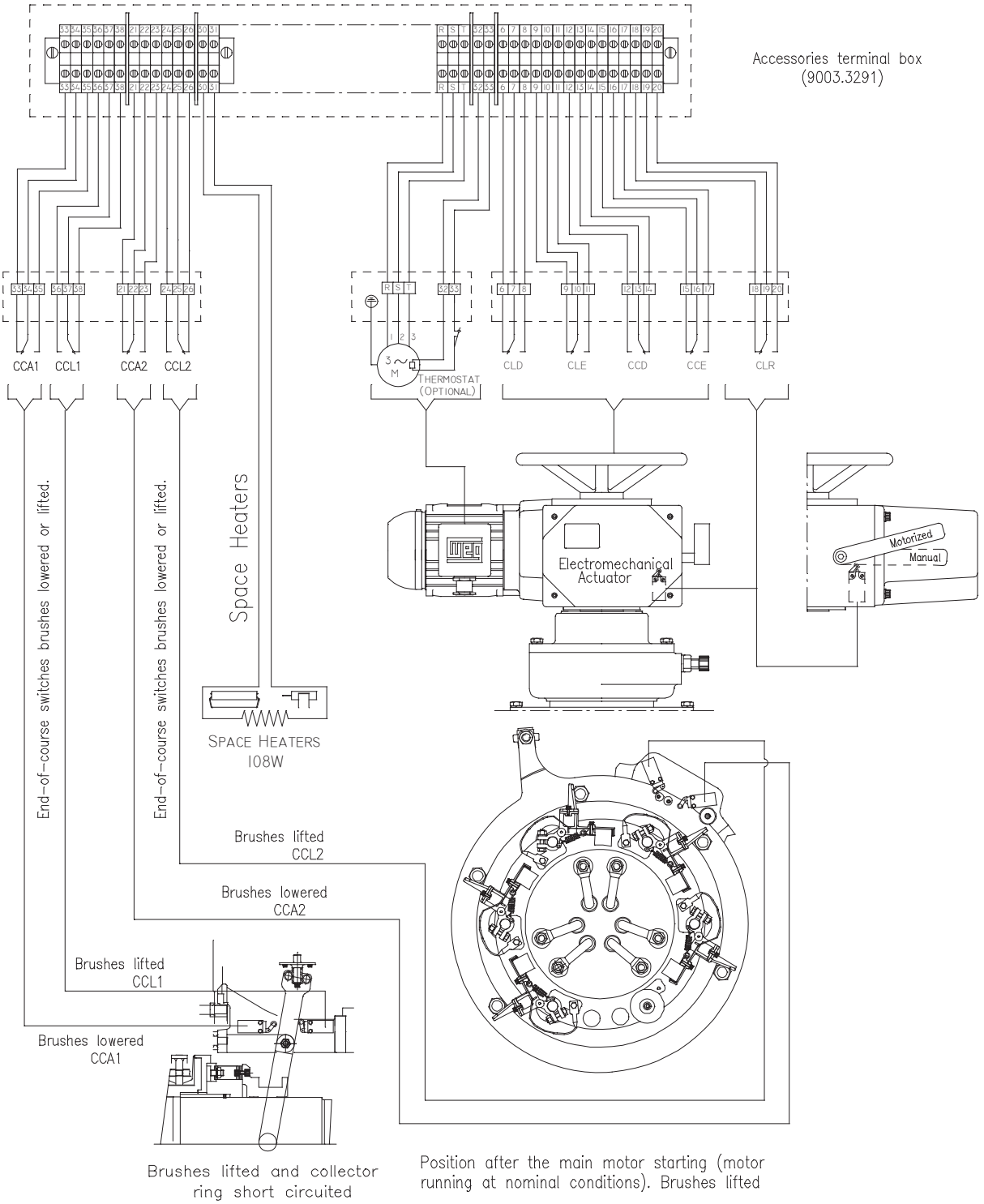
In order to assure the brushes are lifted, the switches:

CCL1 - contacts 37 and 38,

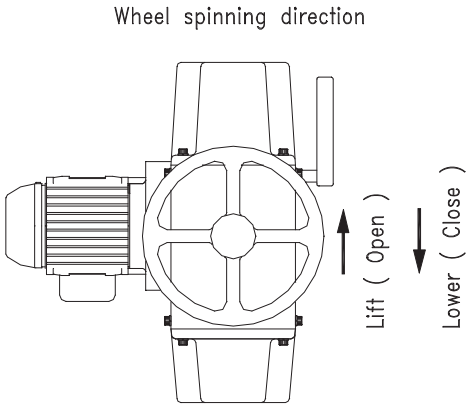
CCL2 - contacts 28 and 29,

CCE - contacts 16 and 17, must have the contacts simultaneously closed (logic "AND").

At this logic the motor is in continuous operation.

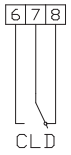


MANUAL OPERATION:



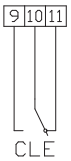
Simbology:
CLD = Torque switch for overload switching off during lowering of the brushes (or phase reversion).

In case of fault on the CCD.



CLE = Torque switch for overload switching off during lifting of the brushes (or phase reversion).

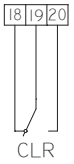
In cause the fault on the CCE.



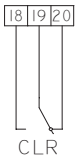
CCD = End-of-course switch for switching off when brushes are totally lowered.

CCE = End-of-course switch for switching off when brushes are totally lifted.

CLR = Selecting switch indicating manual or motorized position.



Remote operating



Manual operating

ADDITIONAL END-OF-COURSE SWITCHES FOR SIGNALIZATION.

CCL1 and CCL2 = End-of-course to indicate when the brushes are totally lifted.

CCA1 and CCA2 = End-of-course to indicate when the brushes are totally lowered.

4.7.2. OPERATION

Brush position or through a signal coming from the CCE switch which indicates the brush position, totally lowered.
In case the signal is not indicating the brush position totally lowered, motor can not be started before adjusting the commanding switch to the position of
brushes totally lowered.
This can be done manually through the flywheel (7), operating the lever (8) or automatically operating the brake motor (9). If the manual system(7) is used, the lever (8) returns automatically to the previous position operating the brake motor (9). Under this condition (brushes totally lowered), the rings (5) are not short-circuited, allowing in this way a series connection of the external resistances (rheostat) with the rotor winding through the brushes (6).

NOTE: Perform the commanding tests with the complete liftable brush holder system before running the motor under load.

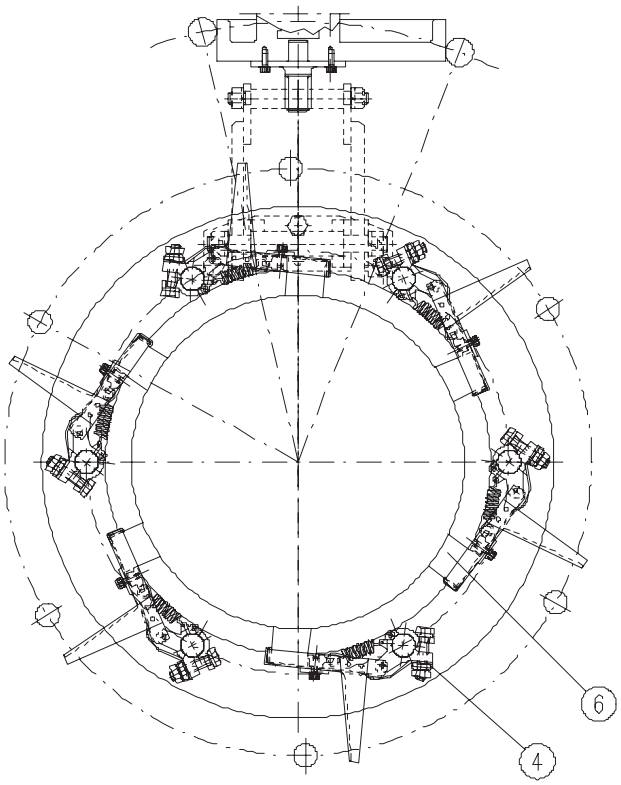
4.7.2.1. PROCEDURE AFTER MOTOR STARTING

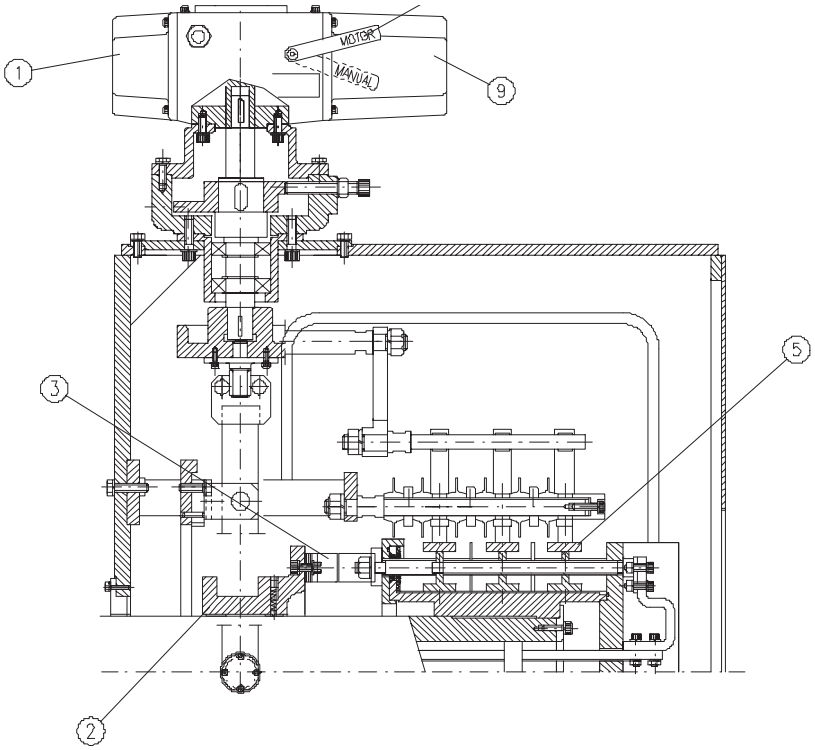
At the moment motor has reached its rated speed, the short-circuit procedure of the collector rings must be started, operating the lifting and short-circuit device (1), on the reserve way, through the brake motor (9), or manually through the flywheel (7).
The short-circuit is done through the slide brushing (2) which holds the silver contacts (3). Furtherly, the brush lifting mechanism (4) is operated.
When brushes are totally lifted, the device is automatically switched-off through the CCE switch.

NOTE 1: The automatic brush lifting system is provided with an overload protection system for the operation brake motor (9), through the torque switches for overload switching off during lowering (CLD) or lifting of brushes (CLE).

NOTE 2: Before motor start up, make sure CLD, LE, CCD and CCE switches are correctly connected to the panel.

NOTE 3: When one of the CLE or CLD switches operate, the rense of the system must be avoided before checking the reason they have operated.





4.7.3. ASSEMBLY

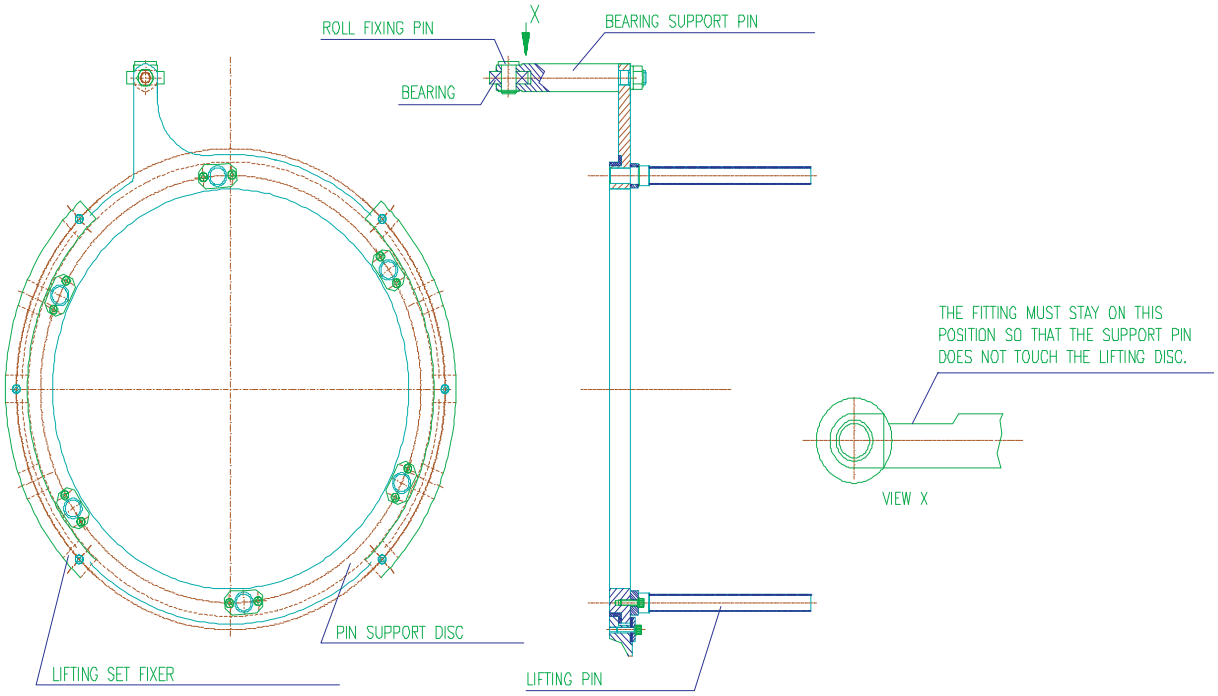
4.7.3.1. BRUSH HOLDER LIFTING DEVICE

1) Fix the pin support disc with the lifting set fixer on the protection box of the brush holder set.

2) Mount the bearing in the support pin and fix with a fixing pin witch must be fixed with a retaining ring.

3) Fix the bearing support pin on the support disc.

NOTE: Bearing support pin: 6305 2ZRS1.



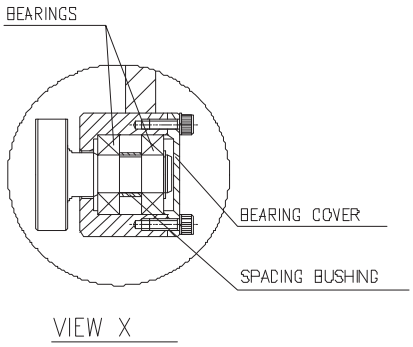
4.7.3.2. SHORT-CIRCUIT BUSHING MOVEMENT SET

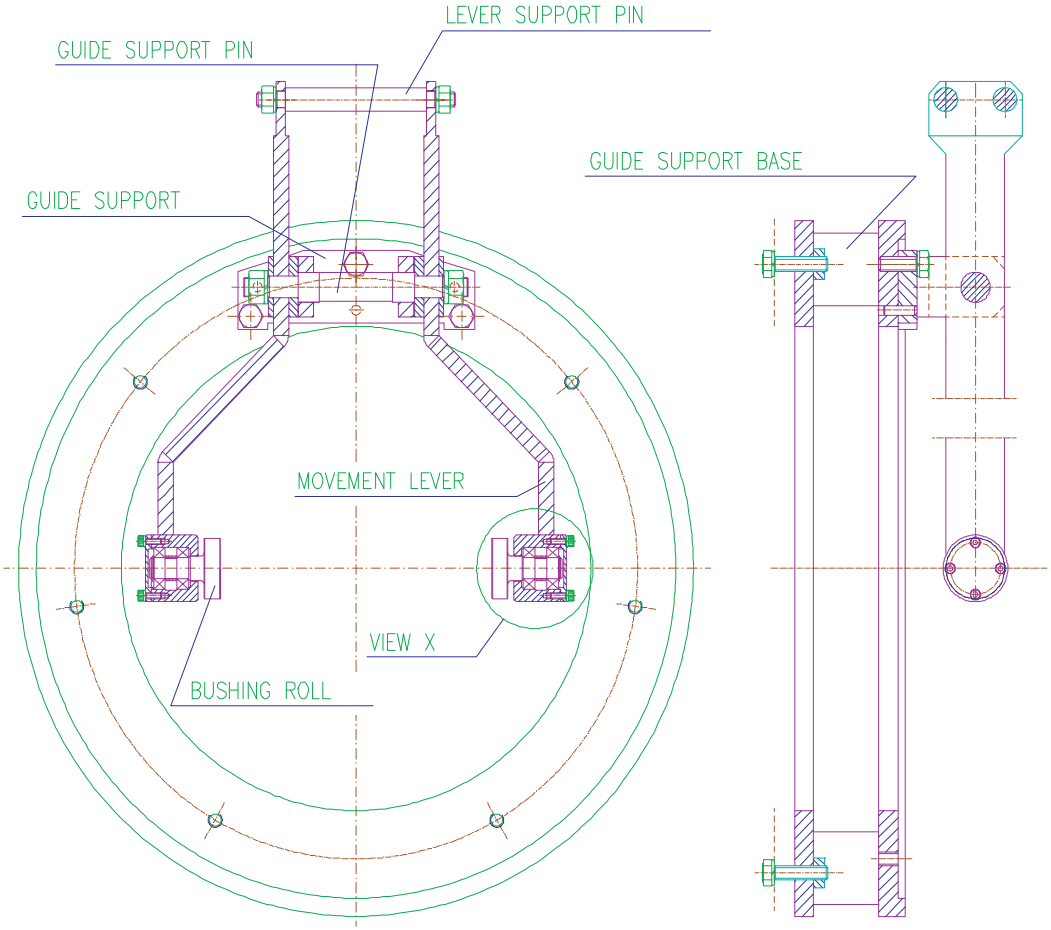
1) Mount the roll on the roll bearing on short bushing movement lever, and then the bearings, the spacing bushing and fix the bearing cover.

2) Fix the upper pins on one of the movement levers.

3) Mount the support pin on the movement lever.

4) Fix the guide support on the support base and the movement lever on the support. The rolls must be aligved with the short circuit bushing in such way that both touch the bushing simultaneously.





4.7.3.3. BRUSH HOLDER OPERATION SET

1) Mount the bearing on the shaft and fix it with retaining rings. Then put a retaining ring to hold the second bearing. After that, mount it with retaining ring.

2) Mount and fix the disc on the operation shaft.

3) Insert the operation shaft in the set flange.

4) Fix the lifting disc on the operation shaft.

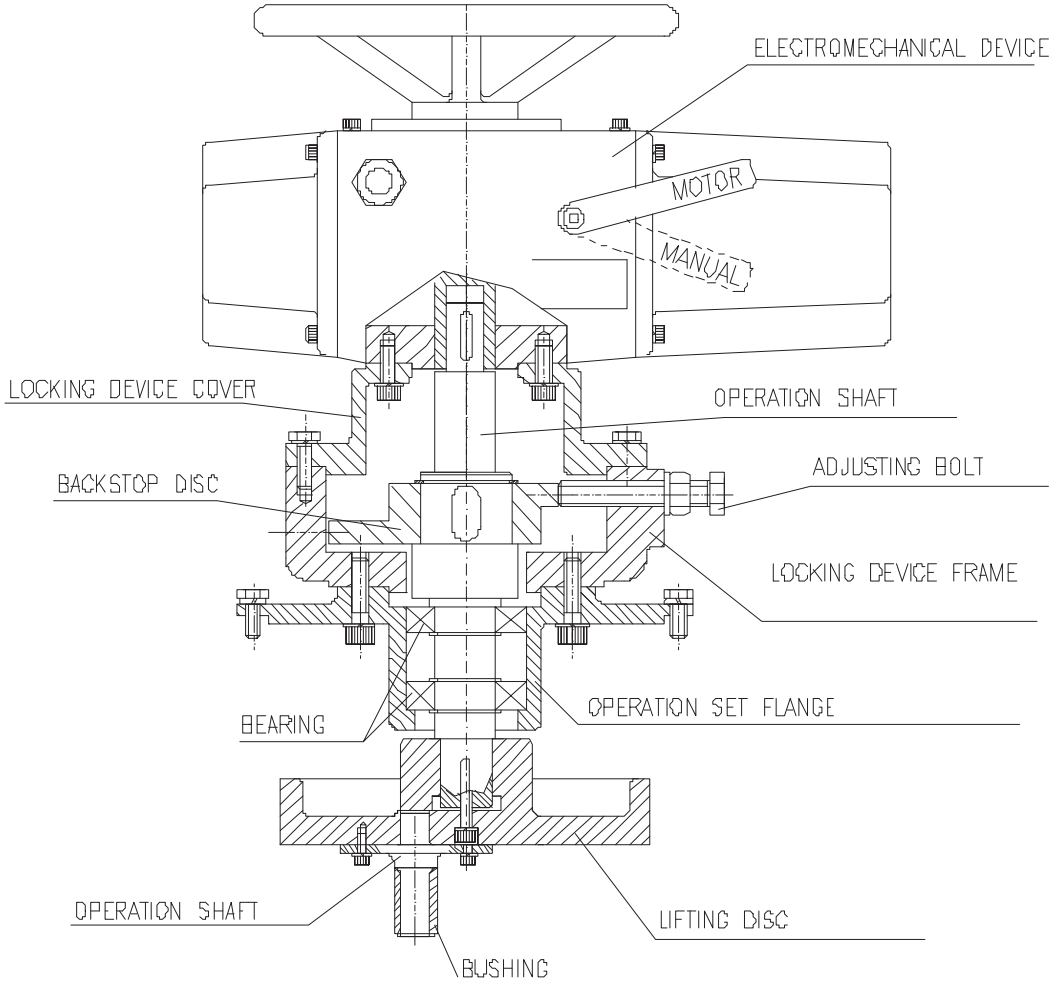
5) Mount the bushing on the lever operation shaft and fix it with a retaining ring. Fix the shaft on the operation disc.

6) Fix the locking device cover on the electromechanical device and then fix it to the device frame.

7) Fix the operation set on the brush holder protection box.

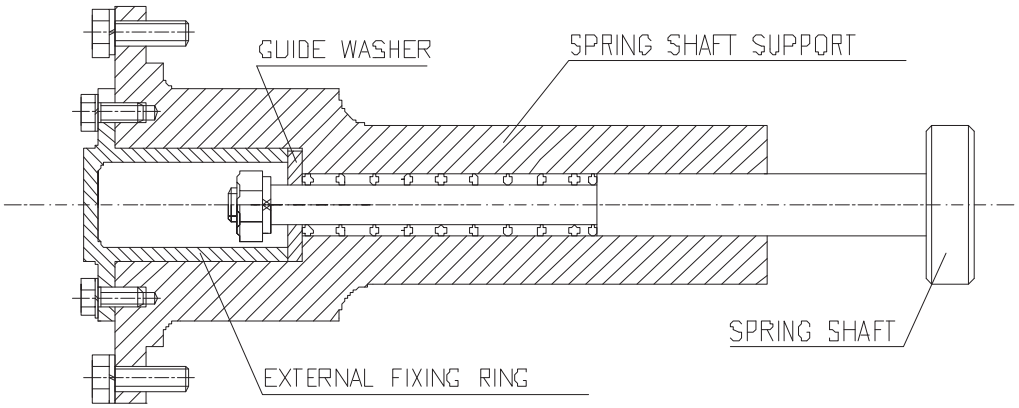
NOTE 1: The operation shaft must be fitted between the upper pins of the lifting lever.

NOTE 2: All the parts touching mechanically must be lubricated. After 6 months of use, check the lubrication of such parts.



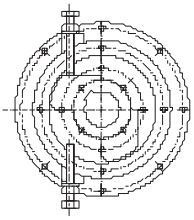
4.7.3.4. RETURN PIN SET

1) Mount the spring shaft on the shaft support. Mount the shaft guide washer; fit it on the shaft and lock it on the shaft and lock it with a nut.
2) Close the set with an external fixing ring and fix on the brush holder protection box.

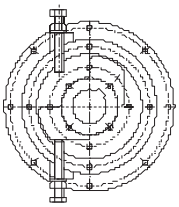


4.7.3.5. BRUSH HOLDER SET

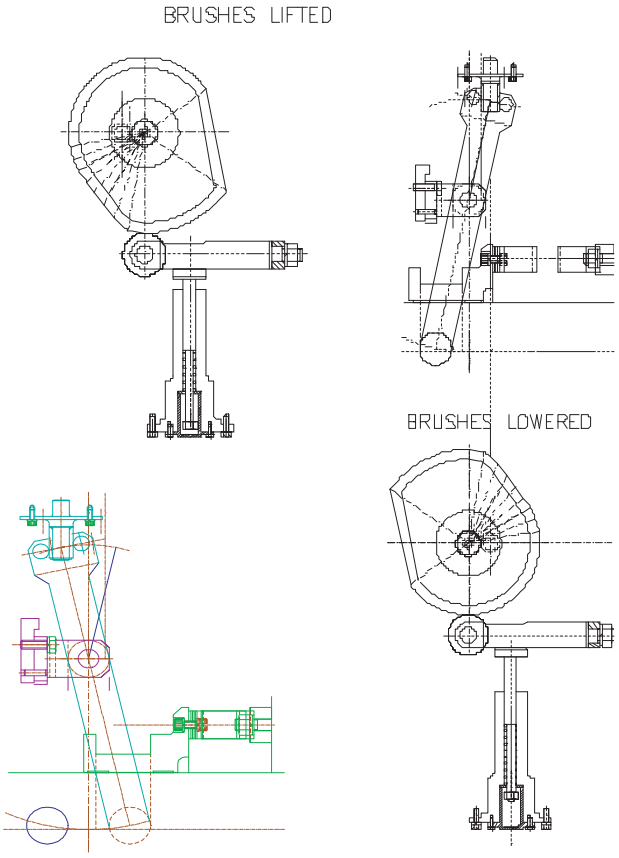
1) Fix the brushes on the brush holder.
2) Fix the isolated pins on the support; mount the isolated discs, brush holders and contact rings on the pins.
3) Adjust the curvature ray existing on the brushes with the collector rings and put a sandpaper between brush and ring. The sandpaper must be moved back and forth in order to make a better fitting of the brush ray with the ring ray. Unfasten the brush holder fixing bolt and turn the brush holder clockwise until the brush ray matches perfectly the ring.



POSITION NON SHORT-CIRCUITED



POSITION SHORT-CIRCUITED



4.7.4. DISASSEMBLY

For the disassembly of the liftable brush holder, proceed in the reserve way in relation to assembly procedures.

4.7.5. ADJUSTMENT OF THE BRUSH LIFTING SYSTEM

1) Turn the lifting disc up to the short-circuit position and then turn it a bit more to release the rolls to avoid unnecessary thrusts on the roller bearings.

2) Fasten the adjusting bolt up to the backstop disc and then lock the adjusting bolt.

3) Turn the lifting disc up to the position of non short-circuit (brushes lowered) and repeat the same procedure carried out for the short circuit position.

4.8. DRYING OF THE WINDINGS

It is recommended that this task be undertaken carefully and by qualified personnel. The rate of temperature rise should not exceed 5ºC per hour and the winding should not be heated up to more than 150ºC.
Excessive temperature as well as too quick temperature rise can generate steams which damage the windings. During the drying process, the temperature should be controlled carefully and the insulation resistance should be measured at regular intervals.
In the beginning, the insulation resistance will decrease due to the temperature increase, but it will increase during the drying process.
The drying process should be continued until successive measurements of the insulation resistance show a constant insulation resistance which should be higher than the minimum value specified, as indicated in item 2.3.3.
It is important to provide a good ventilation inside the motor during the drying process assuring that the moisture is removed effectively.

4.9. DESMANTLING AND REASSEMBLY

4.9.1. " MASTER" LINE

A) Squirrel-cage rotor:

DRIVE-END:
1) Remove the heat exchanger (if any).
3) Remove the temperature detectors from the bearing (if any).
4) Unscrew the bolts which fasten the bearing assembly.
5) Remove the external bearing caps (for roller bearing motors).
   4.1. For ball bearing motors, follow the procedures described in item 4.2.2.2.
6) Unscrew the bolts of the endshield. After being removed, the bolts should be screwed endshields in order to force its removing. To prevent the rotor falling onto the rotor, provide a support for it.
7) Remove the bearing(s) (for roller bearing motors).
8) Remove the internal bearing cap (for roller bearing motors).

NON DRIVE-END
1) Unscrew the protecting screen of the fan (enclosed motors).
2) Remove the fan by unscrewing the bolts which fasten it on the shaft.
3) Loosen the four nuts which fasten the fan cover and remove it.
4) Repeat the procedures 2 to 7 of previous paragraph.

B) Slip Ring Motors:

DRIVE-END:
The procedures are the same as for squirrel cage rotor motors.

NON DRIVE-END:
1) Remove the back protecting cover of the brush holders.
2) Disconnect the cables from the collector ring. Dismantle the brush holders.
3) Unscrew the brush holder protecting box from the cooling box. Remove the collector rings and the ventilating.
4) Repeat the procedures 2 to 4 as mentioned for disc.
5) the dismantling of the "Non drive-end" of squirrel cage rotor motors.

4.9.1.1. ROTOR REMOVING

Remove the rotor from the inside of the stator by means of hoisting ropes or other devices. The device must avoid that the rotor rubs on the stator or on the coil heads.

4.9.2. " A " AND " H " LINES

DRIVE-END:

1) Disconnect the space heater leads from the terminal boxes.
2) Remove the bearing temperature detectors (if any).
3) Unscrew the bolts of the bearing assembly.
4) Remove the external bearing caps (for roller bearing motors). For ball bearing motors, follow the procedures described in item 4.2.2.2.
5) Unscrew the endshield. By using an appropriate tool, force the endshield to release and at the same time turn it to help the removal. Make sure that the shaft is held on a plate and so an eventual fall of the rotor on the stator is avoided.
6) Remove the bearing(s) (for roller bearing motors).
7) Remove the internal bearing cap.

NON DRIVE END:

1) Remove the fan cover.
2) Release the fan retaining ring.
3) Repeat the procedures from 2 to 7 of item 4.8.2. (a).

NOTE:

1) For removing of rotor, observe section 4.8.1.1.
2) It is not necessary to remove the stator from the frame to perform an eventual rewinding.

4.9.3. FAF LINE

A) Drand "H" lines.

B) Non drive end:

1) Repeat the procedures 1 to 3 of item 4.8.2 (b).
2) Remove back protecting cover of the brush holder.
3) Disconnect the cables from the collector ring.
4) Remove the brushes and dismantle the brush-holder.

4.10. GENERAL ADVICES

Any damaged part (cracked, or distorted machined parts, damaged threads) should be replaced and never recovered.
All services herewith described should be undertaken by qualified personnel in order not to damage the equipment. In case of further doubts, contact WEG Máquinas.

4.11. MAINTENANCE SCHEDULE

COMPONENT	DAILY	WEEKLY	EVERY 3 MONTHS	YEARLY (PARTIAL MAINTEN.)	EVERY 3 YEARS (COMPLETE MAINTEN.)
- Complete motor.	- Check the noise and the vibration levels.		- Drain condensed water (it any).	- Retighten the bolts.	- Dismantle the motor. Check spare parts.
- Winding of the stator and rotor.				- Visual inspection. Measure insulation resistance.	- Cleanliness: check the fastenings and the slot wedges; measure the insulation resistance.
- Bearings.	- Check the noise level.	- Regrease; for intervals see the greasing plate.			- Clean the bearings. Replace them, if required, check bearing liner and replace it, if required (sleeve bearing) check sleeve race (shaft) and rebuild, if required.
- Terminal boxes and grounding lugs.				- Clean the inside area retighten the bolts.	- Clean the inside area retighten the bolts.
- Coupling: follow the maintenance instructions contained in the manual of the coupling manufacturer.		- After the first week of operation: check the alignment and fastening.		- Check alignment and fastening.	- Check alignment and fastening.
- Monitoring devices.	- Record the measurement values.				- If possible, disassemble and check its operating condition.
- Filter.			- Clean it, if required.	- Clean it, if required.	- Clean it (see section 4.1.2).
- Slip rings area.		- Inspect the cleanliness and clean it, if required.		- Check the cleanliness and clean it, if required.	
- Slip rings.		- Check surface and contact area.			
- Brushes.		- Check and replace them when 2/3 of their height is worn (check wear mark in fig. 4.5).			
- Air/air heat exchanger.					- Clean the pipes of the heat exchanger.

5. SPARE PARTS

5.1. HOW TO ORDER

When ordering spare parts, motor type and serial number must be always given as indicated on the nameplate or on the frame.

5.2. KEEPING STOCK

It is recommended to keep in stock the spare parts that, under normal use, can have some kind of wear such as:

6. ABNORMAL SITUATIONS DURING OPERATION

The majority of the abnormal situations during operation that affect the running of electric motors can be avoided by a predictive maintenance.
Sufficient ventilation, cleanliness and careful maintenance are the main factors. A further essential factor is the prompt attention to any abnormal situation such as vibrations, shaft knocks, declining insulation resistance, smoke or fire, sparking or unusual slip ring or brush wear, sudden changes of bearing temperature.
When failures of an electric or mechanical nature arise, the first step to be taken is to stop the motor and perform a subsequent examination of all mechanical and electrical parts of the installation.
In the event of having a fire, the motor should be disconnected from the power supply, which is normally done by turning off the respective switches.
In case of starting of fire inside the motor itself, steps should be taken to retrain and suffocate it by covering the ventilation openings. To extinguish a fire, dry chemical or CO^2 extinguishers should be used. Never use water.

6.1. COMMON FAILURES ON INDUCTION MOTORS

Motors built by WEG Máquinas are normally designed for Class F insulation (155ºC) and for ambient temperatures up to 40ºC(as indicated on the motor nameplate). Most winding failures occur when temperature limits, due to current overload, are surpassed throughout the winding or even in only portions thereof. These failures are identified by the darkening or carbonizing of the wire insulation.

6.1.1. SHORT BETWEEN TURNS

A short circuit between turns can be a consequence of two coincident insulation defects, or the result of defects arising simultaneously on two adjacent wires.
In some cases, the three-phase current imbalance can be so insignificant that the motor protective device fails to react. A short circuit between turns, and phases to ground due to insulation failure is rare, and even so, it normally occurs during the early stages of operation.

6.1.2. WINDING FAILURES

a) One winding phase burnt
This failure occurs when a motor runs wired in delta and current fails in one power supply conductor. Current rises from 2 to 2.5 times in the remaining winding with a simultaneous drop of speed. If the motor stops, the current will increase from 3.5 to 4 times its rated value. In most cases, this defect is due to lack of a protective switch, or because this switch has been set too high.

b) Two winding phases burnt
This failure occurs when current fails in one power supply conductor and the motor winding is star-connected. One of the winding phases remains currentless while the other absorb the voltage and carries an excessive current. The slip almost doubles.

c) Three winding phases burnt.
- **Probable cause 1:**
Motor protected only by fuses. An overload on the motor will be the cause of the trouble. As a consequence, progressive carbonizing of the wires and insulation will generate a short between turns, or a short against the frame. A protective switch placed before the motor would easily solve this problem.

- **Probable cause 2:**
Motor incorrectly connected.
For example: a motor with windings designed for 220/380V is connected through a stat-delta switch of 380V. The drawn current will be so high that the winding will burn out in a few seconds if the fuses or a protective switch incorrectly set fail to react promptly.

- **Probable cause 3:**
The star-delta switch is not commutated and the motor continues to run for a certain time connected to the star under overload conditions. As it only develops 1/3 of its torque, the motor cannot reach rated speed. The increase of slip

results in higher ohmic losses arising from the Joule effect. As the stator current, consistent with the load, may not exceed the rated value for delta connection, the protective switch will not react. Consequent to increased winding and motor losses the motor will overheat and the winding will burn out.

- **Probable cause 4:**

Failures from this cause are caused by thermal overload, due to excessive starts under intermittent operation or to an overly long starting cycle.
The perfect functioning of motors operating under these conditions is only assured when the following values are taken into account.

a) Number of starts per hour;
b) starting with or without load;
c) Mechanical brake or current inversion;
d) Acceleration of load connected to motor shaft;
e) Load torque related to speed during acceleration and braking.

The continuous effort withstood by the higher rotor during intermittent starting brings about losses which provoke overheating. Under certain circumstances, there is a possibility that the stator winding be subject to damage with the motor stopped as a result of the heating on the motor.

6.1.3. ROTOR FAILURES (SQUIRREL CAGE)

If a motor running under load conditions produces a noises of varied intensity and decreasing frequency while the load is increased, the reason, in most cases, will be an unsymmetrical rotor winding.
In squirrel-cage motors the cause will nearly always be a break in one or more of the rotor bars; simultaneously, periodical stator current fluctuations may be recorded. As a rule, this defect appears only in molded or die cast aluminum cages. Failures due to spot heating in one or another of the bars in the rotor care are identified by blue coloration at the affected points.
If there are failures in various contiguous bars, vibrations and shuddering can occur. When the rotor core gets a blue or violet coloration, it is a sign of overloading.
This can be caused by overly high slip, by too many starts or overlong starting cycles. This failure can also come from insufficient power supply voltage.

6.1.4. SLIP RING ROTOR FAILURES

A break in one phase of the rotor winding is noticed by a strong noise that varies according to the slip and, in addition, stronger periodical stator current fluctuations occur.
It is possible, but rarely so, that a rupture could have occurred in the connection between the winding and the slip ring. However, it is advisable to first check if there is a break in the rheostat starter connection, or even in the part itself.

6.1.5. SHORT BETWEEN TURNS ON SLIP RING MOTORS

This abnormal situation occurs only under extremely rare circumstances. Depending on the magnitude of the short circuit, the start can be violent even if the rheostat is at the first tap of its starting position. In this case, heavy starting currents are not carried through the rings and so no burn marks will be noticed on them.

6.1.6. BEARING FAILURES

Bearing failure are the most frequent causes for delayed breakdowns.
The most common reasons for this failure are identified as excessive vibration, incorrect operation, bad alignment, unbalanced couplings, excessive radial and/or axial loads.
Check item 4.2 for bearing maintenance.

6.1.7. SHAFT BREAKING

Although bearings traditionally constitute the weakest. part, and the shafts are designed with wide safety margins, it is possible that a shaft may break by fatigue from bending stress caused by excessive belt tension. In most cases, breaking occur right behind the drive end bearing.
As a consequence of alternating bending stress induced by a rotating shaft, breaking travel inwards from the outside of the shaft until the point of rupture is reached when resistance of the remaining shaft cross-section no longer suffices. At this point, avoid additional drilling on the shaft (fastening screw holes) as such operations tend to cause stress concentration.
The replacement of only one or two belts of a belt drive system is frequently a cause of shaft breaking, besides being an incorrect practice.
Any used and consequently stretched belts on a drive system, specially those closer to the motor, while new and unstretched belts are placed on

the same drive but farther from the bearing, can cause shaft stress.

6.1.8. DAMAGE ARISING FROM POORLY FITTED TRANSMISSION PARTS OR IMPROPER MOTOR ALIGNMENT

Damaged to bearing and breaking of shafts are often resulted from inadequate fitting of pulley, couplings or pinions on the shaft.
These parts "knock" when rotating. The defect can be recognized by the scratches that appear on the shaft or the eventual scalelike flaking of the shaft end. Keyways with edges pitted by loosely fitted keys can also cause shaft failures.
Pooly aligned couplings cause knocks and radial and axial shaking to shaft and bearings. Within a short while, these bad practices cause the deterioration of the bearings and the enlargement of the bearing on the drive end side. In other cases, motor shaft can break.

6.2. ABNORMAL SITUATIONS DURING OPERATION

NOTE: The following chart presents a list of abnormal situations during motor operation, the probable cause for such abnormal situations, and the corrective measures. In case of further doubts, contact Weg Máquinas.

ABNORMAL SITUATION	PROBABLE CAUSE(S)	CORRECTIVE MEASURE(S)
- Motor fails to start, neither coupled, nor uncoupled.	- At least two feeding conductors are broken, no voltage supply. - The rotor is locked. - Brushes problem. - Bearing is damaged.	- Check commanding board, switch, fuses, power supply conductors, terminals and setting of brushes. - The brushes might be worn or set incorrectly. - Replace the bearing.
- Motor starts very slowly with load and does not reach rated speed. - Motor starts under no load, but is fails when the load is applied .	- Too high load during start. - Supply voltage too low. - Too high voltage drop on the feeding conductors. - Rotor bars damaged or interrupted. - One supply conductor remained interrupted after the starting.	- Do not apply load on the machine during start. - Measure supply voltage, set the correct value. - Check the cross section of the feeding conductors. - Check and repair the rotor winding (squirrel cage), test the short circuit device (slip ring). - Check the supply conductors.
- Stator current changes with double frequency of the slip; during start humming can be heard.	- Rotor winding is interrupted. - Brushes problem.	- Check and repair rotor winding and short-circuit device. - Clean, set correctly or replace the brushes.
- No load current too high.	- Supply current too high.	- Measure the supply voltage and set it to the correct value.
- Rapid overheating of the stator, there is a humming during the operation.	- Parallel or in phase connected wires of the stator winding are broken.	- Measure the resistance of all winding phases. Replace the stator core with the winding.
- Areas of heating on the stator winding	- Short between turns. - Interruption of conductors connected in parallel or in phase of the stator winding - Poor connection.	- Rewind the motor. - Remake the connections.
- Areas of heating on the rotor.	- Interruption in the rotor winding.	- Repair the rotor winding, or replace it
- Abnormal noise with motor connected to load.	- Mechanical problems. - Electric problems.	- Noise decreases generally with the speed drop; see also "Noisy operation when uncoupled" - Noise disappears when motor is switched on. Contact the manufacturer
- Noise occurs when coupled and disappears when not coupled.	- Failure in the drive components, or on the driven machine. - Failure on the gearing. - Coupling problem. - Foundation is sunk. - Poor balancing of the parts or of the driven machine. - Supply voltage too high. - Direction of rotation is not correct.	- Check the power transmission, coupling and alignment. - Align the driving, check the position (coupling) of the gearing. - Align the motor and the driven machine. - Repair the foundation. - Test the supply voltage and the noload current. - Reverse the connections of two phases. - Rebalance the unit.

ABNORMAL SITUATION	PROBABLE CAUSE(S)	CORRECTIVE MEASURE(S)
- Overheating of the stator winding with load.	- Poor cooling due to dirty air tubes. - Load too high. - Excessive number of starts, or the inertia is too high. - Voltage too high and consequently also the iron losses are too high. - The voltage is too low and consequently the current is too high. - One feeding conductor is interrupted, or one phase of the winding is interrupted. - Rotor is rubbing on the stator. - The operation mode does not correspond to the data on the nameplate. - Electrical load unbalanced (blown fuse, incorrect control). - Dirty windings. - Obstructed cooling system. - Dirty filter. - Rotation direction not compatible with the fan used.	- Clean the air tubes of the cooling system. - Measure the stator voltage, decrease the load, use a larger motor. - Reduce the number of starts. - Do not exceed more than 110% the rated voltage, unless specifications on the nameplate are different. - Check the voltage supply and the voltage drop. - Check the current in all phases and make correction. - Check air gap, operation conditions, bearings, vibrations. - Maintain the operation mode as specified on the nameplate, or reduce the load. - Verify if there are unbalanced voltages, or if the two phases are operating. - Clean. - Clean the felt of the filter. - Analyze the fan in relation to motor rotation direction.
- Noisy operation when uncoupled.	- Unbalancing. - One phase of the stator winding is interrupted. - Dirt in the air gap. - Fastening bolts are loose. - Unbalancing of the rotor increase after the assembling of the driving components. Unbalanced rotor. - Foundation resonance. - Motor frame is deformed. - Bent shaft. - Uneven air gap.	- Noisy operation continues during rundown time after switching off the voltage; rebalance the motor. - Test current input of all feeding conductors. - Remove the dirt and clean the air gap. - Tighten and block bolts. - Check balancing. - Level the foundation. - Check the alignment. - The shaft can be bent, check the balancing and the eccentricity of the rotor. - Check if the shaft is bent or if the bearings are damaged.
- Slip ring motor operating at low speed with external resistance disconnected.	- Control circuit conductors too light. - Open circuit on rotor circuits. - Dirt between brush and slip ring. - Brushes gripe on brush holders. - Incorrect pressure on brushes. - Rough surfaces on slip rings. - Eccentric rings. - High current density on brushes. - Brushes incorrectly set.	- Install heavier conductors on control circuit. - Bring control closer to motor. - Test circuit with a magneto, or other means, and undertake necessary repairs. - Clean slip rings and insulation assembly. - Select brushes of correct size. - Check pressure on each brush and adjust it accordingly. - Clean, sand and polish. - Machine on lathe or with portable tool without removing from machine. - Reduce load or replace brushes. - Reset brushes correctly.
- Brush sparking.	- Poorly set brushes with insufficient pressure. - Overload. - Slip rings in poor condition. - Oval slip rings. - Excess of vibration. Rough surfaces and scored rings. - Low load causing damage to slip rings.	- Check brush setting, adjust for correct pressure. - Reduce load or install motor with higher capacity. - Clean rings and reset brushes. - Polish the slip rings and machine the same on lathe. - Balance the rotor, check the brushes for free movement within holders. - Check origin of vibration and correct it. - Adjust the brushes to the actual load requirement and machine the slip rings.

6.3. ABNORMAL BEARING SITUATIONS AND FAILURES DURING OPERATION

NOTE: The following chart presents abnormal bearing situations and failures during motor operation, the probable cause for such abnormal situation and the corrective measures. In certain cases, bearing manufacturer must be contacted to find out the cause of the failure.

ABNORMAL SITUATION	POSSIBLE CAUSE(S)	CORRECTIVE MEASURE(S)
- The motor "snores" during operation.	- Damaged bearings.	- Replace the bearing.
- Bearing noisy, dull spots, grooves in the ball races.	- Bearing was slanting mounted.	- Align the bearing and machine the bearing seat.
- High bearing noise and a high overheating of the bearing.	- Cage corrosion, small chips in the grease, race failure due to insufficient grease, or inadequate clearance.	- Clean and replace the grease according to the specifications. Replace the bearing.
- Overheating of bearings.	- Excessive grease. - Excessive axial or radial strain on belt. - Bent shaft. - Lack of grease. - Hardened grease cause locking on balls. - Foreign material in the grease.	- Remove the grease relief and run the motor until excess grease is expelled. - Reduce belt tension. - Have shaft straightened and check rotor balance. - Add grease to bearing. - Replace bearing. - Flush out housing and lubricant; regress.
- Dark spots on one side of the ball races subsequently the formation of grooves.	- Excessive axial strength.	- Check the condition between coupling and driving.
- Dark lines on the ball races or very close transversal grooves.	- Current on the bearings.	- Clean and replace the bearing insulation. Install an insulation if there was not any. - Branch the current avoiding that it circulates through the bearing.
- Grooves in the races and depressions in the division of the cylindrical elements.	- External vibration, mainly when the motor stopped for a long period of time. - Lack of maintenance during storage.	- If the motor is stopped during a long period, turn the shaft to an other position from time to time. This is mainly required for spare motors.

IMPORTANT:
The motors listed in this manual are constantly updated. For this reason, the information here with included may change without prior notice.

WARRANTY TERMS FOR ENGINEERING PRODUCTS

These products, when operated under the conditions stipulated by WEG in the operating manual for such product, are warranted against defects in workmanship and materials for twelve (12) months from startup date or eighteen (18) months from manufacturer shipment date, whichever occurs first.
However, this warranty does not apply to any product which has been subject to misuse, misapplication, neglect (including without limitation, inadequate maintenance, accident, improper installation, modification, adjustment, repair or any other cases originated from inadequate applications).
The company will neither be responsible for any expenses incurred in installation, removal from service, consequential expenses such as financial losses nor transportation costs as well as tickets and accommodation expenses of a technician when this is requested by the customer.
The repair and/or replacement of parts or components, when effected by WEG within the Warranty period do not give Warranty extension, unless otherwise expressed in writing by Weg.
This constitutes WEG's only warranty in connection with this sale and is in lieu of all other warranties, expressed or implied, written or oral.
There are no implied warranties of merchantability or fitness for a particular purpose that apply to this sale.

No employee, agent, dealer, repair shop or other person is authorized to give any warranties on behalf of WEG nor to assume for WEG any other liability in connection with any of its products.
In case this happens without Weg's authorization, Warranty is automatically cancelled.

LIABILITY

Except as specified in the foregoing paragraph entitled "Warranty Terms for Engineering Products", the company shall have no obligation or liability whatsoever to the purchaser, including, without limitation, any claims for consequential damages or labor costs, by reason of any breach of the express warranty described therein.
The purchaser further hereby agrees to identify and hold the company harmless from any causes of action (other than cost of replacing or repairing the defective product as specified in the foregoing paragraph entitled "Warranty Terms for Engineering Products", arising directly or indirectly from the acts, omissions or negligence of the purchaser in connection with or arising out of the testing, use, operation, replacement or repair of any product described in this quotation and sold or furnished by the company to the purchaser.

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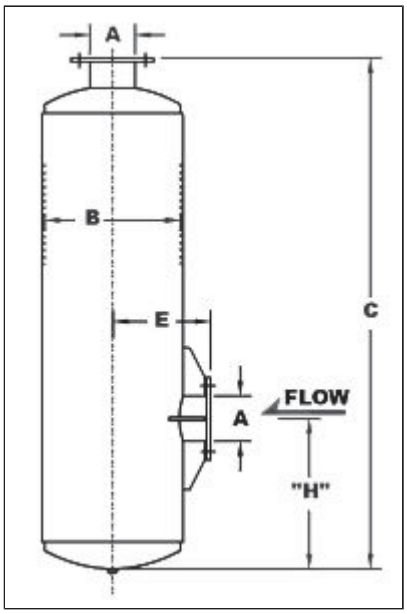
Series D

D13H ROTARY BLOWER COMBINATION SILENCERS

Application
Blower Discharge Silencer for maximum silencing at blower speeds below transition speed.

Design
A multi-chambered silencer containing a special arrangement of volumes and air passageways to effectively reduce pulsations through the conversion of noise energy into heat. D13H may be installed horizontally or vertically. Design parameter permit nozzle orientation to suit installation requirements.

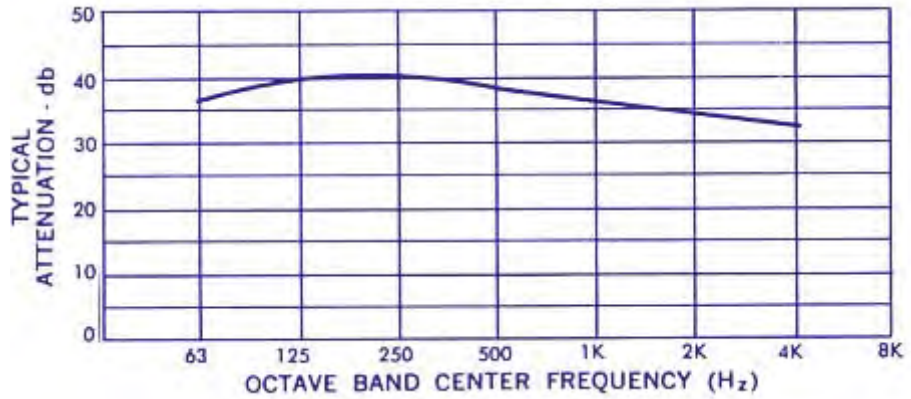
Construction
All welded steel sheet and plate construction for long service life. Exterior surfaces are prime coated. Flanges are drilled to match 125 lb. American Standard Flanges. Inspection opening, mounting brackets, relief valve nozzles or special paint available at extra charge.



Model	A	B	C	E	H		Wt.
					Min.	Max.	
D13H - 2	2*	8	30	7	6	10	25
D13H - 2 1/2	2 1/2*	10	31	8	6	10	36
D13H - 3	3*	10	49	8	6	10	45
D13H - 4	4**	14	49	11	7	24	125
D13H - 5	5**	16	62	12	8	28	145
D13H - 6	6	18	68	13	9	34	175
D13H - 8	8	22	89	15	10	43	465
D13H - 10	10	26	114	17	12	57	748
D13H - 12	12	30	127	19	13	69	1158
D13H - 14	14	36	159	22	15	69	1737
D13H - 16	16	42	173	25	17	81	2353
D13H - 18	18	48	180	28	19	90	3022
D13H - 20	20	48	192	28	20	92	3582
D13H - 22	22	54	205	31	22	96	4815
D13H - 24	24	54	223	31	24	100	5963

* NPT Connections
** Available in both NPT or Flange Connections

TYPICAL ATTENUATION CURVE



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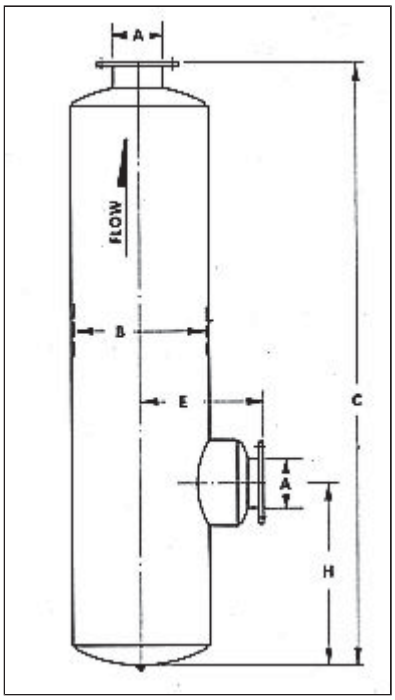
Series D

D33H CHAMBER-ABSORPTION SILENCERS

Application
Blower Discharge Silencer for maximum silencing at blower speeds above transition speed.

Design
A multi-chamber silencer containing a high frequency absorption device in addition to a special arrangement of volumes and air passageways to effectively reduce both pulsation and excessive high frequency through the process of converting noise energy into heat. D33H may be installed horizontally or vertically. Design parameters permit nozzle orientation to suit installation requirements.

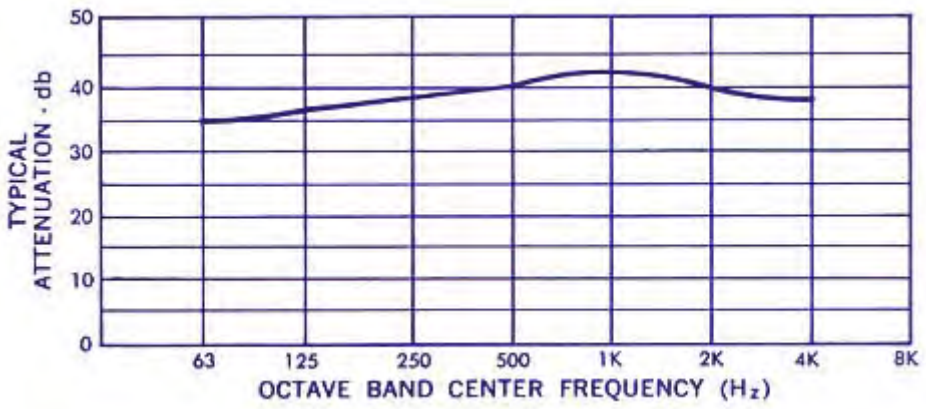
Construction
All welded steel sheet and plate construction for long service life. Standard acoustic absorption material temperature limit is 300°F. Exterior surfaces are prime coated. Flanges are drilled to match 125 lb. American Standard Flanges. Inspection openings, mounting brackets, relief valve nozzles or special paint are available at extra charge.



Model	A	B	C	E	H		Wt.
					Min.	Max.	
D33H - 2	2*	8	30	9	6	10	30
D33H - 2 1/2	2 1/2*	10	31	10	7	11	40
D33H - 3	3*	10	49	12	7	11	50
D33H - 4	4**	14	50	14	8	17	120
~~D33H - 5~~	~~5~~	~~16~~	~~62~~	~~15~~	~~9~~	~~20~~	~~165~~
D33H - 6	6	18	69	17	10	24	215
~~D33H - 8~~	~~8~~	~~22~~	~~95~~	~~26~~	~~12~~	~~26~~	~~715~~
D33H - 10	10	26	120	34	14	36	958
D33H - 12	12	30	133	40	16	40	1353
D33H - 14	14	36	165	48	17	40	1826
D33H - 16	16	42	179	54	19	44	2906
D33H - 18	18	48	186	60	21	46	4175
D33H - 20	20	48	198	66	22	47	4525
D33H - 22	22	54	211	72	24	48	5337
D33H - 24	24	54	229	72	26	54	6560

* NPT Connections
** Available in NPT or Flange Connections

TYPICAL ATTENUATION CURVE



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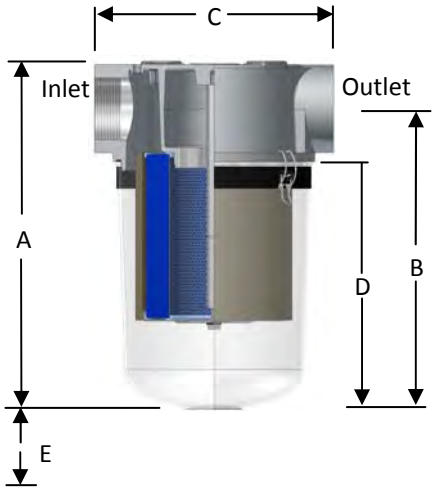
”T” Style Vacuum Filters
ST/CT Series 1” – 6” FPT



General Features

- Compact design for space restrictions; min. service area
- Inlet above element for extended element life & maintenance intervals
- Cast, corrosion resistant aluminum top with machined connections: - Integrated baffle design
  - 4 M12 taps for mounting brackets: 2” to 6”
- ”T” style design minimizes piping requirements
- 1/4” differential gauge ports: 2” to 6”

ST Series Specifications

- See-through bucket made from polycarbonate material
- Bucket has a high tensile strength for dimensional stability
- Temp ratings: - Complete assembly max: 220°F (104°C)
  - See-through bucket only max: 257°F (125°C)
- Increased holding capacity

Technical Specifications

- Vacuum Rating: Gas tight seal
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20” H2O over initial Δ P
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron

Options

- Swing bolts for heavy duty environments
- 1” to 1-1/2” housings have dimples for optional gauge ports & mounting bracket taps
- Epoxy coated housings
- Drain ports
- Spool piece extender on select models
- ISO flange connections: NW25, NW40 (select models)

FPT Inlet & Outlet	Assembly SCFM Rating	Assembly Part Number		Dimensions - inches				Suggested Service HT.	Approx. Weight	Replacement Element Part No.		Element SCFM Rating
		Polyester	Paper	A	B	C	D	E	lbs.	Polyester	Paper	
1"	40	ST-897-100C	ST-896-100C	13 3/8	11 15/16	7	10 3/8	9	11	897	896	115
1-1/4"	60	ST-897-125C	ST-896-125C	13 3/8	11 15/16	7	10 3/8	9	11	897	896	115
1-1/2"	80	ST-897-150C	ST-896-150C	13 3/8	11 15/16	7	10 3/8	9	10	897	896	115
2"	175	ST-851/1-200C	ST-850/1-200C	16 1/4	14 1/4	9	12 1/2	9	15	851/1	850/1	290
2-1/2"	210	ST-851/1-250C	ST-850/1-250C	16 1/4	14 1/4	9	12 1/2	9	14	851/1	850/1	290
3"	300	ST-235P-300C	ST-234P-300C	19 3/4	17	13 1/2	14	9	29	235P	234P	570
4"	520	ST-235P-400C	ST-234P-400C	19 3/4	17	13 1/2	14	9	25	235P	234P	570

Dimension tolerance ± 1/4”

CT Series Specifications

- Carbon steel black enamel drop down bucket
- Swing bolts standard on 6” housings

FPT Inlet & Outlet	Assembly SCFM Rating	Assembly Part Number		Dimensions - inches				Suggested Service HT.	Approx. Weight	Replacement Element Part No.		Element SCFM Rating
		Polyester	Paper	A	B	C	D	E	lbs.	Polyester	Paper	
1"	40	CT-897-100C	CT-896-100C	13 3/8	11 13/16	7	10 3/8	9	12	897	896	115
1-1/4"	60	CT-897-125C	CT-896-125C	13 3/8	11 13/16	7	10 3/8	9	12	897	896	115
1-1/2"	80	CT-897-150C	CT-896-150C	13 3/8	11 13/16	7	10 3/8	9	11	897	896	115
2"	175	CT-851-200C	CT-850-200C	13	10 7/8	9	9	9	16	851	850	290
2-1/2"	210	CT-851-250C	CT-850-250C	13	10 7/8	9	9	9	15	851	850	290
3"	300	CT-235P-300C	CT-234P-300C	18 5/8	16 1/8	13 1/2	13	9	30	235P	234P	570
4"	520	CT-235P-400C	CT-234P-400C	18 5/8	16 1/8	13 1/2	13	9	26	235P	234P	570
6"	1100	CT-275P-600C	CT-274P-600C	18 1/4	14 1/2	19	9 7/8	10	45	275P	274P	1100

Note CT 2” & 2-1/2” models: Element seals on the base of the housing.

See Vacuum Filter Technical Data section for sizing guidelines.

Note: Model offerings and design parameters may change without notice. See www.solbergmfg.com for most current offering.

Models 215V ~~and 337~~

Model 215V is Non-code Vacuum ~~and Model 337~~ is ASME Section VIII, Air/Gas Vacuum, 'UV' National Board Certified, Safety Valves

KUNKLE

Features

- **Large nozzle design** provides high capacity.
- **Flat bronze valve seats are lapped** for optimum performance.
- **Warn ring offers easy adjustability** for precise opening with minimum pre-open or simmer and exact blowdown control.
- **Pivot between disc and spring** corrects misalignment and compensates for spring side thrust.

Model Descriptions

- **Model 337 has 'pull-ring' lift device** for easy manual testing.
- **Every valve is 100% tested/inspected** for pressure setting, blowdown and leakage.
- **All adjustments are factory sealed** to prevent tampering or disassembly.

Option

- SS trim. (nozzle and disc) (Variation 03)

Applications

- Protection of low to medium pressure high volume blowers, compressors and pneumatic conveying systems.
- Bulk hauling trailers/equipment.
- Light gauge tanks.
- Protection of high volume vacuum pumps and conveying systems.

Vacuum Limits

Model 215V:
2-inch HG
to 29-inch HG
[67.7 to 982 mbarg]
-20° to 406°F [-29° to 208°C]

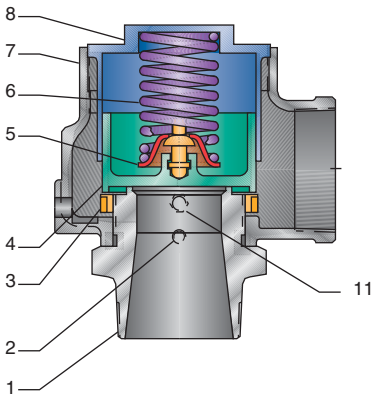
~~Pressure and Temperature Limits~~

~~**Model 337:**~~
~~1 to 60 psig [0.07 to 4.1 barg]~~
~~-20° to 406°F [-29° to 208°C]~~

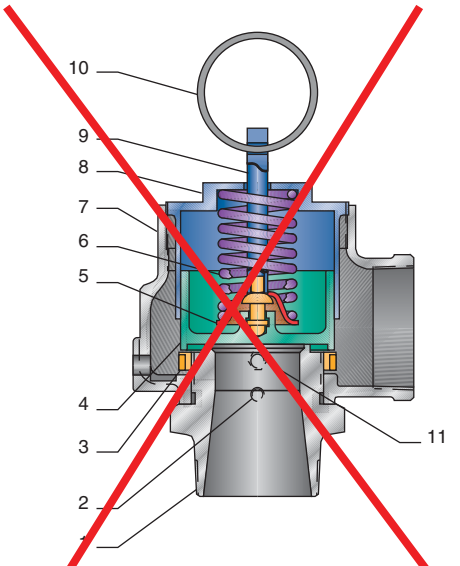
KUKMC-0383-US-0207

Models 215V ~~and 337~~

Parts and Materials



Model 215V



~~Model 337~~

Models 215V and 337

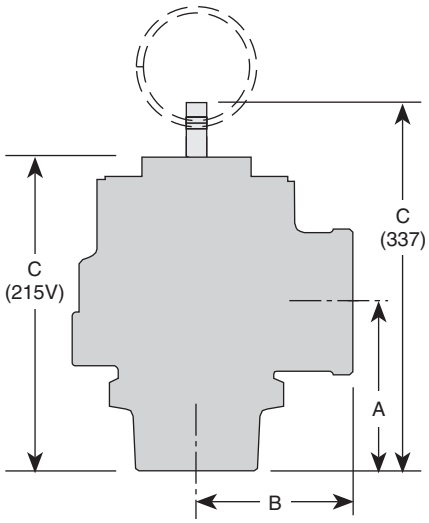
No.	Part Name	215V	~~337~~
1	Nozzle[1]	Bronze, SB62	Bronze, SB62
2	Set Screw	Steel A108-1018 Brass Plated	Steel A108-1018 Brass Plated
3	Regulator Ring	Bronze B584 Alloy 84400	Bronze B584-C84400
4	Disc[1]	Bronze B584 Alloy 84400	Bronze B584-C84400
5	Spring Step	Steel A-109 Coated[3]	Steel A109 Coated[3]
6	Spring	SS, A313 TY 302	SS A313-302
7	Body	Cast Iron, Zinc Plated, B633	Iron A-126, CL A or B
8	Compression Screw	Bronze, B-584 Alloy 84400	Bronze B584-C84400
9	Stem[2]	N/A	Brass B16
10	Lift Ring[2]	N/A	SS A313-302
11	Regulator Ring Set Screw	N/A	Brass B16

Notes

1. Disc and nozzle available in SSA-479 TY 316.
2. Stem and lift ring available on Model 337 only.
3. Corrosion preventative coating.

Specifications

Size Inlet and Outlet	Dimensions, in [mm] A	B	C 215V	~~C 337~~	Weight lb [kg]
2" [50.8 mm]	3 1/4 [82.5]	3 [76.2]	6 1/2 [165.1]	~~7 [177.8]~~	8 [3.6]
~~2 1/2" [63.5 mm]~~	~~3 3/4 [95.2]~~	~~3 1/2 [88.9]~~	~~7 5/8 [194.6]~~	~~8 [203.2]~~	~~12 [5.4]~~
3" [76.2 mm]	4 1/4 [107.9]	4 [101.6]	8 1/2 [215.9]	9 [228.6]	20 [4.1]



Model 337

Models 215V and 337

Model 215V

Non-code Vacuum Air (SCFM) - Flow Coefficient			
Relief Set (in, HG)	Valve Inlet and Outlet Size		
	2" Orifice Area, in^2 1.84	2 1/2" Orifice Area, in^2 2.79	3" Orifice Area, in^2 4.04
2	229	347	503
5	338	512	742
10	415	630	912
15	426	646	936
20	426	646	936

Non-code Vacuum Air [Metric, Nm^3/h]			
Relief Set [mbarg]	Valve Inlet and Outlet Size		
	5.08 cm Orifice Area [11.86 cm^2]	6.35 cm Orifice Area [17.97 cm^2]	7.62 cm Orifice Area [26.05 cm^2]
50	328	498	722
100	450	682	988
150	533	807	1170
200	593	899	1303
250	638	966	1400
300	669	1014	1470
350	690	1046	1516
400	701	1062	1540
450	704	1067	1546
500	704	1067	1546
550	704	1067	1546
600	704	1067	1546
650	704	1067	1546
700	704	1067	1546
750	704	1067	1546

Model 337

Non-code[1] and ASME Section VIII Air (English, SCFM)			
Set Pressure (psig)	Valve Inlet and Outlet Size		
	2"	2 1/2"	3"
1	240	364	527
5	531	805	1166
10	741	1124	1628
15	948	1436	2081
20	1092	1656	2399
25	1237	1875	2718
30	1382	2095	3036
35	1542	2337	3386
40	1701	2578	3736
45	1860	2820	4086
50	2020	3061	4436
55	2179	3303	4786
60	2338	3544	5136

Note

1. No code stamp or 'NB' on nameplate below 15 psig set.

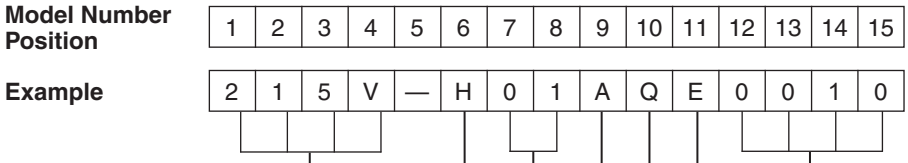
Non-code[1] and ASME Section VIII Air [Metric, Nm^3/h]			
Set Pressure [barg]	Valve Inlet and Outlet Size		
	50 mm	63 mm	80 mm
0.5	1049	1589	2303
1.0	1457	2208	3200
1.5	1888	2861	4147
2.0	2235	3387	4910
2.5	2613	3959	5739
3.0	2995	4538	6579
3.5	3377	5117	7418
4.0	3760	5696	8258

Note

1. No code stamp or 'NB' on nameplate below 1.1 barg set.

Models 215V ~~and 337~~

Model Number/Order Guide



Model
215V
~~0337~~

Inlet Size
H - 2-inch [50.8 mm]
~~J - 2½ inch [63.5 mm]~~
~~K - 3-inch [76.2 mm]~~

Variation (01 through 99)
01 - Bronze Disc and Nozzle
~~02 - SS Disc and Nozzle~~
~~03 - BSP Connections~~

Design Revision
Indicates non-interchangeable revision. Current Design is at Revision 'A'

Valve Service
~~K - Air ASME Section VIII (Model 337 only)~~
Q - Vacuum (Model 215V only)
~~N - Non-code Air/Gas (Model 337 only)~~

Spring Material
E - SS Type 316
~~M - SS (26 psi thru 60 psi set) Type 17-7~~

Set Pressure
~~Model 337, 1 psig [0.7 barg] (0001) through 60 psig [4.1 barg] (0060)~~
Model 215V, 2-inch HG [68 mbarg] (0002) through 29-inch HG [982 mbarg] (0029) vacuum

Facility Phone: 828-669-3700

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Models 215V and 337

Model 215V is Non-code Vacuum and Model 337 is ASME Section VIII, Air/Gas Vacuum, 'UV' National Board Certified, Safety Valves

KUNKLE

Features

- **Large nozzle design** provides high capacity.
- **Flat bronze valve seats are lapped** for optimum performance.
- **Warn ring offers easy adjustability** for precise opening with minimum pre-open or simmer and exact blowdown control.
- **Pivot between disc and spring** corrects misalignment and compensates for spring side thrust.

Model Descriptions

- **Model 337 has 'pull-ring' lift device** for easy manual testing.
- **Every valve is 100% tested/inspected** for pressure setting, blowdown and leakage.
- **All adjustments are factory sealed** to prevent tampering or disassembly.

Option

- SS trim. (nozzle and disc) (Variation 03)

Applications

- Protection of low to medium pressure high volume blowers, compressors and pneumatic conveying systems.
- Bulk hauling trailers/equipment.
- Light gauge tanks.
- Protection of high volume vacuum pumps and conveying systems.

Vacuum Limits

Model 215V:
2-inch HG
to 29-inch HG
[67.7 to 982 mbarg]
-20° to 406°F [-29° to 208°C]

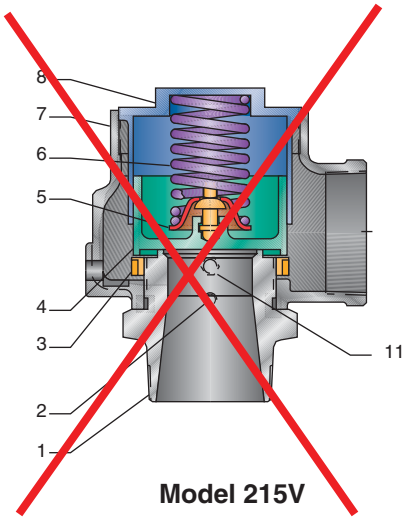
Pressure and Temperature Limits

Model 337:
1 to 60 psig [0.07 to 4.1 barg]
-20° to 406°F [-29° to 208°C]

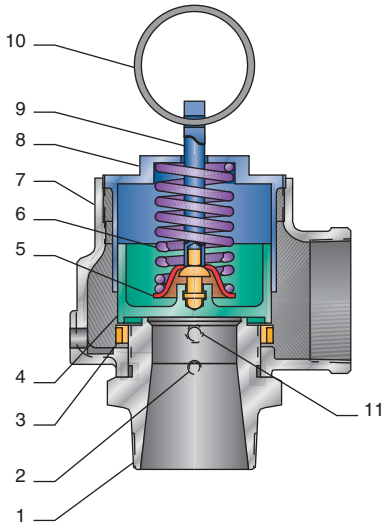
KUKMC-0383-US-0207

Models 215V and 337

Parts and Materials



Model 215V



Model 337

Models 215V and 337

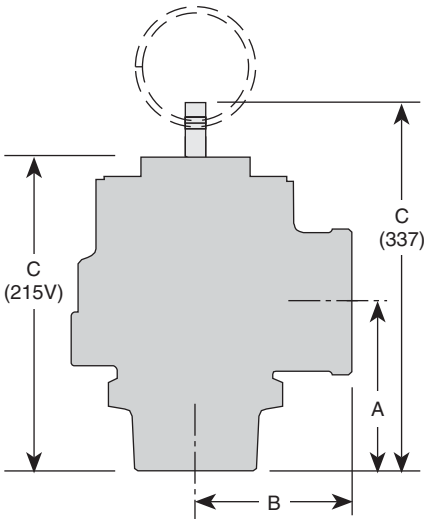
No.	Part Name	215V	337
1	Nozzle[1]	Bronze, SB62	Bronze, SB62
2	Set Screw	Steel A108-1018 Brass Plated	Steel A108-1018 Brass Plated
3	Regulator Ring	Bronze B584 Alloy 84400	Bronze B584-C84400
4	Disc[1]	Bronze B584 Alloy 84400	Bronze B584-C84400
5	Spring Step	Steel A-109 Coated[3]	Steel A109 Coated[3]
6	Spring	SS, A313 TY 302	SS A313-302
7	Body	Cast Iron, Zinc Plated, B633	Iron A-126, CL A or B
8	Compression Screw	Bronze, B-584 Alloy 84400	Bronze, B584-C84400
9	Stem[2]	N/A	Brass B16
10	Lift Ring[2]	N/A	SS A313-302
11	Regulator Ring Set Screw	N/A	Brass B16

Notes

1. Disc and nozzle available in SSA-479 TY 316.
2. Stem and lift ring available on Model 337 only.
3. Corrosion preventative coating.

Specifications

Size Inlet and Outlet	Dimensions, in [mm] A	B	C 215V	C 337	Weight lb [kg]
2" [50.8 mm]	3 1/4 [82.5]	3 [76.2]	6 1/2 [165.1]	7 [177.8]	8 [3.6]
2 1/2 [63.5 mm]	3 3/4 [95.2]	3 1/2 [88.9]	7 5/8 [194.6]	8 [203.2]	12 [5.4]
3" [76.2 mm]	4 1/4 [107.9]	4 [101.6]	8 1/2 [215.9]	9 [228.6]	20 [4.1]



Model 337

Models 215V and 337

Model 215V

Non-code Vacuum Air (SCFM) - Flow Coefficient

Relief Set (in. HG)	Valve Inlet and Outlet Size 2" Orifice Area, in² 1.84	2½" Orifice Area, in² 2.79	3" Orifice Area, in² 4.04
2	229	347	503
5	338	512	742
10	415	630	912
15	426	646	936
20	426	646	936

Non-code Vacuum Air [Metric, Nm³/h]

Relief Set [mbarg]	Valve Inlet and Outlet Size 5.08 cm Orifice Area [11.86 cm²]	6.35 cm Orifice Area [17.97 cm²]	7.62 cm Orifice Area [26.05 cm²]
50	328	498	722
100	450	682	988
150	533	807	1170
200	593	899	1303
250	638	966	1400
300	669	1014	1470
350	690	1046	1516
400	701	1062	1540
450	704	1067	1546
500	704	1067	1546
550	704	1067	1546
600	704	1067	1546
650	704	1067	1546
700	704	1067	1546
750	704	1067	1546

Model 337

Non-code[1] and ASME Section VIII Air (English, SCFM)

Set Pressure (psig)	Valve Inlet and Outlet Size 2"	2½"	3"
1	240	364	527
5	531	805	1166
10	741	1124	1628
15	948	1436	2081
20	1092	1656	2399
25	1237	1875	2718
30	1382	2095	3036
35	1542	2337	3386
40	1701	2578	3736
45	1860	2820	4086
50	2020	3061	4436
55	2179	3303	4786
60	2338	3544	5136

Note

1. No code stamp or 'NB' on nameplate below 15 psig set.

Non-code[1] and ASME Section VIII Air [Metric, Nm³/h]

Set Pressure [barg]	Valve Inlet and Outlet Size 50 mm	63 mm	80 mm
0.5	1049	1589	2303
1.0	1457	2208	3200
1.5	1888	2861	4147
2.0	2235	3387	4910
2.5	2613	3959	5739
3.0	2995	4538	6579
3.5	3377	5117	7418
4.0	3760	5696	8258

Note

1. No code stamp or 'NB' on nameplate below 1.1 barg set.

Models 215V and 337

Model Number/Order Guide

Model Number Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Example	0	3	3	7	—	H	0	1	A	K	E	0	0	0	2

Model
~~215V~~
0337

Inlet Size
H - 2-inch [50.8 mm]
~~J - 2½ inch [63.5 mm]~~
K - 3-inch [76.2 mm]

Variation (01 through 99)
01 - Bronze Disc and Nozzle
~~03 - SS Disc and Nozzle~~
60 - BSP Connections

Design Revision
Indicates non-interchangeable revision. Current Design is at Revision 'A'

Valve Service
K - Air ASME Section VIII (Model 337 only)
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N - Non-code Air/Gas (Model 337 only)

Spring Material
E - SS Type 316
~~M - SS (26 psi thru 60 psi set) Type 17-7~~

Set Pressure
Model 337, 1 psig [0.7 barg] (0001) through 60 psig [4.1 barg] (0060)
Model 215V, 2-inch HG [68 mbarg] (0002) through 29-inch HG [982 mbarg] (0029) vacuum

Facility Phone: 828-669-3700

tyco / Valves & Controls

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KUNKLE PRESSURE RELIEF VALVES

Installation and Operating Instructions

Pre-Installation Handling

This pressure relief valve is designed to protect equipment from overpressure. The valve should be handled with care, not subjected to heavy shock loads, and protected to prevent contamination from getting inside. It should be installed correctly per A.S.M.E. Boiler & Pressure Vessel Code requirements. Failure to do so could result in property damage or serious injury to personnel. When hoisting the valve into position for installation, care should be exercised so that lifting straps do not contact the valve lift lever.

Installation

Always wear proper safety equipment, including safety glasses and ear protection.

1. Mount the valve in a vertical position so that the valve body is self-draining. If a body drain port is provided, make sure it is open when required by the ASME code. Do not plug any bonnet vent openings. The inlet piping should be as short as possible, with no elbows, and equal to or greater than the size of the pressure relief valve inlet connection. This will help to limit the inlet pressure drop to 3% or less when the valve is relieving.

2. When discharge piping is connected to valve outlet, make sure it is self draining if a body drain port is not used. The valve should not be connected to any discharge pipe that contains pressure before the valve opens or to any pipe where the pressure build-up is greater than 10% of the set pressure when the valve is open and relieving.

   Discharge piping, other than a short tailpipe, must be supported. For steam service, a drip pan elbow or flexible connection between the valve and the pipe should be used to prevent excessive pipe stress, due to thermal expansion, from being imposed on the valve body.

3. For threaded valves, to prevent sealing compound from entering and damaging the valve, apply a small amount of pipe thread sealing compound to external threads only. Do not put any sealing compound on the first thread or on any internal threads. To do so may cause the sealing compound to enter the valve and cause seat leakage.

   Do not use the valve body or bonnet for installing the valve in threaded connections. Use the wrench flats provided to tighten the valve to the connecting pipe, and do not overtighten. To do so may cause valve leakage.

4. For flanged valves, use new gaskets and tighten the mounting studs evenly.

Operation

1. Maintain a system operating pressure at least 5 psig or 10% below the set pressure of the valve, whichever is greater. Operating too close to the valve set pressure will cause seat leakage and will shorten the time between valve maintenance.

2. Do not use the safety valve as a control valve to regulate system operating pressure. Excessive operation will cause the seat to leak and will require more frequent valve maintenance.

3. ASME Section I and VIII valves equipped with lift levers are designed to be operated only when the system pressure is 75% of set pressure or greater. ASME Section IV valves may be operated at any set pressure. When hand operating the valve, hold it open long enough to purge any foreign matter from the seat area. If a cable or wire is attached to the lift lever for remote actuation, make sure the direction of pull is the same as it would be if the lever were pulled directly by hand.

Maintenance

Maintenance should be performed on a regular basis. An initial inspection interval of 12 months is recommended. Depending on the service conditions and the condition of the valve, the inspection interval may be decreased or increased. Use only Kunkle parts for repair. Depending on the local jurisdictional requirements where the valve is installed, repairs may have to be made by a repair facility holding a VR stamp.

WARNING!

Removal of the seal wires or any attempt to adjust, repair or modify this product by non-qualified or non-authorized persons voids the product guarantee and may cause serious damage to equipment, personal injury, and death. Kunkle Valve is not liable for any damage resulting from misuse or misapplication of its products.

Kunkle Valve Division

Rev B 01/14/2002

Phone: 828-669-5515 953 Old US 70, Black Mountain, NC 28711 Fax: 828-669-4017

SECTION - 3

Heat Exchanger

AEV 1000

Air Ventilator

Suitable for temperate climates where balanced ventilation is needed, an Air Exchanger Ventilator (AEV 1000) is designed to provide fresh air into a building while exhausting an equal amount of stale air. During the winter months, the incoming cold fresh air is warmed by mixing it with return air before it is supplied to the home. During summer months when the indoor space is air conditioned, the AEV will help in cooling the incoming fresh air with the stale air that is being exhausted.

Features

- Washable synthetic filter
- Unit can be installed in any position
- External three position (Low/Standby/Medium
- Weighs 22lbs (10 Kg)

Optional controls

- MDEH1 – Dehumidistat

Specifications

- Duct size – 5" (127 mm)
- Voltage/Phase – 120/1
- Power rated – 81 W
- Amp – 0.7 A
- Average airflow – 68 cfm (32 L/s)
  @ 0.2" P_S (50 Pa)

Fans

Two (2) factory-balanced fans with backward curved blades. Motors come with permanently lubricated, sealed ball-bearings to guarantee long life and maintenance-free operation.

Serviceability

Filter can be easily serviced through access door located on front of the cabinet. Electrical box, with its panel located on the outside of the unit, can also be easily accessed.

Case

22 gauge galvanized steel. Baked powder coated paint.

Insulation

Cabinet is fully insulated with 1" (25 mm) high density expanded polystyrene.

Filters

Washable Synthetic Filter, 11.75" (298.5mm) x 12.88" (327.2mm) x 0.625" (15.88mm).

Controls

External three (3) position (Low/Stand By/Medium) rocker switch that will offer continuous ventilation. Fantech offers a variety of external controls. (see accessories)

Installation

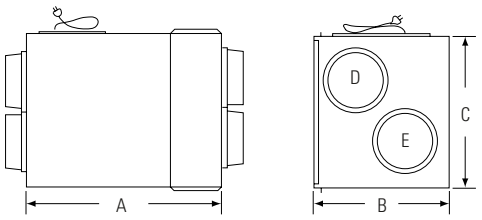
Unit is typically hung by using the installation kit supplied with unit. Mounting bolts provided on top four (4) corners of unit. Unit can also be hung in the basement or attic. (see illustrations on back page)

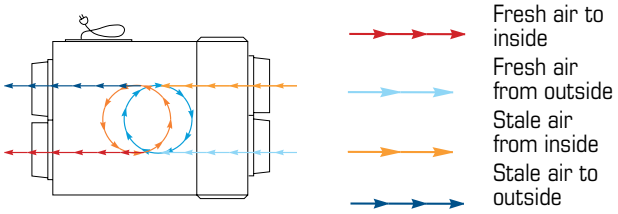
Warranty

7 year on motors, and 5 year on parts.

fantech

Dimensions & Airflow

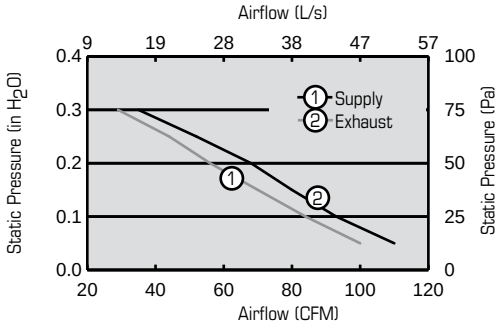




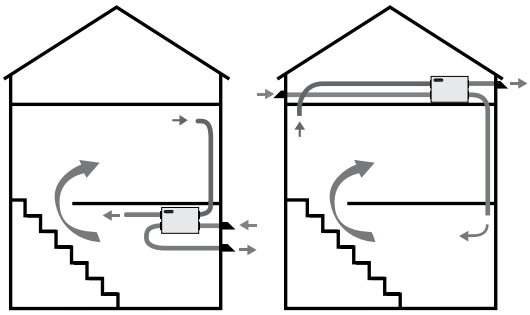
Model	A		B		C		D		E	
	in	mm	in	mm	in	mm	in	mm	in	mm
AEV 1000	18 3/16	457	12 1/2	318	14	356	5	127	5	127

Ventilation Performance

in. wg. (Pa)	0.1 (25)	0.2 (50)	0.3 (75)
	cfm (L/s)	cfm (L/s)	cfm (L/s)
Supply airflow	93 (44)	68 (32)	35 (17)
Exhaust airflow	84 (40)	56 (26)	29 (14)



Installation



Requirements and standards

- Complies with the CSA C22.2 no. 113 Standard applicable to fans and ventilators
- Complies with the CSA F326 requirements regulating the installation of Residential Mechanical Ventilation Systems

Contacts

Submitted by: Date:
Quantity: Model: Project #:
Comments:
Location:
Architect:
Engineer: Contractor:

Distributed by:

United States 10048 Industrial Blvd. • Lenexa, KS 66215 • 1.800.747.1762 • www.fantech.net
Canada 50 Kanalflakt Way • Bouctouche, NB E4S 3M5 • 1.800.565.3548 • www.fantech.net

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Fantech
Your Ventilation Solutions Company

AEV Series
Air Exchange Ventilator

IMPORTANT - PLEASE READ THIS MANUAL BEFORE INSTALLING UNIT

CAUTION - Before installation, careful consideration must be given to how this system will operate if connected to any other piece of mechanical equipement, i.e. a forced air furnace or air handler, operating at a higher static. After installation, the compatibility of the two pieces of equipment must be confirmed by measuring the airflow's of the Air Exchange Ventilator by using the balancing procedure found in this manual.
It is always important to assess how the operation of any AEV may interact with vented combustion equipment (i.e. Gas Furnaces, Oil Furnaces, Wood Stoves, etc.).

NEVER - install a ventilator in a situation where its normal operation, lack of operation or partial failure may result in the backdrafting or improper functioning of vented combustion equipment!!!

Your ventilation system should be installed in conformance with the appropriate provincial or state requirements or in the absence of such requirements with the current edition of the National Building Code, and / or ASHRAE's " good Engineering Pratice".

AEV Models

AEV 1000

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

The Best Limited Warranty in the Business

- The motors found in all Fantech AEV's require no lubrication, and are factory balanced to prevent vibration and promote silent operation.
- The limited warranty covers normal use. It does not apply to any defects, malfunctions or failures as a result of improper installation, abuse, mishandling, misapplication, fortuitous occurrence or any other circumstances outside Fantech's control.
- Inappropriate installation or maintenance may result in the cancellation of the warranty.
- Any unauthorized work will result in the cancellation of the warranty.
- Fantech is not responsible for any incidental or consequential damages incurred in the use of the ventilation system.
- Fantech is not responsible for providing an authorized service centre near the purchaser or in the general area.
- Fantech reserves the right to supply refurbished parts as replacements.
- Transportation, removal and installation fees are the responsibility of the purchaser.
- The purchaser is responsible to adhering to all codes in effect in his area.
- The warranty is limited to 5 years on parts and 7 years on the motor from the date of purchase, including parts replaced during this time period. If there is no proof of purchase available, the date associated with the serial number will be used for the beginning of the warranty period.

** This warranty is the exclusive and only warranty in effect relative to the ventilation system and all other warranties either expressed or implied are invalid. Please fill out the warranty registration and return it within two weeks of purchase or the warranty will be voided.*

TABLE OF CONTENTS

Sizining (Example) for maximum airflow normally required.

AEV's are typicaly sized to be able to ventilate the whole house at a maximum of 1/3 of an air change per hour. To calculate this simply take the square footage of the home (including basement)
multiply by the height of the ceiling to get cubic volume, and then multiply that by .005.

Example:		
	SQFT of House	1100
	Basement	1100
	Total SQFT	2200
	Height of ceiling	x 8
	Cubic volume	17600
		x .005
	Maximum airflow required (CFM)	88

* Always consult your local code for sizing requirements in your area.

Room classification	Number of rooms	CFM (L/s)	CFM Required
Master bedroom		x 20 cfm (10 l/s)	=
Basement	yes or no	if yes add 20 cfm / 10 l/s if no = 0	=
Bedrooms		x 10 cfm (5 l/s)	=
Living room		x 10 cfm (5 l/s)	=
Others		x 10 cfm (5 l/s)	=
Kitchen		x 10 cfm (5 l/s)	=
Bathroom		x 10 cfm (5 l/s)	=
Laundry room		x 10 cfm (5 l/s)	=
Utility room		x 10 cfm (5 l/s)	=

Total ventilation Requirements (add last column) **=**

1 cfm = 0.47189 l/s
1 l/s = 3.6 m³/hr

TECHNICAL DATA

Components

CASE - 22 gauge galvanized steel with powder coat paint, lined with strong top quality insulation.

FILTER - Synthetic high quality filter for better indoor air quality and clean air.

UNIT CONTROLS - Case mounted rocker switches provide the following functions. ON/OFF switch is to engage the operations of the ventilation system. At OFF position, the system can still achieve high speed from the remote dehumidistat or optional timer switch. LOW/MED switch is to control the continuous ventilation mode. At LOW speed, the system will be operating at its lowest ventilation requirement. At MED speed, the system will operate to meet building codes requirements according to sizing and design conditions.

REMOTE OVERRIDE -24 volts (low voltage) remote switching circuit for high speed operation to reduce the humidity level in the dwelling. This is archieved by a dehumidistat, an optional timer switch or any indoor air quality (IAQ) remote sensor

BLOWERS
- The motors are factory-balanced to prevent vibrations, providing greater comfort without noise pollution.
  -Fans equipped with motors of insulation class "B"
- The motors are completely sealed , keeping out moisture, dust and lint.
- The motors feature maintance-free bearings and are the most dependable and efficient on the market.
- Built-in thermocontact prevents overheating
- Increased corrision protection

AEV Series Performance Data

Model	Airflow Cap. L/s (cfm)		
	High	Med	Low
AEV 1000	49 (104)	38 (60)	20 (42)

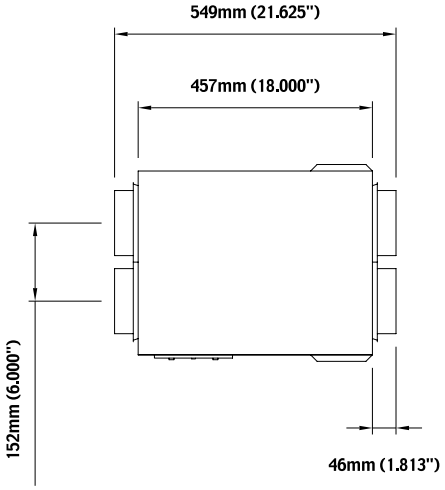
AEV Series Electrical Data

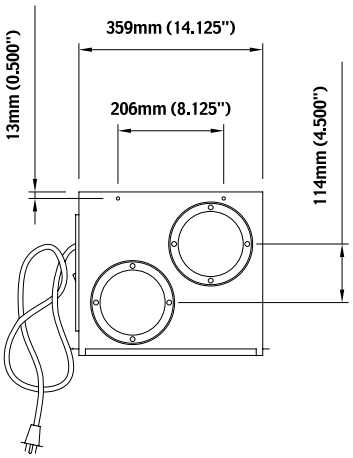
Model	Volts	Amp Rating
AEV 1000	115 V	0.6 A

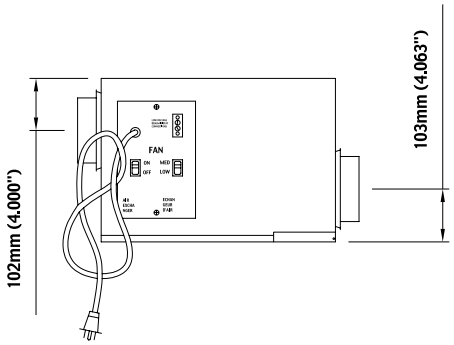
All of the AEV models are 120V unless specified otherwise.

C US

Dimensions







OPERATION

An Air Exchanger Ventilator (AEV) is designed to provide fresh air into a building while exhausting an equal amount of stale air. During the winter months, the incoming cold fresh air is warmed by mixing it with return air before it is supplied to the home. During summer months when the indoor space is air conditioned, the AEV will help in cooling the incoming fresh air with the stale air that is being exhausted.

Fantech AEV's are designed to run continuous or on intermittent, giving the homeowner complete control over their air quality. Continuous low speed ventilation is recommended, which will help eliminate carbon dioxide, voc's and other gases as well as freshen up the home. Intermittent high speed ventilation can be obtained through a variety of optional remote controls found in this manual (page 3). Below are some examples of seasonal operation of an AEV.

Winter:
Humidity control is very important during the winter months. This is when problems will be most apparent since condensation on the windows will often occur. The colder the outside temperature, the greater the risk of condensation in the home. The average relative humidity should be maintained between (30-60) to avoid condensation. Low speed continuous ventilation with high speed override is recommended.

Spring:
Temperatures are more moderate and become warmer each day. To keep the humidity and temperature uniform, set the dehumidistat higher and the switch on the AEV to standby.

Summer:
The air is sometimes hot and humid. To stop the warm humid air from entering, set the dehumidistat at its highest level and the switch on the AEV to standby.

Fall:
Rain and rapid temperature changes make it difficult to control the internal humidity level and may result in condensation on the windows. A remote dehumidistat may help give greater control over the inside environment.

NOTE: Some products may not be exactly as illustrated in the Installation, Operation and Maintenance Manual.

Fantech Inc. reserves the right to modify, at any time and without notice, any or all of its products' features, designs, components and specifications, to maintain their technological leadership position.

OPTIONAL REMOTE CONTROLS

PRACTICAL TIPS

To avoid window condensation:

- *It is not necessary to change the humidity control every day. Monitor the average weekly temperature or experiment with various settings until you find a level that is comfortable for you. Adjust the control when needed.*

Dehumidistat I

The wall mount dehumidistat monitors the humidity level in the area it is installed. When the humidity level rises above the desired set-point, the AEV will activate to high speed/override mode. Once the humidity level returns to desired condition, the unit will return to the normal mode.
2 low voltage wires required for operation.

Air Quality Sensor

The wall mount Air Quality Sensor (AQS) monitors indoor air quality and activates the override mode when carbon monoxide, formaldehyde, benzene, volatile organic compounds and other pollutants are detected. The unit will then return to normal mode once the air pollutants are reduced to a pre-determined lower level.
Three low voltage wires are required for operation with transformer

* This control is not a warning device.

* All controls are low voltage. 18 to 24 gauge wire is recommended.

INSTALLATION

PRACTICAL TIPS

- *Install the unit close to the outside wall on which the supply and exhaust hoods will be mounted.*
- *Have a nearby power supply 120 Volts, 60 Hz.*
- *Have the possibility of mounting the unit to supporting beams.*
- *Mount the unit as level as possible.*
- *Have a certain amount of heat around the unit (attic installation is not recommended).*
- *Minimize any noise level that would be created by the unit in the living area.*
- *Have access for future maintenance.*

LOCATION

The Air Exchanger must be located in a heated space where it will be possible to conveniently service the unit. Typically the AEV would be located in the mechanical room or an area close to the outside wall where the weatherhoods will be mounted. If a basement area is not convenient or does not exist, a utility or laundry room may be used.
Attic installations are not normally recommended due to:

- the complexity of work to install
- freezing conditions in the attic
- difficulty of access for service and cleaning

Connecting appliances to the AEV It is not recommended, incuding:

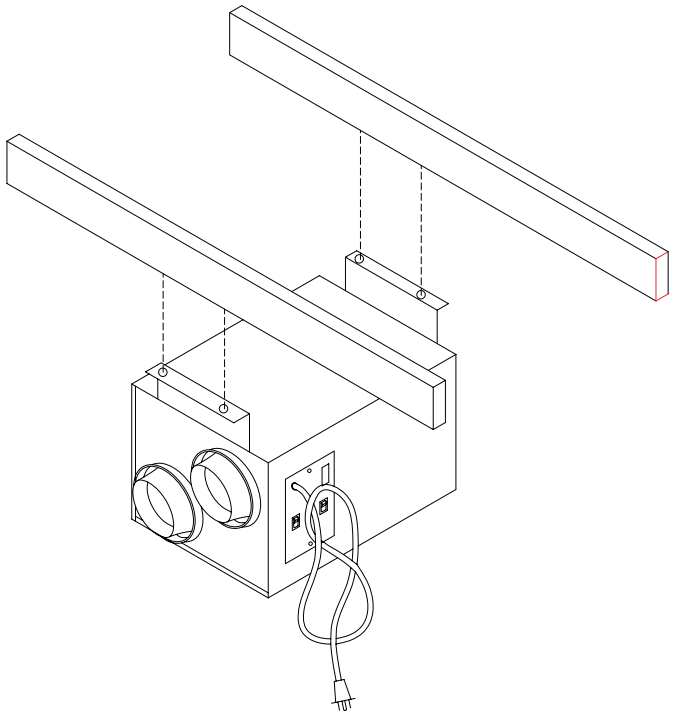
- clothes dryer
- range top
- stovetop fan
- central vacuum system

These appliance may cause lint, dust or grease to collect in the AEV , damaging the unit.
NOTE: Connecting any of these type of appliances to the AEV will invalidate your warranty

MOUNTING

• Although we recommend installing the unit as shown, the flexibility offered by our centrifugal external rotor motor allows for the unit to be installed in any position.

• Use #10 wood screws plus vibration insulator grommets supplied with the unit.



INSTALLING DUCTS GOING TO / FROM OUTSIDE

A well designed and installed ducting system will allow the AEV to operate at its maximum efficiency. Always try to keep duct runs as short and straight as possible.
See Installation Diagrams for installation examples.

PRACTICAL TIPS

- *Decide where your intake and exhaust hoods will be located.*

Locating the Intake Weatherhood

- *Should be located upstream (if there are prevailing winds) from the exhaust outlet*
- *At least 6' (2m) from the exhaust weatherhood*
- *At least 6' (2m) away from dryer vents and furnace exhaust (medium or high efficiency furnaces)*
- *A minimum of at least 6' (2m) from driveways, oil fill pipers, gas meters, or garbage containers*
- *At least 18" (457mm) above the ground, or above the depth of expected snow accumulation*
- *At least 3' (1m) from the corner of the building*
- *Do not locate in a garage, attic or crawl space*

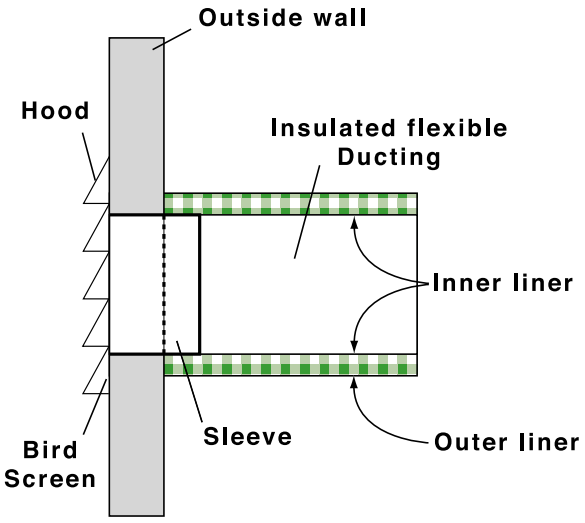
Locating the Exhaust Weatherhood

- *At least 6' (2m) from the ventilation air intake*
- *At least 18" (457mm) above ground or above the depth of expected snow accumulation*
- *At least 3' (1m) away from the corner of the building*
- *Not near a gas meter, electric meter or a walkway where fog or ice could create a hazard*
- *Not into a garage, workshop or other unheated space*

When installing the weatherhood, it's outside perimeter must be sealed with exterior caulking.

INSTALLING THE DUCTING TO THE WEATHERHOODS

The inner liner of the flexible insulated duct must be clamped to the sleeve of the weatherhoods (as close to the outside as possible) and to the appropriate port on the AEV. The insulation should remain full and not be squished. The outer liner, which acts as a vapor barrier must be completly sealed to outer wall and the AEV using tape and or caulking. A good bead of high quality caulking (preferably acoustical sealant) will seal the inner flexible duct to both the AEV port and the weatherhood prior to clamping.
To minimize air flow restriction, the flexible insulated duct that connects the two outside weatherhoods to the AEV should be stretched tightly and be as short as possible. Twisting of folding the duct will severely restrict air flow.



1 Using the collar of the outside hood, outline the intake & exhaust holes to be cut. The holes should be slightly larger than the collar to allow for the thickness of the insulated flexible duct. Cut a hole for both the intake and exhaust hoods.

2 Pull the insulated flexible duct through the opening until it is well extended and straight. Slide the duct's inner vinyl sleeve over the hood collar and secure, pull the insulation over the duct and then the vapour barrier over the sleeve and secure with duct tape.

3 Push the hood into the opening. Attach the hood to the outside wall with mounting screws. Repeat the installation procedure for both the Supply and Exhaust hood.

4 Using a caulking gun, seal around both hoods to prevent any leaks.

INSTALLING DUCTS TO / FROM INSIDE (CON'T)

Exhaust Air ducting

The stale air exhaust system is used to draw air from the points in the house where the worst air quality problems occur. It is recommended that return air ducts be installed in the bathroom, kitchen, and laundry room. Additional return air ducts from strategic locations (i.e. greenhouse, atrium, swimming pool, sauna, etc.) may be installed. The furnace return duct may be also used to exhaust from. In this method, the exhaust air is not ducted back from bathrooms, kitchens, etc to the AEV with "dedicated lines".

This method has become popular and provides good ventilation when installed in accordance with the instructions. The furnace blower must be running when the AEV is operating for this method to be effective.

PRACTICAL TIPS

- *For new construction, the rigid ducts are run in the walls.*
- *Choose the loction your Supply and Exhaust Fantech grille {MGE (metal) or PGE (plastic)}s. The Supply grilles should be located in every habitable room and the Exhaust Grilles should be located in the wet rooms.*
- *A piece of flexible ducting should be placed between the Suppy Air In and Out collar of the AEV and the rigid ducting to absorb any noise or vibrations.*
- *For proper network of ducting, see **TYPES OF INSTALLATIONS.***
- *The grilles are to be installed on the ceiling or on the wall 6" (152 mm) to 12" (305 mm) from the ceiling.*

Dedicated installation for existing home - non force air heating / cooling system.

1 Begin with the duct collar marked "Exhaust Air In". Slide a short piece (12") of flexible duct over the duct collar. Using duct tape, tape the flexible duct to the collar. Run the flexible ducting to the main rigid duct trunk line, which connects to the remainder of the ducts going to and from rooms in the house.. Repeat the steps for the "Supply Air Out" on the side of the AEV.

2 Working from a closet, attic or inside your joist wall, run the length of ducting required for the proper grille location and cut a hole in the gyprock. Fasten the mounting collar (optional) to the ducting and fasten the collar to the wall or ceiling with screws.

3 The Fantech grille {MGE (metal) or PGE (plastic)} airflow can be adjusted by rotating the inside unit. It is recommended that the grilles be completely opened at first and then adjusted later as needed.

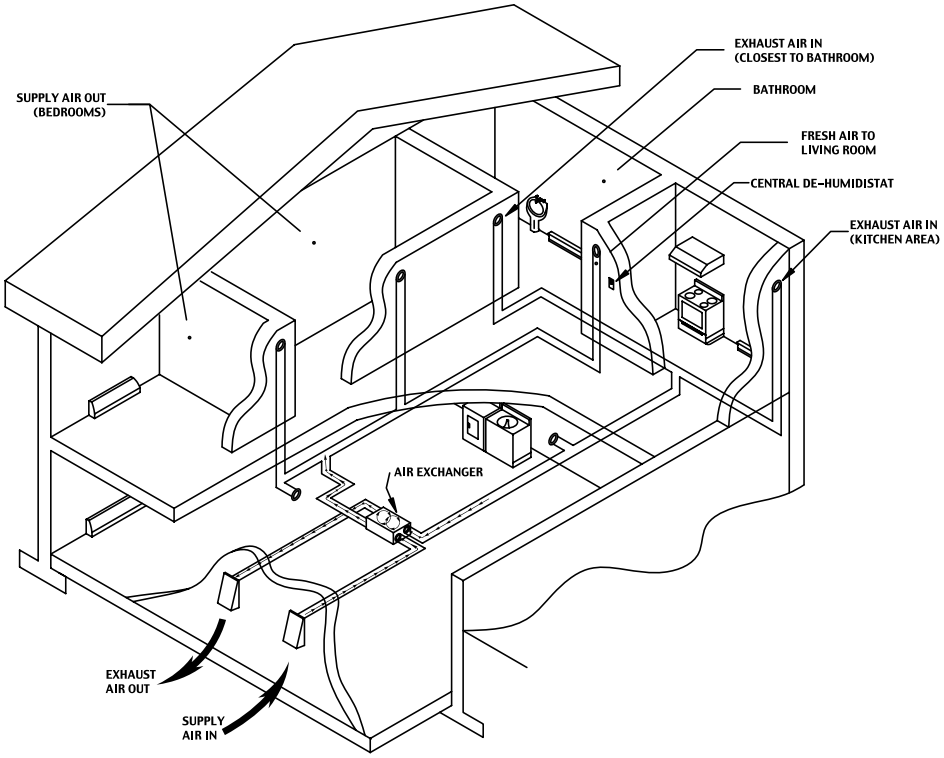
4 Push the Fantech grille {MGE (metal) or PGE (plastic)} into the optional mounting collar or directly into installed elbow.

INSTALLATION (CON'T)

Radiant, Hydronic and Electric Baseboard Heating

- This diagram shows the installation of your unit with radiant hydronic or baseboard heating.
  As shown, the stale air is extracted from the rooms with high humidity levels, and the fresh air is delivered in the living areas. In this case, a complete ducting system for ventilation must be installed.

PRACTICAL TIPS



Follow local building codes

AIR FLOW BALANCING

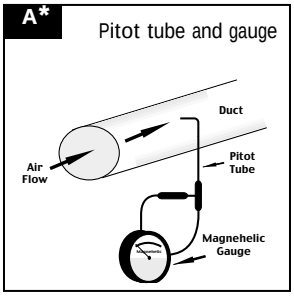
PRACTICAL TIPS

- *If the unit's airflows are not properly balanced...*

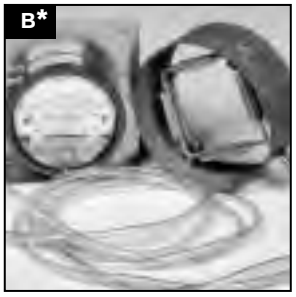
- *The unit may not operate at it's maximum efficiency.*

- *The unit's use could cause negative or positive pressure in your home causing cold air to enter or other combustible equipment to backdraft.*

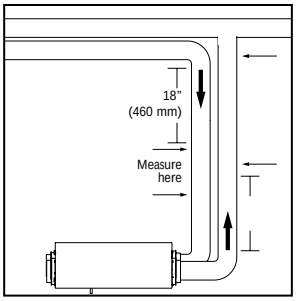
- The balancing procedure consists of measuring the exhaust air leaving the system and the supply air entering the system and ensuring that these two are equal. A deviation of 10% or less is acceptable. In such cases, it is recommended to have a greater amount of exhaust air than supply air as so to increase the supply air's temperature.



A The duct's airflow velocity is measured with a magnehelic gauge and a pitot tube. See "Pitot Tube Balancing Procedure" next page.



B This airflow measuring station reads the airflow by being connected to the ducting.



- To avoid airflow turbulence and incorrect readings, the airflow velocity should be measured on steel ducting a minimum of 18" (457 mm) from the unit or elbow and before any transition.

AIR FLOW BALANCING (CONT')

1 For this flow measuring station, cut the duct and place the flow measuring station between each station. Make sure that the flow measuring station's air direction arrow points in the direction of the airflow. Secure the flow measuring station with duct tape.

2 Before taking the reading, make sure that the magnehelic gauge is level and at 0. Refer to the flow measuring station's chart to determine your unit's airflow velocity.

3 The airflow is regulated by a balancing damper located inside the collar of the AEV. Adjust the "Supply Air Out" damper until you reach the desired velocity. Follow the previous steps to adjust the "Exhaust Air Out" damper.

PITOT TUBE BALANCING PROCEDURE

PITOT TUBE

BALANCING PROCEDURE

The following is a method of field balancing an AEV using a Pitot tube, advantageous in situations when flow stations are not installed in the ductwork. Procedure should be performed with the AEV on high speed.

The first step is to operate all mechanical systems on high speed, which have an influence on the ventilation system, i.e. the AEV itself and the forced air furnace or air handler if applicable. This will provide the maximum pressure that the AEV will need to overcome, and allow for a more accurate balance of the unit.

Drill a small hole in the duct (about 3/16), three feet downstream of any elbows or bends, and one foot upstream of any elbows or bends.
These are recommended distances but the actual installation may limit the amount of straight duct.
The Pitot tube should be connected to a magnehelic gauge or other manometer capable of reading from 0 to 0.25 in (0-62 Pa) of water, preferably to 3 digits of resolution. The tube coming out of the top of the pitot is connected to the high pressure side of the gauge. The tube coming out of the side of the pitot is connected to the low pressure or reference side of the gauge.

Insert the Pitot tube into the duct; pointing the tip into the airflow. For general balancing it is suffivient to move the pitot tube around in the duct and take an average or typical reading. Repeat this procedure in the other (supply or return) duct. Determine which duct has the highest airflow (highest reading on the gauge). Then damper that airflow back to match the lower reading from the other duct. The flows should now be balanced. Actual airflow can be determined from the gauge reading. The value read on the gauge is called the velocity pressure. The Pitot tube comes with a chart that will give the air flow velocity based on the velocity pressure indicated by the gauge. This velocity will be in either feet per minute or metres per second. To determine the actual airflow, the velocity is multiplied by the cross sectional areas of the duct being measured.

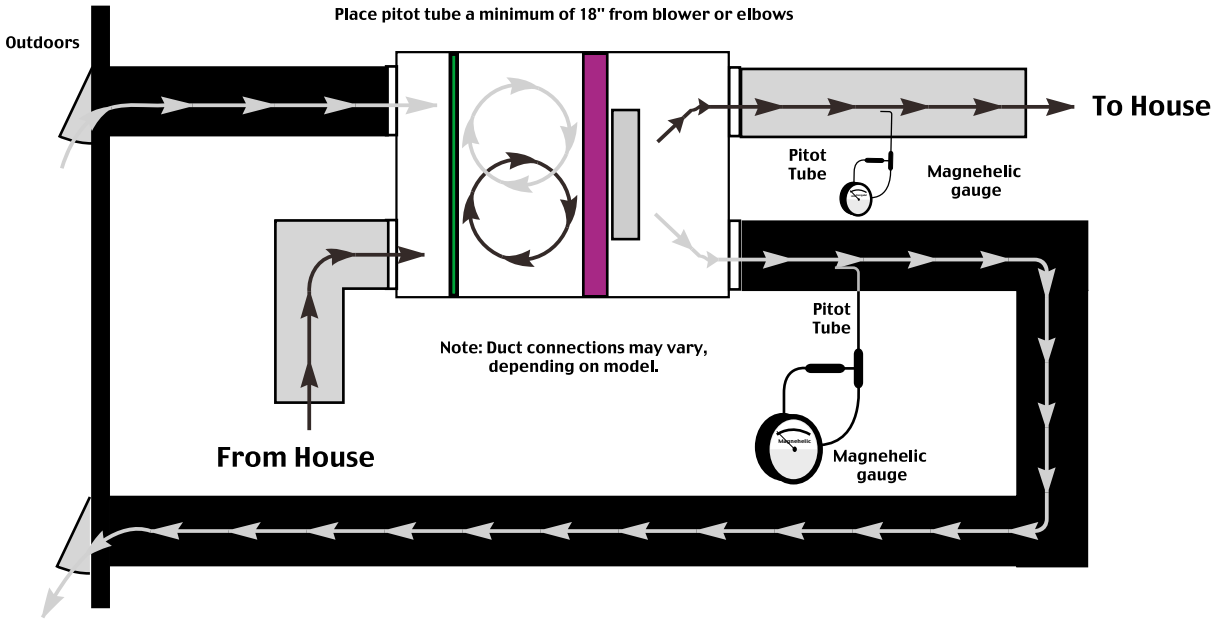
This is an example for determining the airflow in a 6" duct.
The Pitot tube reading was 0.025 inches of water.
From the chart, this is 640 feet per minute.
The 6" duct has cross sectional area of
= [3014x(6" 12)2 4
=0.2 squeare feet
The airflow is then:
640 ft./min.x0.2 square feet-128cfm

For your convenience, the cross sectional area of some common round duct is listed below:

DUCT DIAM. (inches)	CROSS SECTION AREA (sq ft.)
5	0.14
6	0.20
7	0.27

The accuracy of the air flow reading will be affected by how close to any elbows or bends the readings are taken. Accuracy can be increased by taking an average of multiple readings as outlined in the literature supplied with the Pitot tube.

PITOT TUBE BALANCING PROCEDURE (CONT')



* Pitot tube should be kept at least 12" away from fans elbows and dampers to ensure acurate reading.

MAINTENANCE

CAUTION **MAKE SURE UNIT IS UNPLUGGED BEFORE ATTEMPTING ANY MAINTENANCE WORK**

The following components should also be inspected regularly and well maintained.

PRACTICAL TIPS

- *To prevent electrical shock, check that the unit is unplugged before doing any repairs or maintenance.*
- *A yearly inspection is recommended to ensure the efficiency and trouble-free use of your system. Run through the system and verify the different operating modes.*

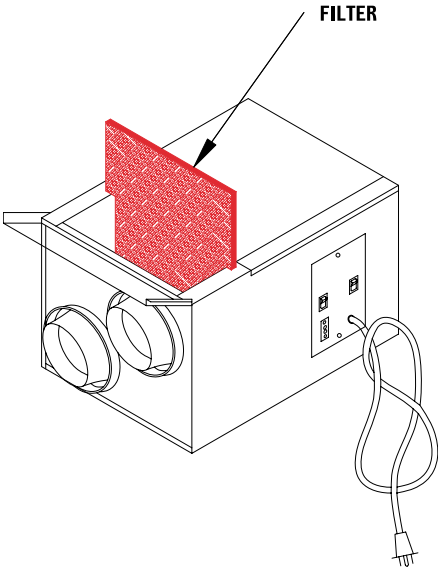
The motor - The motor are factory balanced and lubricated for life. They require no maintenance.

The unit - The inside of the unit should be vacuumed yearly. Be careful not to damage any of the mechanical components and electrical connections.

Outside hoods - The outside hoods need to be checked every season to make sure there are no leaves or insects blocking the airflow. Check regularly that there are no pollutants near the intake hood. Make sure they are clear of any snow accumulation during the winter months.

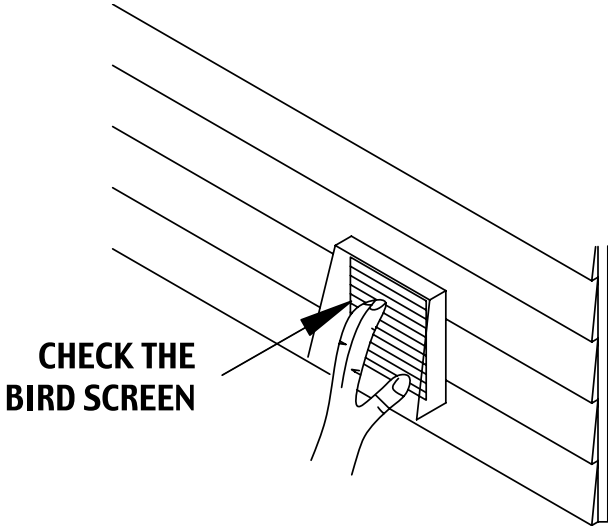
FILTER

The filter needs to be checked and cleaned every three months or when it appears dirty. To clean, remove the filter and vacuum. If the filter still appears dirty, it can be washed in warm sudsy water (mild detergent). Replace the filter if it becomes too soft after washing. The filter should be replaced yearly or when it can no longer be cleaned properly. You may have to change the synthetic filter after washing a few times.



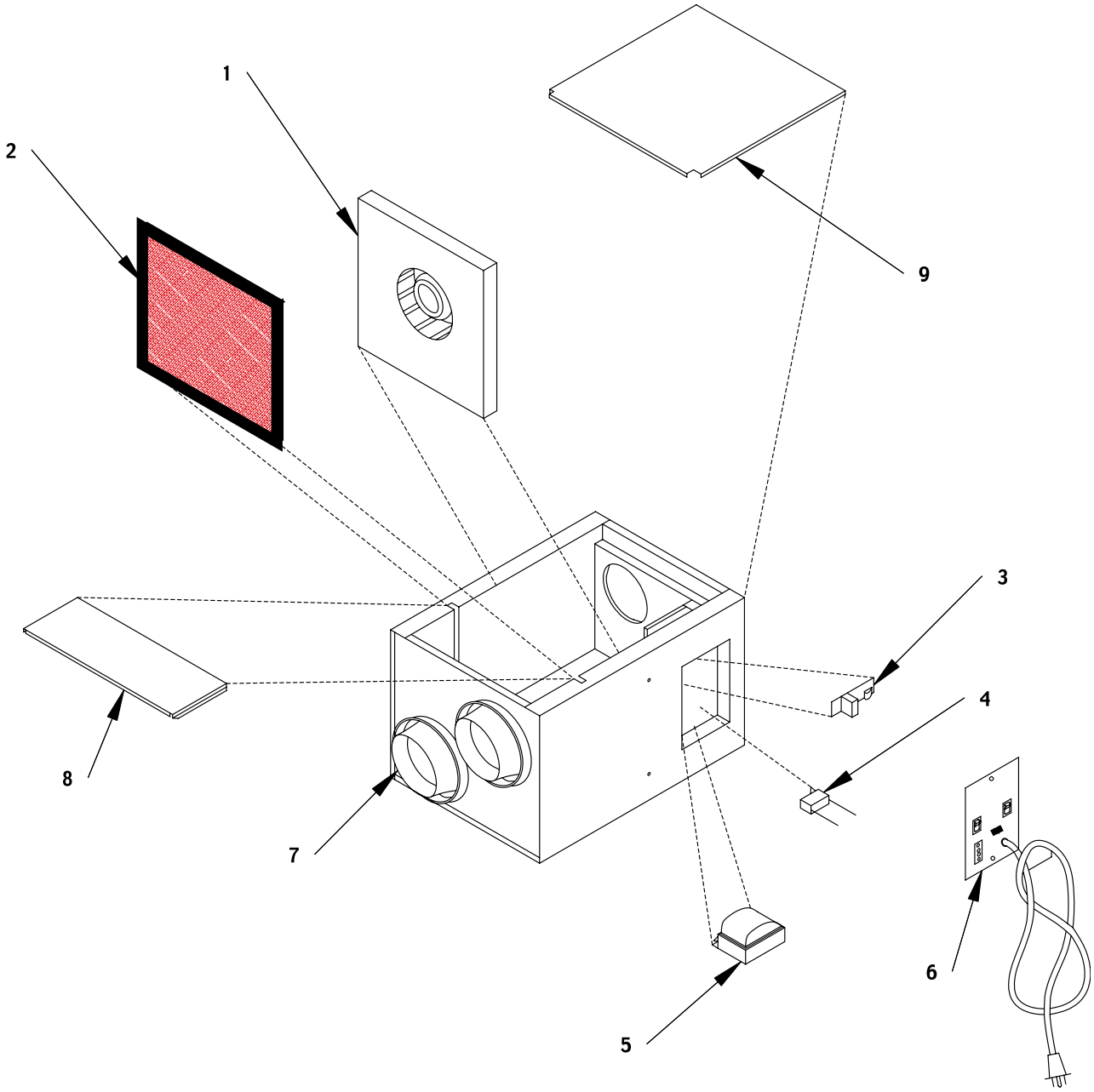
OUTSIDE HOODS

The outside hoods need to be checked every season to make sure there are no leaves or insects blocking the airflow. Check regularly that there are no pollutants near the intake hood. Make sure they are clear of any snow accumulation during the winter months.



NOTE: Some products may not be exactly as illustrated in Installation, Operation and Maintenance manual.

SERVICING



PARTS LIST

Description	Part #
1 Motorized Impeller	500000
2 Filter	017068
3 Override Relay Board	410150
4 Capacitor	410428
5 Auto-Transformer	410350
6 Control Panel	200422
7 5” Collar	530172
8 Filter Door	200426
9 Access Panel	203939

TROUBLESHOOTING

Problem	Causes	Solutions
Air is too dry	Dehumidistat control is set too low	Increase the desired level of humidity. Change ventilation mode from continuous mode to standby.
	AEV out of balance	Balance AEV
Air is too humid	Dehumidistat control is set too high	Reduce the desired level of humidity. Combine this step with use of continuous exchange mode.
	Sudden change in temperature	Wait until outside temperature stabilizes (winter). Heating will also improve situation.
	Storing too much wood for heating	Store a majority of your wood outside. Even dried, a cord of wood contains more than 20 gallons of water.
	Dryer vent exhaust is inside home	Arrange outside vent for dryer.
	Poor air circulating near windows	Open curtains or blinds. Bay or bow windows may require mechanical method.
	AEV out of balance	Balance AEV
	Basement door is closed	Open the door or install a grill on the door.
Persistent condensation on window	Improper adjustment of dehumidistat control	Reduce the desired level of humidity. Combine this with the use of continuous exchange mode.
	AEV out of balance	Balance AEV
Poor Air Flows	-1/4" (6mm) mesh on the outsid hoods is plugged -filter plugged -house grilles closed or blocked -dampers are close if installed -poor power supply at site -ductwork is restricting AEV -improper speed control setting -AEV airflow improperly balance	-clean exterior hoods or vents -remove and clean filter -check and open grilles -have electrician check supply voltage at house -check duct installation -increase the speed of the AEV. -have contractor balance AEV
Supply air feels cold	-poor location of supply grilles, the air-flow may irritate the occupant -outdoor temperature extremely cold	-locate the grilles high on the walls or under the baseboards, install ceiling mounted diffuser or grilles so as not to directly spill the supply air on the occupant (eg. Over a sofa) -turn down the AEV supply speed. A small duct heater (1kw) could be used to temper the supply air -placement of furniture or closed doors is restricting the movement of air in the home -if supply air is ducted into furnace return, the furnace fan may need to run continuously to distribute ventilation air comfortably
AEV and / or Ducts Frosting up	-AEV air flows are improperly balanced -malfunction of the AEV system	-Note: minimal frost build-up is expected -have HVAC contractor balance the AEV -Duct heaters
Condensation or Ice Build Up in Insulated Duct to the Outside	-incomplete vapour barrier around insulated duct -a hole or tear in outer duct covering	-tape and seal all joints -tape any holes or tears made in the outer duct covering -ensure that the vapour barrier is completely sealed.

Technical support hotline 1.800.565.3548

United States

1712 Northgate Blvd. • Sarasota, Fl. USA 34234
(T) 1.800.747.1762 • (F) 1.800.487.9915
(T) 1.941.309.6000 • (F) 1.941.309.6099

Ontario & Western Canada

10-6665 Tomken Road
Mississauga, Ontario
Canada L5T 2C4
(T) 1.800.407.6195 • (F) 1.800.407.8965
(T) 1.905.696.9235 • (F) 1.905.696.9236

Québec & Atlantic Provinces

50 Kanalflakt Way • Bouctouche, NB, Canada E4S 3M5
(T) 1.800.565.3548 • (F) 1.877.747.8116
(T) 1.506.743.9500 • (F) 1.506.743.9600

web: www.fantech.net
e-mail: info@fantech.net

Manufactured by:
Kanalflakt
ISO 9001

Article #: 301001
Rev Date: A-0212-E

SECTION - 4

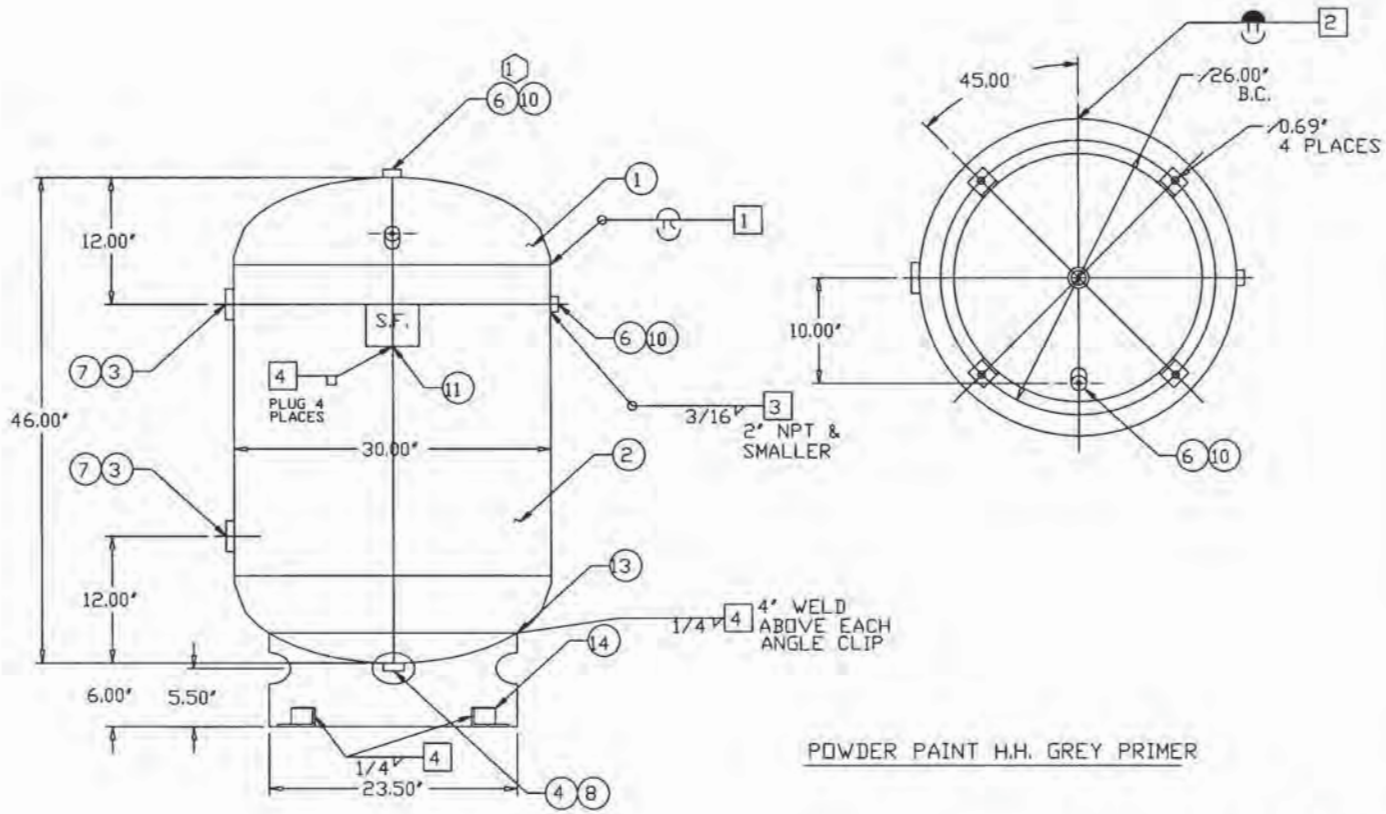
Moisture Separator

#2 .227 X 29-1/2" X 93-3/4"

#13 3/16" X 60 X 78" (7 TO 1)

SW

PW



POWDER PAINT H.H. GREY PRIMER

ITEM	P/N	DESCRIPTION	QTY
1	H30186J	30"OD 2:1 SE JOGGLE HEAD	2
2	R100015	227 ROLLED SHELL	1
3	F102002	2" RAD. O-RING NPT	2
4	F101000	1" SERIES 385 NPT	1
5			
6	F100250	1/4" SERIES 381 NPT	3
7	F502000	2" PLASTIC PLUG	2
8	F501000	1" PLASTIC PLUG	1
9			
10	F500250	1/4" PLASTIC PLUG	3
11	S100001	NAME PLATE	1
			1
13	S100164	3/16" BASE RING	1
14	R400001	1/4" X 2" X 2"X 2" LG	4

DESIGN & CALCULATIONS COMPLY WITH ASME CODE SECTION VIII, DIV. 1.
20..... EDITION
..... ADDENDA

ATTACHMENT WPS

3/16 & BELOW	A569 SFI-6
5/16 & ABOVE	A36 SFI-2-1
STRUCTURAL	A36 SFI-2-1
1/4	A635 SFI-3

WPS
1 SFI-1 SK 1
2 SFI-1 SK 2
3 SFI-2-1
4 SEE ATTACHMENT

NDE
1 MAGNETIC PARTICLE
2 SPOT X-RAY PER UW52
3 FULL X-RAY PER UW51
S SEAL WELDING REQUIRED

30" X 46" VERTICAL - AIR RECEIVER - 120 GALLONS

NO.	DATE	REVISION	ENG	QCM
1	11/20/02	1/4" NPT WAS 1" NPT		

HEAD THK: .186 MIN. C.A.: NONE MAT'L SA414-G EFF 85%
SHELL THK: .227 NOM. C.A.: NONE MAT'L SA455 EFF 70%

NAT'L BD. YES
STAMP: "U" STAMP
CRN: C6406.1C
REF: AIR ENERGY

MAWP 200 PSI AT 400 ° F
MDMT -20 °F AT 200 PSI
TEST: HYDRO AT 260 PSI
PNEU. AT 260 PSI

AIR ENERGY
XA10047 W/ NO TOP PLATE AND 1" NPT DRAIN)

ENG APP'L/DATE

QCM APP'L/DATE

FITTNGS - SA181-70
IMPACT TESTING NOT REQUIRED PER UG-20(f)

OAKVILLE,ONT. STEEL FAB ABINGDON,VA

DRAWN BY: LPS
DATE 7/18/02

P/N A12276

ACS INDUSTRIES, LP
Separations Technology Division

Customer:	Franklin
Contact:	Bill K
Quote Number:	
Date:	02/21/2007
Reference Number:	12324
Engineer:	TM

PROCESS	**CASE 1**
Gas/Liquid system	Air / Water
Temperature, °F	55
Pressure, in water, gauge	-65
Compressibility factor	1
Gas density, lb/ft³	0.0648
Gas viscosity, centipoise	0.0183
Gas flow rate, scfm	865
Liquid density, lb/ft³	62.36
Liquid viscosity, centipoise	1.214
Fouling	No

PAD/VANE DEFINITION	
Pad style	7CA
MistMaster®	No
Pad density	5.0
Wire diameter(s)	0.011
Surface area(s)	45
Percent voids	99
Material	Metal

PERFORMANCE	
% Collection Eff. @ 5 µm	88.59
10 µm	97.52
15 µm	98.55
20 µm	98.82
50 µm	99.12
Dry pressure drop, in-water	0.1108

GEOMETRY	
Pad/vane thickness, inch	6
Pad shape	Round
Actual Dimension 1, in*	20
Actual Dimension 2, in**	--
Actual Capacity factor	0.2513
Actual Velocity, fps	7.788
Actual Area, ft²	2.182
Optimum Capacity factor	0.3002
Optimum Velocity, fps	9.305
Optimum Area, ft²	1.826

* Dimension 1: Diameter (round, segment); Length (rectangle)
** Dimension 2: Width (rectangle); Segment width (segment)

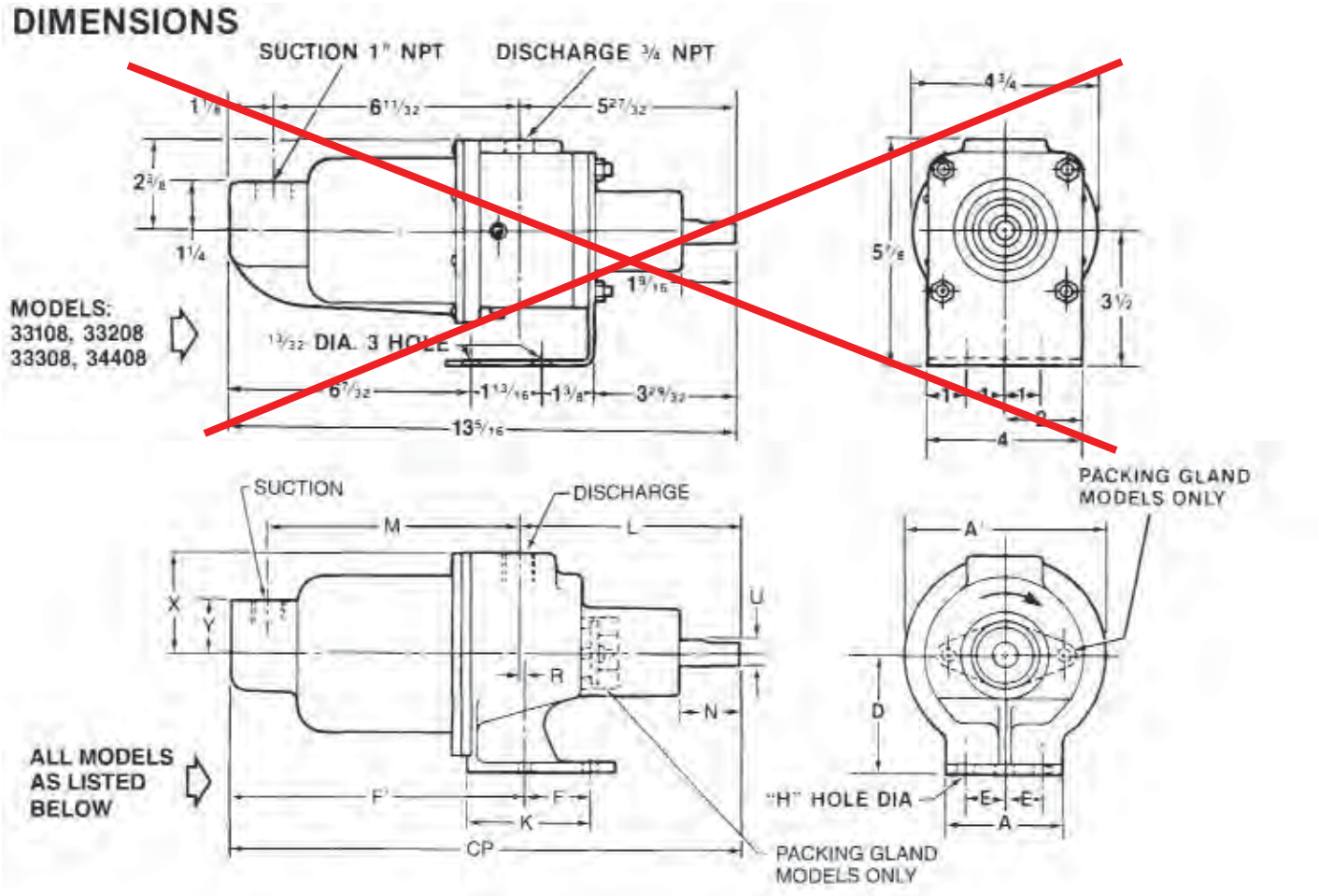
MOYNO
Always the Right Solution™

SPECIFICATION DATA

MOYNO® 500 PUMPS

300 SERIES
~~331, 332, 333,~~ 344, ~~350 AND 367~~ MODELS

DIMENSIONS

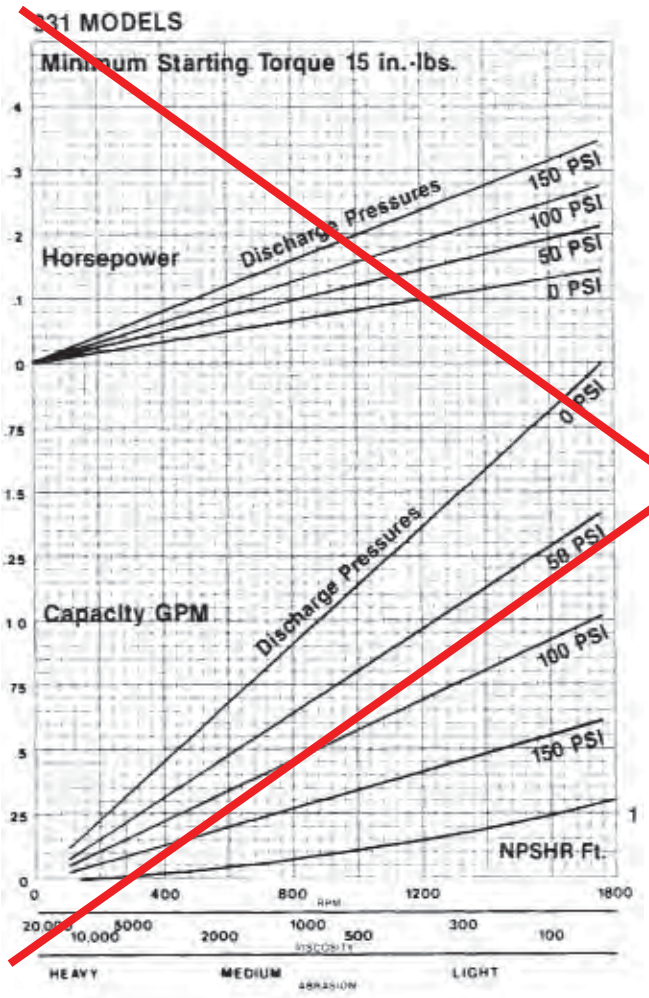


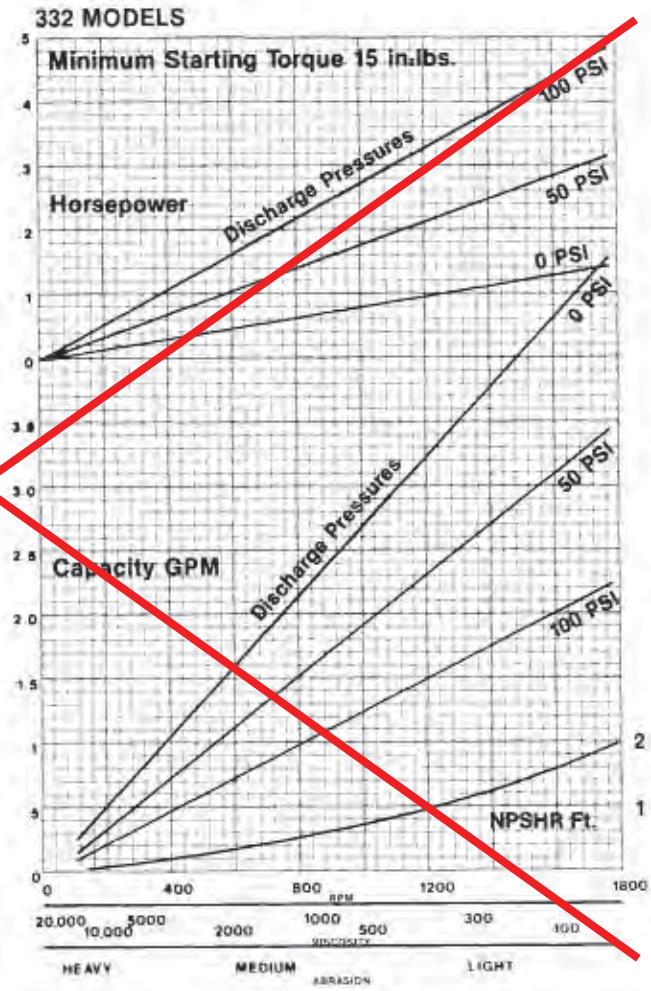
MODELS	CP	A	A[1]	D	E	F	F[1]	H	K	L	M	N	R	U	X	Y	SUCT (NPT)	DISCH (NPT)
~~33101, 33201~~ ~~33301, 33401~~ ~~33204, 33304~~ 34401, ~~34404~~	$12\frac{5}{8}$	$3\frac{1}{8}$	$4\frac{3}{4}$	$2\frac{3}{4}$	1	$1\frac{13}{16}$	$6\frac{15}{16}$	$\frac{13}{32}$	$3\frac{1}{32}$	$5\frac{11}{16}$	$6\frac{1}{16}$	$1\frac{7}{16}$	—	$\frac{5}{8}$	$2\frac{3}{8}$	$1\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{4}$

*Packing Gland Model

All dimensions are in inches. Specifications subject to change without notice.

~~331, 332, 333 and~~ 344 MODELS
PERFORMANCE (water at 70ºF)



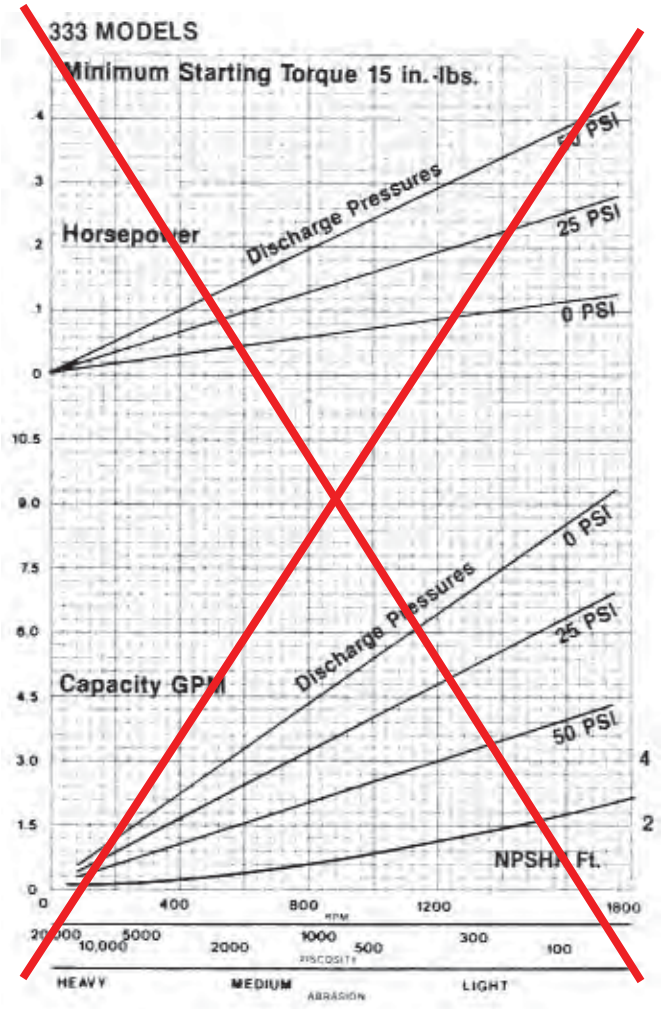


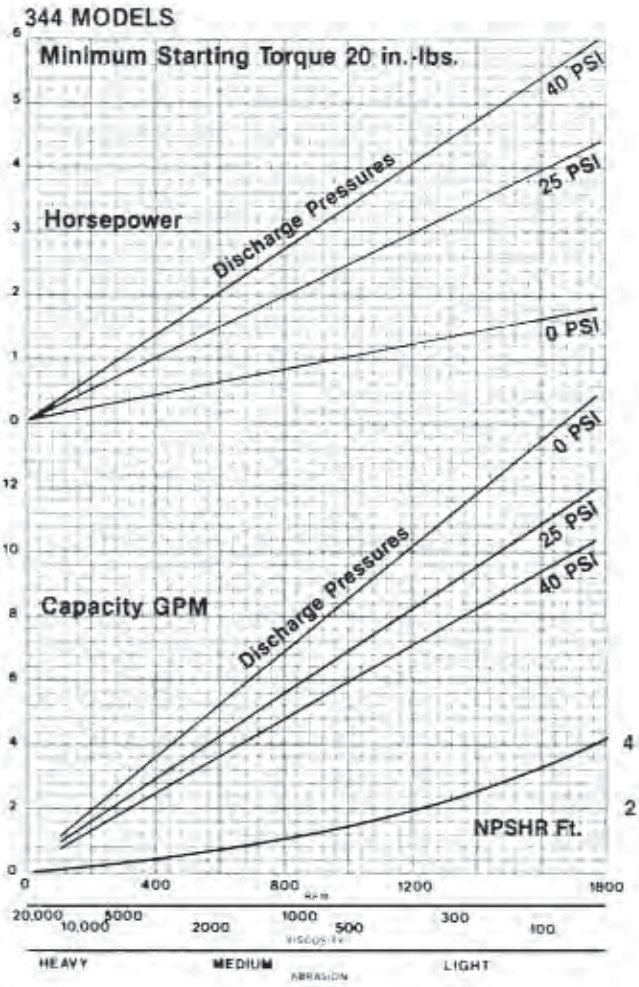
NOTE: For fluids with viscosity over 200 CP (1000 SSU), pump capacity is reduced by 20%.

MATERIALS OF CONSTRUCTION

COMPONENT	MODELS			
	~~33101, 33201~~ ~~33301~~, 34401	33104, 33204 ~~33304~~, 34404	33108, 33208 33308, 34408	*34411
Housing	Cast iron	316 SS	Nylon	Cast iron
Rotor	416 SS/CP	316 SS/CP	416 SS/CP	416 SS/CP
Stator	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)
Weight (lbs)	16	16	8	16

* Packing Gland Model
CP = Chrome plated





NOTE: For fluids with viscosity over 200 CP (1000 SSU), pump capacity is reduced by 20%.

SERVICE MANUAL

MOYNO® 500 PUMPS

300 SERIES
331, 332, 333, 344, 356 AND 367 MODELS

Mechanical Seal Models

Packing Gland Models

DESIGN FEATURES	MODELS				
	33101 34401 33201 35601 33301 36701	33104 34404 33204 35604 33304 36704	33108 33308 33208 34408	34411 35611	35613
Housing:	Cast Iron	AISI 316 SS	Nylon	Cast Iron	AISI 316 SS
Pump Rotor:	Chrome plated 416 SS	Chrome plated 316 SS	Chrome plated 416 SS	Chrome plated 416 SS	Chrome plated 316 SS
Pump Stator:	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)
Shaft:	416 SS	316 SS	416 SS	416 SS	316 SS
Flexible Joint:	Carbon steel/ NBR	316 SS/ NBR	Carbon steel/ NBR	Carbon steel/ NBR	316 SS/ NBR
Bearings:	Ball (sealed)	Ball (sealed)	Ball (sealed)	Ball (sealed)	Ball (sealed)
Mechanical Seal:	Carbon-ceramic	Carbon-ceramic	Carbon-ceramic	---	---
Packing:	---	---	---	Braided PTFE	Braided PTFE

Note: Alternate elastomers available. Refer to Repair/Conversion kit numbers, page 8.

INSTALLATION

Mounting Position. Pump may be mounted in any position. When mounting vertically, it is necessary to keep bearings above seals to prevent possible seal leakage into bearings.

Pre-Wetting. Prior to connecting pump, wet pump elements and mechanical seal or packing by adding fluid to be pumped into suction and discharge ports. Turn shaft over several times in a clockwise direction to work fluid into elements.

Piping. Piping to pump should be self-supporting to avoid excessive strain on pump housings. See Table 1 for suction and discharge port sizes of each pump model. Use pipe "dope" or tape to facilitate disassembly and to provide seal.

Drive. On belt driven units, adjust belt tension to point of non-slip. Do not overtighten.

On direct drive units, coupling components should be aligned and spaced at least 1/16" apart.

Pump rotation must be clockwise when facing shaft to prevent damage to pump. Check direction of rotation before startup.

Water Flush of Packing (356 Models Only). The packing may be either grease lubricated through a grease fitting in the stuffing box or have plumbing connected to the housing to allow a water flush.

Maximum speed is 1750 rpm.

When the material being pumped is abrasive in nature, it may be advantageous to flush the packing to prevent leakage under packing and excessive shaft wear.

Clean water can be injected through a 1/8" NPT tapped hole that normally houses the grease fitting for lubricating the packing. The water can be permitted to leak axially along the shaft in either direction or can be removed from the second tapped hole in the stuffing box. In both cases, the discharge from the stuffing box should be throttled slightly to maintain 10-15 PSI higher pressure in the stuffing box than is present in the discharge housing.

Table 1. Pump Data

Pump Models	331	332	333	344	356	367
Suction Port (NPT)	3/4*	*3/4**	*3/4**	3/4*	1-1/2	2
Discharge Port (NPT)	3/4	3/4	3/4	3/4	1-1/4	2
Discharge Pressure (psig)	150	100	50	40	50	50

*08 versions = 1" NPT

Table 2. Temperature Limits

Elastomer	Temperature Limits
*NBR	10°-160°F
*EPDM	10°-210°F
*FPM	10°-240°F

*NBR = Nitrile
*EPDM = Ethylene-Propylene-Diene Terpolymer
*FPM = Fluoroelastomer

OPERATION

Self-Priming. With wetted pumping elements, the pump is capable of 25 feet of suction lift when operating at 1750 rpm with pipe size equal to port size.

DO NOT RUN DRY. Unit depends on liquid pumped for lubrication. For proper lubrication, flow rate should be at least 10% of rated capacity.

Pressure and Temperature Limits. See Table 1 for maximum discharge pressure of each model. Unit is suitable for service at temperatures shown in Table 2.

Storage. Always drain pump for extended storage periods by removing suction housing bolts and loosening suction housing.

TROUBLE SHOOTING

WARNING: Before making adjustments, disconnect power source and thoroughly bleed pressure from system. Failure to do so could result in electric shock or serious bodily harm.

Failure To Pump.

1. Belt or coupling slip: Adjust belt tension or tighten set screw on coupling.
2. Stator torn; possibly excessive pressure: Replace stator, check pressure at discharge port.
3. Wrong rotation: Rotation must be clockwise when facing shaft.
4. Threads in rotor or on shaft stripped: Replace part. Check for proper rotation.
5. Excessive suction lift or vacuum.

Pump Overloads.

1. Excessive discharge pressure: Check discharge pressure for maximum rating given in Table 1. Check for obstruction in discharge pipe.
2. Fluid viscosity too high: Limit fluid viscosity to 20,000 CP or 100,000 SSU.

Viscosity CP	Limit RPM
1-300	1750
300-1,000	1200
1,000-2,000	700
2,000-5,000	350
5,000-10,000	180
10,000-20,000	100

3. Insufficient motor HP: Check HP requirement.

Noisy Operation.

1. Starved suction: Check fluid supply, length of suction line, and obstructions in pipe.
2. Bearings worn: Replace parts; check alignment, belt tension, pressure at discharge port.
3. Broken flexible joint: Replace part, check pressure at discharge port.
4. Insufficient mounting: Mount to be secure to firm base. Vibration induced noise can be reduced by using mount pads and short sections of hose on suction and discharge ports.

Mechanical Seal Leakage (Mechanical Seal Models Only).

1. Leakage at startup: If leakage is slight, allow pump to run several hours to let faces run in.
2. Persistent seal leakage: Faces may be cracked from freezing or thermal shock. Replace seal.

Packing Leakage (Packing Models Only).

1. Leakage at startup: Adjust packing as outlined in maintenance instructions.

Note: Slight leakage is necessary for lubrication of packing.

2. Persistent leakage: Packing rings and/or shaft may be worn. Replace parts as required.

Pump Will Not Prime.

1. Air leak on suction side: Check pipe connections.

MAINTENANCE

General. These pumps have been designed for a minimum of maintenance, the extent of which is routine lubrication and adjustment of packing. The pump is one of the easiest to work on in that the main elements are very accessible and require few tools to disassemble.

Packing Lubrication (356 Models Only). The zerk fitting on the side of the suction housing leads to the lantern ring halves in the mid-section of the packings. At least once a week, inject a small quantity of good quality grease, such as MPG-2 Multi Purpose Grease (Du Bois Chemical), or equivalent, into the zerk fitting to lubricate the packings.

Note: For Model 34411, lubricate packing by applying a liberal amount of grease during assembly.

Packing Adjustment (Packing Models Only). Packing gland attaching nuts should be evenly adjusted so they are little more than finger tight. Over-tightening of the packing gland may result in premature packing failure and possible damage to the shaft and gland.

When the packing is new, frequent minor adjustments are recommended for the first few hours of operation in order to compress and seat the packing. Be sure to allow slight leakage for lubrication of packing.

When excessive leakage can no longer be regulated by tightening the gland nuts, remove and replace the packings in accordance with the DISASSEMBLY and REASSEMBLY instructions. The entire pump need not be disassembled to replace the packings.

Bearing Lubrication. The prelubricated, fully sealed bearings do not require additional lubrication.

PUMP DISASSEMBLY

WARNING: Before disassembling pump, disconnect power source and thoroughly bleed pressure from system. Failure to do so could result in electric shock or serious bodily harm.

To Disassemble Mechanical Seal Models:

1. Disconnect suction and discharge piping.
2. Remove screws (112) holding suction housing (2) to pump body (1). Remove suction housing and stator (21).
3. Remove rotor (22) from flexible joint (24) by turning counter-clockwise (RH thread). Use 3/16 inch diameter punch to remove rotor pin (45) on Model 36701.
4. Flexible joint (24) can be removed from shaft (26) by using a 3/16 inch allen wrench in end of joint (1/4 inch wrench on 356 Models) and turn counter-clockwise. Use 3/16 inch diameter punch to remove shaft pin (46) on Model 36701.
5. Carefully slide mechanical seal (69) off shaft (26). Carefully pry seal seat out of pump body (1). If any parts of mechanical seal are worn or broken, the complete seal assembly should be replaced. Seal components are matched parts and are not interchangeable.
6. The bearings (29) and shaft (26) assembly can be removed from pump body (1) after snap ring (66) has been removed. To remove the assembly, lightly tap the shaft at threaded end using a block of wood to protect the threads. The bearings may be pressed off the shaft.

To Disassemble Packing Models:

1. Disconnect suction and discharge piping.
2. Remove screws (112) which hold suction housing (2) to pump body (1). Remove suction housing and stator (21).
3. Remove rotor (22) from flexible joint (24) by turning in a counter-clockwise direction (RH thread).
4. Flexible joint (24) can be removed by using a 3/16 inch allen wrench in end of joint (1/4 inch wrench on 356 Models) and turn in a counter-clockwise direction.
5. The packing (42) can be removed without removing the shaft (26) using the following procedure:
   a. Remove gland bolts (47).
   b. Slide gland (41) away from packing (42).
   c. Pull out packing (42) (and lantern ring halves (57) on 356 Models) using a packing removing tool.

   Note: Packing can be removed after shaft has been removed by pushing out from pump side of pump body after gland (41) has been detached.
6. The bearings (29) and shaft (26) assembly can be removed from pump body (1) after snap ring (66) has been removed. To remove the assembly, lightly tap the shaft at threaded end using a block of wood to protect the threads.
7. To disassemble shaft assembly, remove snap ring (66A) from shaft (26) and press bearings (29) and bearing spacer (33) off the shaft.

PUMP ASSEMBLY

To Assemble Mechanical Seal Models:

1. Press bearings (29) on shaft (26), and locate slinger ring (77) near bearing on threaded end of shaft.

Note: When replacing bearings, always press on the inner race when assembling to shaft, and on the outer race when pressing bearings into the housings.

2. Press shaft assembly into pump body (1) securing with snap ring (66).
3. Install mechanical seal (69) using the following procedure:
   a. Clean and oil sealing faces using a clean light oil (not grease).

Caution: Do not use oil on EPDM parts. Substitute glycerin or soap and water.

   b. Oil the outer surface of the seal seat, and push the assembly into the bore in the pump body (1), seating it firmly and squarely.
   c. After cleaning and oiling the shaft, slide the seal body along the shaft until it meets the seal seat.
   d. Install seal spring and spring retainer on shaft.
4. Thread flexible joint (24) into shaft (26) in a clockwise direction (RH thread). On 356 Models, install seal spacer (69A) and washer (116) before threading flexible joint onto shaft in a clockwise direction. On Model 36701, use shaft pin (46) to pin flexible joint (24) to shaft.
5. Thread rotor (22) onto flexible joint (24) in a clockwise direction (RH thread). On Model 36701, pin rotor (22) to joint using rotor pin (45).
6. Slide stator (21) on rotor (22). On 331 and 332 Models, insert rounded end of stator ring (135) into end of stator prior to installing stator on rotor.
7. Secure stator (21) and suction housing (2), with suction port vertically up, to pump body (1) using screws (112).
8. Proceed as in installation instructions.

To Assemble Packing Models:

1. Press bearings (29), with bearing spacer (33) in between, on shaft (26) and secure in place using snap ring (66A).

Note: When replacing bearings, always press on the inner race when assembling to shaft, and on the outer race when pressing bearings into the housings.

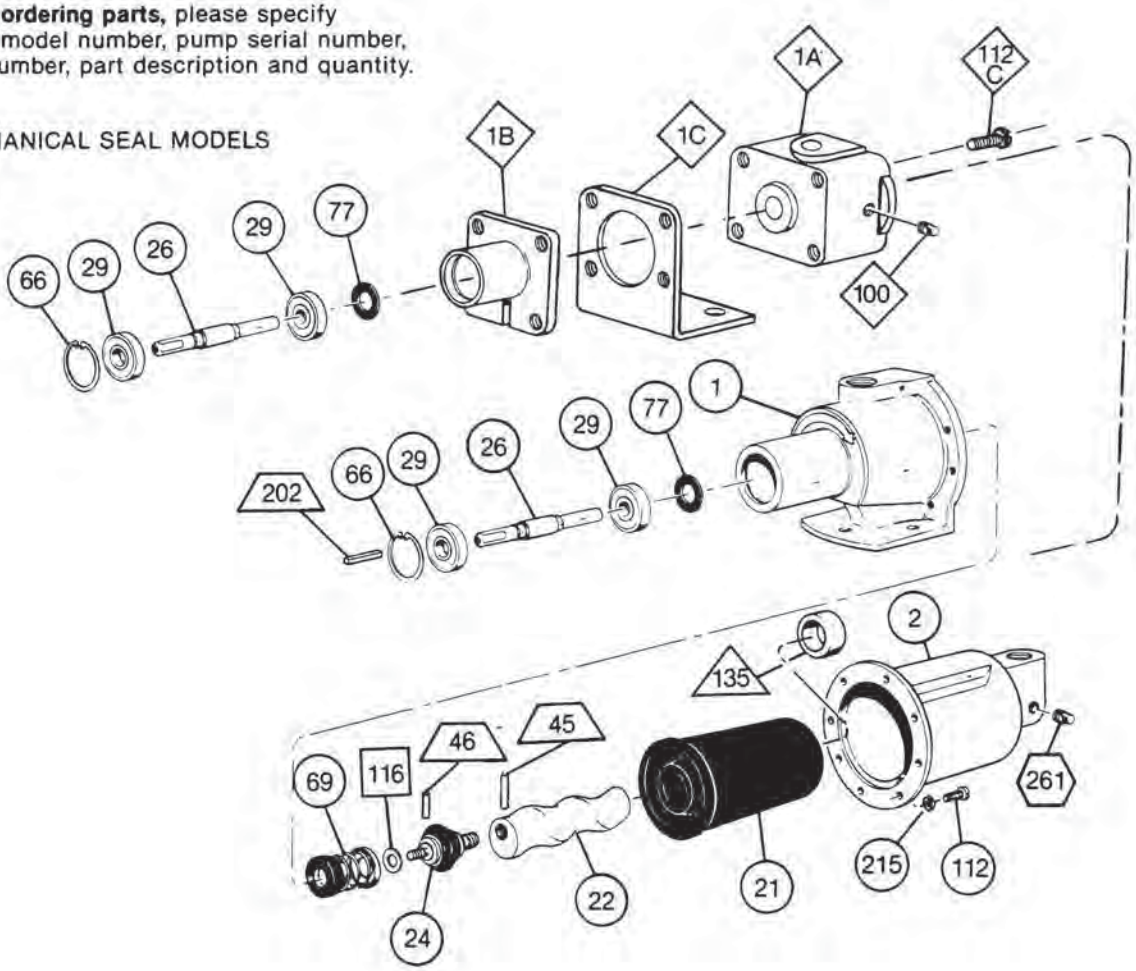
2. Install packing (42) before installing shaft assembly using the following procedure:
   a. Lubricate each individual ring of packing with a grease that is insoluble in the fluid being pumped.
   b. Individually assemble each ring of packing loosely in the packing chamber of the pump body (1). Stagger splits on rings. (Four rings, 3/16 inch square required on Model 34411; four rings, 1/4 inch square and two lantern ring halves (57) assembled between two rings on 356 Models).
   c. Loosely install packing gland (41) on pump body (1) using gland bolts (47).
3. Press shaft assembly into pump body (1) positioning slinger ring (77) between packing gland (41) and bearing end of pump body. Secure the shaft assembly with snap ring (66).
4. Thread flexible joint (24) into shaft (26) in a clockwise direction (RH thread).
5. Thread rotor (22) onto flexible joint (24) in a clockwise direction (RH thread).
6. Slide stator (21) on rotor (22). On 331 and 332 Models, insert rounded end of stator ring (135) into end of stator prior to installing stator on rotor.
7. Secure stator (21) and suction housing (2), with suction port vertically up, to pump body (1) using screws (112).
8. Proceed as in installation instructions.

Note: Adjust newly installed packing as described in maintenance procedure.

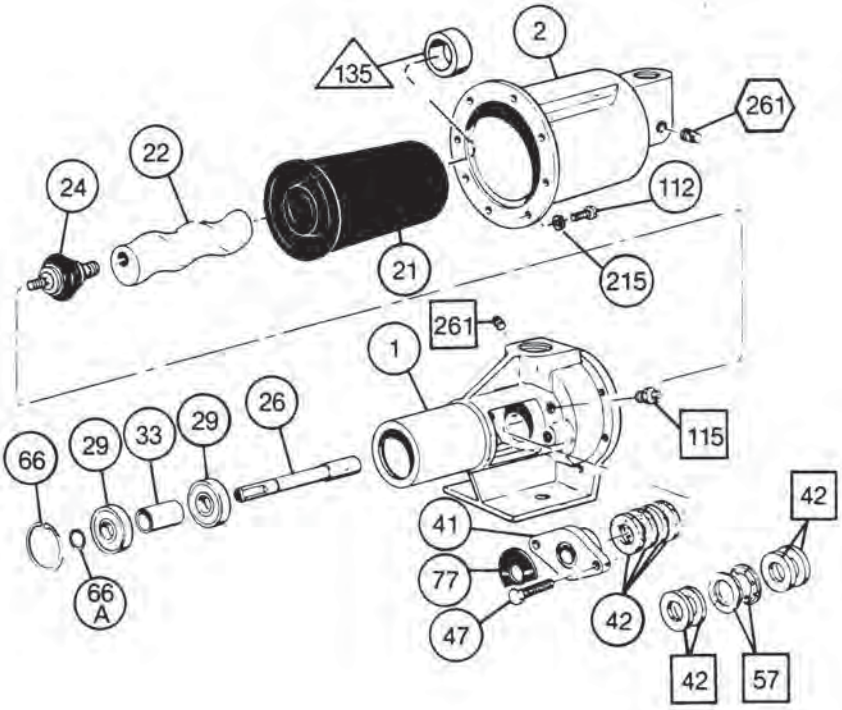
WARNING: Replace belt or coupling guards before reconnecting power.

When ordering parts, please specify pump model number, pump serial number, part number, part description and quantity.

MECHANICAL SEAL MODELS



PACKING MODELS



Used on 332 and 367 only.

Used on 356 only.

Used on 356 and 367 only.

Used on -08 only.

Used on 367 only.

PARTS LIST — 331, 332, 333, AND 344 MODELS

Item No.	Description	Mechanical Seal Models			Packing Gland Models
		33101 33201 ~~33301~~ 34401	33104 33204 33304 34404	33108 33208 33308 34408	34411
1	Pump Body	330-1065-002	330-1910-002		340-1000-001
1A	Discharge Housing			340-2362-000	
1B	Bearing Housing			330-4587-000	
1C	Pump Base			340-2369-000	
2	Suction Housing	330-1064-002	330-1911-002	330-4536-000	330-1064-002
*21	Stator	See Stator section below.			
*22	Rotor	See Rotor section below with circled numbers for each series.			
		(1)	(2)	(1)	(1)
24	Joint	Carbon Steel/NBR 320-1511-000	316 SS/NBR 320-3759-000	Carbon Steel/NBR 320-1511-000	
26	Drive Shaft	320-1499-000	320-2938-000	320-1499-000	320-2448-000
29	Bearing (2 req.)	630-0502-031			
33	Bearing Spacer				320-1900-000
41	Packing Gland				320-0101-004
42	Packing				340-3396-005
47	Gland Bolt				619-1520-161
66	Snap Ring	320-1506-000			
66A	Snap Ring				320-4182000
69	Mechanical Seal	320-2424-000			
77	Slinger Ring	320-6382-000			320-6384-000
100	Pipe Plug (3 req.)			610-0120-021	
112	Screws (8 req.)	619-1430-103	320-5968-000	619-0860-081	619-1430-103
112C	Screws (4 req.)			61 9-0890-281	
135	Stator Ring (331 -332 only)	320-7812-000			
215	Lock Washer (8 req.)	320-6464-000			

*Recommended spare parts.

STATORS		Models			
		331	332	333	344
21	Standard Stator, NBR All Models	340-3501-120	340-3502-120	340-3503-120	340-3504-120
21	EPDM Stator	340-3501-320	340-3502-320	340-3503-320	340-3504-320
21	FPM Stator	340-3501-520	340-3502-520	340-3503-520	340-3504-520
ROTORS					
22	(1) 416SS - All Models	320-2729-000	330-0906-000	320-1394-000	320-1841-000
22	(2) 316SS – All Models	320-2933-000	320-2942-000	320-2936-000	320-2934-000

See page 8 for Repair/Conversion Kits

PARTS LIST — 356 AND 367 MODELS

Item No.	Description	Mechanical Seal Models		Packing Gland Models		Mechanical Seal Model	
		35601	35604	35611	35613	36701	36704
1	Pump Body	Cast Iron 340-0636-000	316SS 340-1550-000	Cast Iron 350-0420-000	316SS 350-0491-000	Cast Iron 350-0423-000	316SS 350-0423-007
2	Suction Housing	350-0280-000	350-0489-000	350-0280-000	350-0489-000	350-0302-000	350-0302-007
*21	Stator	NBR 340-3505-120		NBR 340-3505-120		NBR 340-3506-120	
22	Rotor	416SS 320-2304-000	316SS 320-4431-000	416SS 320-2304-000	316SS 320-4431-000	416SS 330-2042-000	316SS 330-3077-000
24	Flex Joint	Carbon Steel 320-1583-000	316SS 320-4427-000	Carbon Steel 320-1583-000	316SS 320-4427-000	Carbon Steel 320-1749-000	316SS 320-4436-000
26	Drive Shaft	320-1759-000	320-4430-000	320-2765-000	320-4435-000	330-1805-000	330-1805-015
29	Bearing (2 req.)	630-0552-051				630-0552-061	
33	Bearing Spacer			320-2764-000			
41	Packing Gland			320-0003-004	320-0003-007		
*42	Packing			340-3396-008			
45	Rotor Pin					320-4439-002	
46	Shaft Pin					320-4439-001	
47	Gland Bolt			619-1530-241			
57	Lantern Ring Half**			320-6585-000			
66	Snap Ring	320-1758-000				320-2794-000	
66A	Snap Ring			320-3533-000			
*69	Mechanical Seal	320-3945-000				320-1750-000	
69A	Seal Spacer	320-4434-000					
77	Slinger Ring	320-6383-000		320-6385-000		320-6385-000	
112	Screws (6 req.)	619-1530-161				619-1530-161	
115	Zerk Fitting			320-2503-001			
135	Stator Spacer	330-7594-000					
202	Shaft Key					611-0040-240	
215	Lock Washer (6 req.)	623-0010-411					
261	Pipe Plug	610-0120-011	610-0420-010	610-0120-011	610-0420-010	610-0120-011	610-0420-010

*Recommended spare parts.
**2 Required

See page 8 for Repair/Conversion Kits

REPAIR/CONVERSION KIT NUMBERS

ELASTOMER REPAIR/CONVERSION KITS

Item No.	Description	331 Models			332 Models		
		NBR	EPDM	FPM	NBR	EPDM	FPM
—	Kit No.	311-9026-000	311-9025-000	311-9054-000	311-9027-000	311-9038-000	311-9055-000
21	• Stator	340-3501-120	340-3501-320	340-3501-520	340-3502-120	340-3502-320	340-3502-520
24	• Joint	320-1511-000‡	320-6367-000†	320-4670-000†	320-1511-000‡	320-6367-000†	320-4670-000†
69	• Seal	320-2424-000	320-6379-000	320-6501-000	320-2424-000	320-6379-000	320-6501-000
Item No.	**Description**	**333 Models**			**344 Models**		
		NBR	EPDM	FPM	NBR	EPDM	FPM
—	Kit No.	311-9029-000	311-9028-000	311-9056-000	311-9031-000	311-9030-000	311-9057-000
21	• Stator	340-3503-120	340-3503-320	340-3503-520	340-3504-120	340-3504320	340-3504520
24	• Joint	320-1511-000‡	320-6367-000†	320-4670-000†	320-1511-000‡	320-6367-000†	320-4670-000†
69	• Seal	320-2424-000	320-6379-000	320-6501-000	320-2424-000	320-6379-000	320-6501-000

t316SS/with appropriate elastomer.
‡Carbon steel. NBR kits are available only with carbon steel joints; a 316SS/NBR joint for 331-344 Models is available as 320-3759-000.

Item No.	Description	356 Models			367 Models		
		NBR	EPDM	FPM	NBR	EPDM	FPM
—	Kit No. (Mech. Seal Models)	311-9033-000	311-9032-000	311-9058-000	311-9060-000	311-9036-000	311-9124-000
21	• Stator	340-3505-120	340-3505-320	340-3505-520	340-3506-120	340-3506-320	340-3506-520
24	• Flex Joint	320-1583-000‡	320-6369-000†	320-4671-000†	320-1749-000‡	320-6378-000‡	3206515-000‡
69	• Seal	320-3945-000	320-6380-000	320-6510-000	320-1750-000	320-6390-000	320-6517-000
45	• Rotor Pins				320-4439-002	320-4439-002	320-4439-002
46	• Shaft Pin				320-4439-001	320-4439-001	320-4439-001
—	Kit No (Packing Gland Models)	311-9035-000	311-9034-000	311-9059-000			
21	• Stator	340-3505-120	340-3505-320	340-3505-520			
24	• Joint	320-1583-000‡	320-6369-000†	320-4671-000†			

†316SS/with appropriate elastomer.
‡Carbon steel. NBR kits are available only with carbon steel joints; a 316SS/NBR joint for Model 35604 and 35613 pumps is available as 320-4427-000; a 316SS/NBR joint for model 36704 is available as 320-4436-000.

ABRASION RESISTANT SEALS

	Models		
Elastomer	**331-344**	**356**	**36701**
NBR	3206460000	3206505000	3206511000
EPDM	3206502000	3206506000	3206512000
FPM	3206503000	3206507000	3206513000

NBR = Nitrile
EPDM = Ethylene-Propylene-Diene Terpolymer
FPM = Fluoroelastomer

Printed in U.S.A.

Double The Length Of Your Moyno Pump Warranty For FREE!

For your *free* pump warranty extension, choose from one of the three options below:

1. Go to www.moyno.com and fill out the registration form online

2. Mail this form by placing it in an envelope and sending it to: **Moyno, Inc.**
Attn: Tish Wilson
P. O. Box 960
Springfield, OH 45501-0960
U.S.A.

3. Fax this form to 937-327-3177

Thank you for choosing a Moyno Pump. Please take the time to complete this warranty registration form. Upon receipt of your form, your standard limited warranty on defective material and workmanship will be extended to twice the standard period of time at no additional cost to you. We appreciate your business and look forward to serving you in the future.

LLOYD'S REGISTER QUALITY COMPANY ISO9001 NATIONAL ACCREDITATION OF CERTIFICATION BODIES
CERTIFICATE No. 101442

MOYNO
Always the Right Solution™

Always Insist on Genuine Moyno Replacement Parts!

Moyno® Pump Warranty Registration

Pump Model # _____ Pump Serial # _____
Purchased From _____ Date Purchased _____
Your Name _____ Your Title _____
Your Company Name _____
Address _____
City/State (Province)/Zip Code _____
Phone Number _____ Fax Number _____
E-mail _____

Application for Which This Pump Was Purchased

Material _____ Flow Rate _____ Process Temperature _____
Operating Speed _____ Viscosity _____ pH Value _____
Hours Operated per Day _____ Continuous _____ Intermittent _____
Discharge Pressure _____ Suction Pressure _____ NPSH Available _____
Percent of Solids _____ Particle Size _____ Abrasion Rating _____

How Did You First Hear of Moyno Pumps?

❑ Advertisement ❑ Postcard ❑ Trade Show ❑ Referral
❑ Distributor Salesperson ❑ Previous Experience With Moyno Pumps ❑ Other – Explain Below

Thank You!

AC & DC Motor Installation – Maintenance Instructions

These instructions are intended to complement (not replace) the information in MN400 Installation and Operation manual for "Integral Horsepower AC Induction Motors ODP, TEFC, Explosion Proof" and MN605 Installation and Operation manual for "Integral Horsepower DC Motors".

Handling

The weight of the motor and shipping container will vary. Use correct material handling equipment to avoid injury.

Use caution when removing the motor from its packaging. Sharp corners may exist on motor shaft, motor key, sheet metal and other surfaces.

Receiving

Inspect the motor for damage before accepting it. The Motor shaft should rotate freely with no rubs. Report any damage immediately to the commercial carrier that delivered your motor.

Safety Notice

Only qualified personnel trained in the safe installation and operation of this equipment should install this motor. When improperly installed or used, rotating equipment can cause serious or fatal injury. Equipment must be installed in accordance with the National Electrical Code (NEC), local codes and NEMA MG2 Safety Standards for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators. Observe the following guidelines:

1. When eyebolts are provided, they must be fully tightened and are intended to lift the motor and its included accessories only.
2. Ground the motor according to NEC and local codes.
3. Provide a permanent guard to prevent accidental contact of body parts or clothing with rotating or moving parts or burns if motor is hot.
4. Shaft key must be secured before starting motor.
5. Do not apply power to the motor until the motor is securely mounted by its mounting holes.
6. This motor must only be connected to the proper line voltage, line frequency and load size.
7. Motors are not to be used for load holding or restraining unless a properly sized brake is installed. If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure.
8. Disconnect all power services, stop the motor and allow it to cool before servicing.
9. For single phase motors, discharge the start and/or run capacitors before servicing.
10. Do not by-pass or render inoperative any safety device.
11. DC series wound motors must be protected from sudden loss of load causing overspeed damage. DC shunt wound motors must be protected from loss of field voltage which can result in damage.
12. When using AC motors with frequency inverters, be certain that the motors Maximum Speed Rating is not exceeded.
13. Mounting bolts should be high tensile steel. Be sure to use a suitable locking device on each bolt (spring washer or thread lock compound).

Guarding

After motor installation is complete, a guard of suitable dimensions must be constructed and installed around the motor/gearmotor. This guard must prevent personnel from coming in contact with any moving parts of the motor or drive assembly but must allow sufficient cooling air to pass over the motor.

If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure.

Brush inspection plates and electrical connection cover plates or lids, must be installed before operating the motor.

When this motor is installed according to these instructions, it complies with the EEC Machinery Directive. Electromagnetic Compatibility (EMC) requirements for CE compliance are met when the incoming power is purely sinusoidal. For other power source types, refer to MN1383 "Recommended Practices for Installation for EC Directive 89/336/EEC Relating to EMC".

BALDOR
MOTORS • DRIVES • GENERATORS

P.O. Box 2400
Fort Smith, AR 72902–2400 U.S.A.
(479) 646–4711

Motor Enclosure

ODP, **Open drip proof** motors are intended for use in clean, dry locations with adequate supply of cooling air. These motors should not be used in the presence of flammable or combustible materials. Open motors can emit flame and/or molten metal in the event of insulation failure.

TEFC, **totally enclosed** motors are intended for use where moisture, dirt and/or corrosive materials are present in indoor and outdoor locations.

Explosion proof motors, as indicated by the Underwriters Laboratories, Inc. label are intended for use in hazardous areas as specified by the NEC.

Mounting

Foot mounted machines should be mounted to a rigid foundation to prevent excessive vibration. Shims may be used if location is uneven.

Flange mounted machines should be properly seated and aligned. Note: If improper rotation direction is detrimental to the load, check rotation direction prior to coupling the load to the motor shaft.

For **V-belt drive,** mount the sheave pulley close to the motor housing. Allow clearance for end to end movement of the motor shaft. Do not overtighten belts as this may cause premature bearing failure or shaft breakage.

Direct coupled machines should be carefully aligned and the shaft should rotate freely without binding.

Wiring

Connect the motor as shown in the connection diagram. If this motor is installed as part of a motor control drive system, connect and protect the motor according to the control manufacturers diagrams. The wiring, fusing and grounding must comply with the National Electrical Code and local codes. When the motor is connected to the load for proper direction of rotation and started, it should start quickly and run smoothly. If not, stop the motor immediately and determine the cause. Possible causes are: low voltage at the motor, motor connections are not correct or the load is too heavy. Check the motor current after a few minutes of operation and compare the measured current with the nameplate rating.

Adjustment

The neutral is adjustable on some DC motors. AC motors have no adjustable parts.

Noise

For specific sound power or pressure level information, contact your local Baldor representative.

Vibration

This motor is balanced to NEMA MG1, Part 7 standard.

Brushes (DC Motors)

Periodically, the brushes should be inspected and all brush dust blown out of the motor. If a brush is worn $^1/_2$ (from length specified in renewal parts data), replace the brushes. If the commutator is worn or rough, the armature should be removed. The commutator should be turned in a lathe, the mica recut and the commutator polished. Reassemble and seat the new brushes using a brush seating stone. Be sure the rocker arm is set on the neutral mark.

Lubrication

This is a ball or roller bearing motor. The bearings have been lubricated at the factory. Motors that do not have regrease capability are factory lubricated for the normal life of the bearings.

Lubricant

Baldor motors are pregreased, normally with Polyrex EM (Exxon Mobil). If other greases are preferred, check with a local Baldor Service Center for recommendations.

Relubrication Intervals (For motors with regrease capability)

New motors that have been stored for a year or more should be relubricated. Lubrication is also recommended at these intervals:

Table 1 Relubrication Interval

NEMA (IEC) Frame Size	Rated Speed (RPM)			
	3600	1800	1200	900
Up to 210 incl. (132)	5500Hrs.	12000Hrs.	18000Hrs.	22000Hrs.
Over 210 to 280 incl. (180)	3600Hrs.	9500Hrs.	15000Hrs.	18000Hrs.
Over 280 to 360 incl. (225)	*2200Hrs.	7400Hrs.	12000Hrs.	15000Hrs.
Over 360 to 5000 incl.(300)	*2200Hrs.	3500Hrs.	7400Hrs.	10500Hrs.

* Lubrication interval for 6313 or 6314 bearings that are used in 360 through 5000 frame, 2 pole motors. If roller bearings are used, bearings must be lubricated more frequently, divide the relubrication interval by 2.

Table 2 Service Conditions

Severity of Service	Ambient Temperature Maximum	Atmospheric Contamination	Type of Bearing
Standard	40 C	Clean, Little Corrosion	Deep Groove Ball Bearing
Severe	50 C	Moderate dirt, Corrosion	Ball Thrust, Roller
Extreme	>50 C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion	All Bearings
Low Temperature	<-30 C**		

* Special high temperature grease is recommended.

** Special low temperature grease is recommended.

Table 3 Lubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Table 4 Amount of Grease to Add

Frame Size NEMA (IEC)	Bearing Description (Largest bearing in each frame size)					
	Bearing	OD D mm	Width B mm	Weight of grease to add ounce (gram)	Volume of grease to add	
					inches^3	teaspoon
Up to 210 incl. (132)	6307	80	21	0.30 (8.4)	0.6	2.0
Over 210 to 280 incl. (180)	6311	120	29	0.61 (17.4)	1.2	3.9
Over 280 to 360 incl. (225)	6313	140	33	0.81 (23.1)	1.5	5.2
Over 360 to 5000 incl.(300)	NU322	240	50	2.12 (60.0)	4.1	13.4

Weight in grams = 0.005 DB

Procedure

Clean the grease fitting (or area around grease hole, if equipped with slotted grease screws). If motor has a purge plug, remove it. Motors can be regreased while stopped (at less than 80 C) or running.

Apply grease gun to fitting (or grease hole). Too much grease or injecting grease too quickly can cause premature bearing failure. Slowly apply the recommended amount of grease, taking 1 minute or so to apply. Operate motor for 20 minutes, reinstall purge plug if previously removed.

Caution: Keep grease clean. Mixing dissimilar grease is not recommended.

Sample Relubrication Determination

This sample determination is based on a NEMA 286T (IEC 180) motor operating at 1750 RPM driving an exhaust fan in an ambient of 43 C atmosphere that is moderately corrosive.

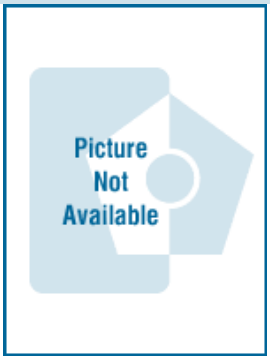
1. Table 1 list 9500 hours for standard conditions.
2. Table 2 classifies severity of service as "Severe".
3. Table 3 lists a multiplier value of 0.5 for Severe conditions.
4. Table 4 shows that 1.2 in^3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

SECTION - 5

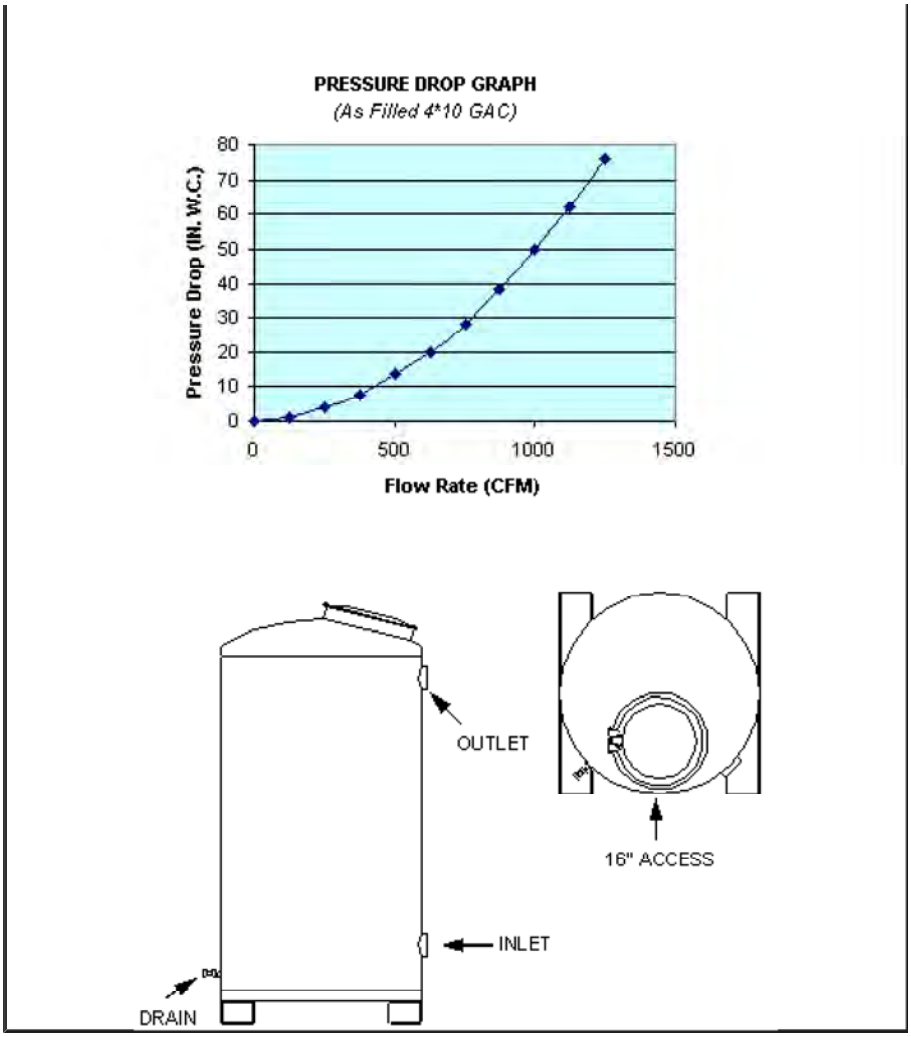
Vapor-Phase Granular Activated Carbon

VFV SERIES FILTERS
MODEL VFV-2000



The VFV-2000 filter is a media filter vessel designed to treat vapor streams where pressure drop is a strong concern. While the typical design application is a activated carbon adsorbtion unit, the filter can easily accommodate many medias. The sturdy construction makes these filter vessels ideal for long term treatment units. Some applications include:

- Soil Vapor Extraction Treatment
- Air Stripper Off Gas Treatment
- Odor Removal System
- Storage Tank Purge Vapor Treatment
- Pilot Study
- Industrial Process Treatment



VFV-2000 SPECIFICATIONS			
Overall Height	7'7"	Vessel/Internal Piping Materials	CS/ SCH 40 PVC
Diameter	48"	Internal Coating	Polyamide Epoxy Resin
Inlet / Outlet (FNPT)	4"	External Coating	Urethane Enamel
Drain / Vent (FNPT)	3/4"	Maximum Pressure / Temp	10 PSIG / 140º F
GAC Fill (lbs)	2000	Cross Sectional Bed Area	12.5 FT^2
Shipping / Operational Weight (lbs)	2,925/3,425	Bed Depth/Volume	5.7 FT / 71 FT^3

Our Company | News | Catalog | Services | RFQs | Contact

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Toll Free: 800-441-4034 Telephone: 765-643-3941 • Fax: 765-643-3949
www.tetrasolv.com • info@tetrasolv.com

Tetrasolv Filtration

Operation & Maintenance Manual

VFD • VFV • VF • VR SERIES

Tetrasolv Filtration Vapor Filters

Liquid & Vapor Filtration
Remedial • Industrial • Municipal

CONTENTS

1.0 GENERAL DESCRIPTION

The liquid series filters utilize fixed bed filtration to treat vapor. The filters employ a variety of medias to remove or catalyze contaminants. Flow through the filter may be either up flow or down flow depending upon the media supplied and the operation parameters. Generally inlet and outlet locations are indicated on the filter and or the filter drawings.

The most common application utilizes activated carbon as the adsorption media. Typically vapor which contains low levels of organic contaminants flows upward through the column of activated carbon where the larger organic molecules adhere to the porous structure of the activated carbon granules. This adsorption begins at the bottom of the “bed” and continues upward as the original adsorptive area becomes saturated.

Complete saturation of the carbon is dependent upon many factors such as contaminant levels, temperature, compounds being adsorbed, humidity, etc. Typically a carbon isotherm has been run on the influent stream to determine the expected rate of consumption of the activated carbon media. When monitoring has determined discharge air no longer meets discharge requirements the carbon will have to be removed and replaced ***(refer to section 5.0)***.

2.0 SAFETY CONSIDERATIONS

It is important that the entire O&M manual be read prior to set up and operation of the carbon system. If you have any questions please contact Tetrasolv Filtration at the number listed below or support@tetrasolv.com.

- ***WARNING: Where system pressure may exceed design pressure we strongly recommend the use of a relief device. Exceeding the maximum pressure of the filter could result in catastrophic failure***

of the vessel.

- Always adhere to “lockout/tagout” procedures when servicing the system.

- Wear appropriate safety equipment when operating system.

♦ ***WARNING: Wet or dry activated carbon preferentially removes oxygen from air. In closed or partially closed containers, oxygen depletion may reach hazardous levels. If workers must enter a container containing carbon, appropriate sampling and work procedures should be followed for potentially low-oxygen spaces - including all applicable federal and state requirements.***

♦ ***WARNING: High concentrations of certain compounds such as BETX and low concentrations such as ketones, aldehydes, organic acids and sulphur may cause severe temperature rises.***

- Understand the potential hazards of the stream being treated by the system. The activated carbon may contain higher concentrations of the contaminants being adsorbed than is in the influent stream. In addition the carbon may be considered hazardous material and therefore may require specific handling precautions unknown to Tetrasolv Filtration.

3.0 INSTALLATION

3.1 Shipment

Typically filters are shipped with media installed. However, in certain instances media is shipped to the site to be installed after installation. In very large systems it may be advisable to not install the media until adsorbers have been placed into final position and secured.

3.2 Unloading

Refer to the product data sheet for weight information for appropriate sizing information for the equipment to be used.

All components should be lifted either by crane or forklift as designated by the model.

♦ ***WARNING: Failure to follow the procedures outlined below can result in catastrophic damage to the system.***

Crane Lift - If a crane lift is to be used we recommend the following method. A “spreader” equaling 75% of the distance between the opposing lifting eyes on each adsorber should be used to insure proper lifting force direction. Attach an appropriately sized spreader beam and lifting cables to each lift eye of the component. The use of an experienced crane operator and quality equipment is highly recommended.

Fork-Lift - When using a forklift we recommend that the fork tubes on the filter be used or a pallet if the unit was shipped on a pallet.

3.3 Inspection

Perform the following inspections after un-loading the system. Note any discrepancies and contact TetraSolv immediately.

- Check the vessel exterior for damage which may have occurred during shipment. Inspect the support structures and piping support for damage.

- Inspect the piping system for damage. Insure the valves operate properly. Check installed instruments and instrument installation points for damage.

- If the filters are shipped without carbon visually inspect the interior of the vessel for damaged internals.

- Inspect the carbon discharge, drain and vent valves for damage

3.4 Set Up

The filter should be placed on a level concrete pad of appropriate thickness to support the system at it’s maximum operational weight. The filter should be secured to the pad using appropriately sized anchor bolts.

Connect the site piping to the filter inlet and outlet connection points. It is important that all piping connected to the filter should be self supported. We also recommend in hard pipe installation that a flexible joint be used to further insulate the filter from vibration and stress.

Connect any gauges and instrumentation shipped

loose with the system.

The outlet piping if connected to a stack or vent should be designed to prevent the introduction of water or debris into the adsorber piping. Discharge piping should be sized equal to or greater than the diameter of the system piping or back pressure could occur creating excess pressure drop on the system.

Flowrates greater than 60 cfm / sq ft can produce bed fluidization in vapor phase filters. When this occurs carbon granules can be lifted and propelled out of the carbon bed in up-flow applications. In extreme cases large amounts of carbon can be expelled. If the system will be operating near or greater than the amount stated above please contact Tetrasolv for recommendations.

Carbon filters can be manifold in parallel operation for higher flowrates. Series operation is the preferred method of operation as it provides for the greatest degree of bed utilization.

Vapor conditions such as high humidity and high temperature (> 125º F) can cause inefficient adsorbtion to occur. If these conditions exist contact Tetrasolv for support. Also, any free water or product and debris should be eliminated with a knockout filter prior to the vapor stream entering the system. Many other vapor issues may effect Adsorber operation and we therefore recommend you discuss your specific installation with a representative.

4.0 OPERATION

4.1 Modes of Operation

With certain applications (2) filters in series flow are utilized. Listed below are typical operational modes.

- Shutdown - Both filters completely off-line and isolated.
- Series Flow - Influent enters primary filter and exits through secondary adsorber (this is the preferred method of operation)
- Isolation Flow - Only one filter is receiving influent. This mode is typically used when the operator is maintaining the off-line filter.
- Parallel Flow - Both filters are receiving the influent as the primary. Flow is split equally between the filters. This mode is used when higher flow rates need to be achieved and contact times are not critical.

4.3 Monitoring

Adsorber units only require periodic monitoring if properly installed. The following items may be monitored:

Pressure: Check inlet and outlet pressure. Increase in pressure differential may indicate media breakdown or presence of high moisture. Rapid increase in pressure drop could indicate adsorber failure.

Samples: Inlet and outlet sample points if provided for vapor analysis to determine system performance.

5.0 ADSORBER SERVICING

The Adsorber may be serviced on-site using a vacuum removal method. Prior to servicing the unit should be closed off from influent and effluent lines and any electrical devices or connections should be tagged off.

After removal of the spent carbon is complete, it is recommended that the inside of the Adsorber be checked thoroughly and any minor maintenance conducted.

5.1 Carbon Loading - Bulk Bag

- ***WARNING - Dry activated carbon generates considerable dust. While activated carbon poses no health risk the dust can cause respiratory irritation and occasional skin rash. Therefore we recommended the use of proper clothing and dust mask during filling operation.***

Hoist the bag over the manway and untie the outer bag exposing the inner chute. Untie the inner chute while clasping it shut. Remain holding the chute and carefully lower the chute into the manway. Un-clasp the chute and allow the carbon to discharge from the sack. The carbon should flow out very quickly and completely. When finished shake the bag and invert the chute into the bag.

If at any time you wish to stop the flow of carbon simply re-grasp the chute up high and cinch. Re-tie the bag.

5.2 Carbon Loading - Vacuum Method

In this method dry-activated carbon will be loaded into to the adsorbers using a vacuum rig. To add the carbon to the filters use the following method:

WARNING: Due to the low vacuum rating of the VF series adsorbers (< 60" H_20) only experienced change-out personnel should attempt this method of re-filling. Exceeding the recommend vacuum rating could lead to failure of the superstructure of the vessel.

1. Connect a 3" vacuum source to the auxiliary connection of the adsorber to be filled.

2. Install a 16" bolted transfer lid onto the manway opening of the adsorber to be filled.

3. Turn on the vacuum and check for good flow of air through the adsorber. Connect the fill line to the transfer lid and lead enough hose to reach the fresh carbon source (Note: This should be as short of a distance as possible).

4. Begin vacuuming carbon into the adsorber. It is important to note that the loading method is actually conveying and not true vacuum. The hose should contain 1/3 air with the carbon. Closely view the adsorber being filled. If the adsorber is collasping in excessively take less carbon and more air. This is something from experience and cannot be adequately explained here.

5. When transfer is complete the transfer lid should be removed and the carbon in the adsorber should be leveled out to insure even pressure drop across the bed.

6. Close the manway and turn the adsorber back on.

> ***Note: When the system if first started up small amounts of fines may be present in the discharge stream. This is normal and should discontinue within a short period of time.***

6.0 MAINTENANCE

6.1 Extended Shutdown

If the system is to be shutdown for extended period of time it is recommended that the valve be placed in shutdown mode and the system water drain valve be left open.

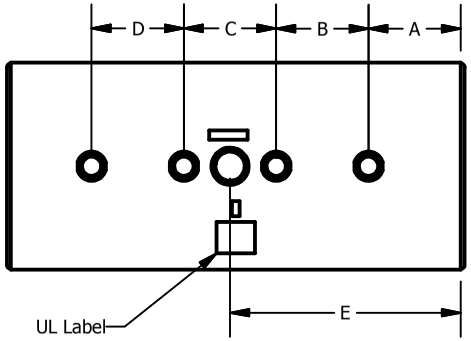
Monitor the system closely after extended shutdown for signs of potential problems such as interior manifold failure or leaking valves and gaskets.

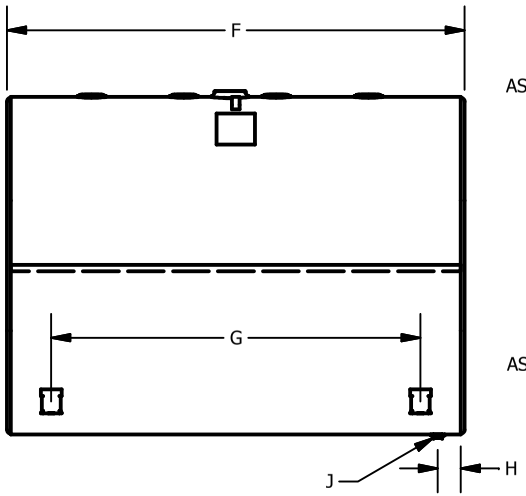
SECTION - 6

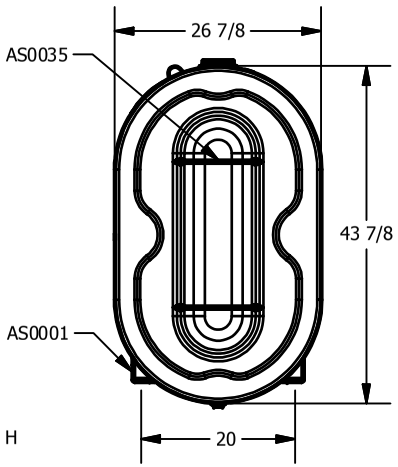
Tanks

Table Describing digits 1 to 5 of Product #											
Product #	Cap. (US gal)	Steel thk. (ga)	A (in	B (in)	C (in)	D (in)	E (in)	F (in)	G (in)	H (in)	SIDE VIEW
20320_	230	12	12	12	12	12	30	60	48	3	3
20320_T	230	12	7¼	22	11	11	18¼	60	48	57	3
20420_	275	12	12	12	12	12	30	60	48	3	1
20420_T	275	12	7¼	22	11	11	18¼	60	48	57	1
20520_	330	12	22	12	12	12	6½	72	48	3	1
20520_T	330	12	13¼	11	11	22	40½	72	48	69	1
20810_T	138	12	4¼	14	6		11¼	30	20	17	1
21120_	275	10	12	12	12	12	30	60	48	3	2

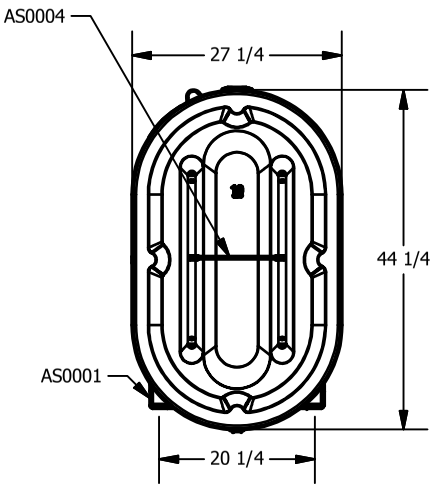
Table Describing Digits 6 of Product#	
Product#	J
_ _ _ _ _ 3	½" NPT
_ _ _ _ _ 6	¾" NPT



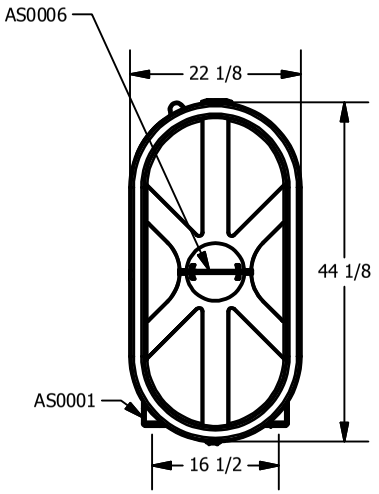




SIDE VIEW 1



SIDE VIEW 2



SIDE VIEW 3

TOLÉRANCES LINÉAIRES, LINEAR STD TOLERANCES
0 OR FRAC. (X/X) -> ±0.5" 0.00 -> ±0.125"
0.0 -> ±0.25" 0.000 -> ±0.0625"

TOLÉRANCES ANGULAIRES, ANGULAR STD TOLERANCES
0 -> ± 2 DEG. 0.00 -> ± 0.1 DEG.
0.0 -> ± 0.5 DEG.

Les soudures doivent respecter la spécification SI-0039.
Tank welds must respect SI-0039 specifications.

Matériau / Material :

Description de la révision / Revision description

Dessiné par / Drawn by: E Bourassa — 2009-03-11

Approuvé par / Approved by : E Bourassa — 2010-04-19

Unités / Units: INCHES | Échelle / Scale: 0.05 : 1 | Feuille / Sheet: 1 / 1

Réservoirs d'Acier Granby, Granby Steel Tanks

Format / Size: A | No de la pièce / Part no.: SI0078 | REV: C .

Description / Title

GENERIC DRAWING FOR RESEDENTIAL VERTICAL UL-142 TANKS

D-TANK_TMPLT-C

INSTALLATION AND MAINTENANCE

GUIDELINES FOR ATMOSPHERIC ABOVEGROUND TANKS

FOR FLAMMABLE LIQUIDS ON SUPPORTS

MODELS: •OBROUND AND CYLINDRICAL UL142 TANKS

Manufactured by :

GRANBY STEEL TANKS
RÉSERVOIRS D'ACIER GRANBY

UL LISTED

1020 André-Liné Granby, Québec, Canada
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Fax: 450-378-5202
E-mail: service@granbytanks.com
Website: http//www.granbytanks.com

1. Scope

These instructions apply to stationary installations of obround or cylindrical UL-142 tanks manufactured by Granby Steel Tanks. These tanks are designed to contain stable flammable and combustible liquids at atmospheric pressure (as classified by NFPA 30) with a specific gravity not exceeding that of water. Here are examples of fluids that can be stored in a UL 142 tank: Fuel oil, Diesel fuel, Gasoline, Lubricating oils, Kerosene, Toluene, Xylene, Methanol, Turpentine...

Since these tanks are used in a broad range of applications, this document does not cover detailed but only general installation instructions. For specific details and regulations, you must refer to the appropriate codes and local regulations.

- For all installations, you can refer to NFPA 30.
- If the tank is used to supply **Oil-Burning Equipment**, you can refer to NFPA 31.
- If the tank is installed on a farm or an isolated site, you can refer to NFPA 395.
- If the tank is used in **Motor Fuel Dispensing Facilities**, **Marine Refuelling** and **Repair Garages**, you can refer to NFPA 30A and NFPA 30.
- If the tank is used to supply **Stationary Combustion Engines** or **Gas Turbines**, you can refer to NFPA 37 and NFPA 30.

2. Tank Inspection

Inspect the tank immediately upon reception. Minor dents and scratches may be acceptable and repaired on site. If damages affect the integrity and performance of the tank, please contact your distributor.

3. Tank Handling

This is a stationary tank. Do not use this tank to transport any product or move the tank unless it is empty. Never drag or drop the tank.

4. Tank Installation

The installation of the tank must be performed by a certified and qualified technician recognized by the authorities having jurisdiction. It is assumed that the installer possesses the skills, the tools and the appropriate documentation (codes and regulations) to install the tank in proper and safe manner.

Condensation can form in the tank during its storage period. During winter months, before its installation, the tank must reside in a warm environment (above freezing level) for a period long enough to melt all the ice that might be present inside. Water must then be drained out of the tank prior to the installation.

4.1. Foundations and Anchoring

The tank shall rest on a foundation of concrete, masonry, piling or steel. This foundation has to be designed to minimize the uneven settling of the tank and to minimize the corrosion of the components resting on the foundation. The site should have all organic materials such as sod or bark removed and the soil must be mechanically compacted. A well-drained sub grade should then be utilized to provide appropriate drainage.

Clearances below the tank shall prevent any part of the tank, except for its base, to be in contact with the soil or foundation.

Where a tank is located in an area subjected to flooding, measures shall be taken to prevent the empty tank from floating in water levels established as maximum flood levels.

4.2. Tank Legs for Obround Tanks

Our obround tanks are provided with four threaded leg supports. Tanks legs shall be 1¼“ black iron pipes threaded on one end. Leg sizes shall be 11” at the outlet end and 12” at the opposite end. This gives a slope of ¼” per foot of tank length and provides enough room for the shutoff valve and filter installation. Tank legs shall be vertically straightened to level to support evenly the weight of the tank filled with fuel (2200 lb. ±).

The installer must verify that a minimum slope of ¼’’ by foot toward the fuel outlet is respected. This is a critical point of the installation and failure to comply with it will render the tank warranty NULL and VOID.

4.3. Location of Tank

The tank shall be located at a safe distance from property lines, public ways, important buildings and adjacent tanks. Refer to applicable codes and local authorities.

4.4. Tank Piping

Before beginning the piping or the installation of accessories, remove shipping caps from each flange.

4.4.1. Tank Vent

Each tank shall be adequately vented to prevent the build-up of pressure or vacuum inside the tank when filling, emptying or when subjected to atmospheric temperature changes. The vent shall be at least as large as the largest filling or withdrawal connection and in no case be at smaller than 1 ¼" nominal inside diameter.

Note: the type of vent required varies depending on the type of liquid contained in the tank. Refer to applicable codes.

4.4.2. Tank Emergency Vent

Each tank shall be equipped with a listed emergency vent device. This device must have a venting capacity at least equal to the value specified in the following table. This value is also specified and on the tank next to the emergency vent opening.

Tank Model	Primary Tank Vent Capacity (cubic feet per second)	Secondary Tank Vent Capacity (cubic feet per second)
137 gal. (obround)	31 600	
230 gal. and 275 gal. (obround)	52 700	
330 gal. (obround)	63 200	
300 gal. 38" dia. x 60" long (cylindrical)	52 700	
300 gal. 38" dia. x 70" long (D/W cylindrical)	52 700	63200
500 gal. 50" dia. x 60" long (cylindrical)	73 700	
500 gal. 50" dia. x 70" long (D/W cylindrical)	73 700	84200
500 gal. 46" dia. x 72" long (cylindrical)	84 200	
1000 gal. 50" dia. x 120" long (cylindrical)	126 000	
1000 gal. 50" dia. x 129" long (D/W cylindrical)	126 000	147000

Piping to or from approved emergency vent devices shall be sized to provide emergency venting flows that limit back pressure to less than 2.5 PSIG within the tank.

Tanks containing *Class IIIB* type fluids (transmission oils, lubricating oils, power steering fluids) or tanks supplying Oil-Burning equipment that are not in the diked area or drainage path of tanks storing *Class I* or *Class II* fluids do not need to meet these emergency venting requirements (see NFAP30 for details).

4.4.3. Openings Below Liquid Level

Each opening below liquid level through which liquid does not normally flow shall be plugged with a liquid tight closure.

4.4.4. Openings Above Liquid Level

All openings that remain unused after completion of the installation shall be properly sealed with a liquid tight metal threaded pipe plug.

5. Testing

These tanks must pass the appropriate test below at job site before being put in service.
Warning: Over pressurization may cause tank to fail.

5.1. Testing Single Wall Tanks

Apply internal air pressure of not less than 3 PSIG or more than 5 PSIG and soap all seams and welded areas.

5.2. Testing Double Wall Tanks

Testing the Primary tank

5.2.1. Make sure the secondary tank opening is free of any obstruction and is properly vented to atmosphere.
5.2.2. Pressurize inner tank to at least 3 PSIG and to no more than 5 PSIG.
5.2.3. Make sure all primary tank openings are properly sealed with a soapy solution.
5.2.4. Cut air supply to the inner tank but keep it pressurized for an hour.
5.2.5. If a steady pressure drop is noticed, it may mean a leak in the primary tank.

Testing the Secondary Tank

5.2.6. Pressurize inner tank to at least 3 PSIG and to no more than 5 PSIG.
5.2.7. Pressurize outer tank to at least 3 PSIG and to no more than 5 PSIG.
5.2.8. Apply a soapy solution to tank exterior surfaces welds and seams.
5.2.9. Relieve pressure from outer tank then relieve pressure from inner tank.

6. Inspection of the Tank After its First Filling

The installer MUST make sure, at the first filling of the tank that no unforeseen damage has occurred during handling, transportation, installation and connection. Such damage could ultimately results in a leak. THE ONLY WAY TO MAKE SURE THAT THE INSTALLATION IS TIGHT IS TO BE IN ATTENDANCE THE FIRST TIME THE TANK IS FILLED COMPLETELY WITH OIL. The installer or a person delegated by him can perform that function. The installer or oil company representative shall visually inspect all seams and fittings for leakage after the first complete filling.

7. Transfer of Product

Most premature failures of steel oil tanks are caused by water and sludge that may accumulate at the bottom of the tank. If you choose to transfer the product from the old tank to the new one, you must insure that the transferred product is free of contaminants, sludge and water.

8. Oil Tank Management (Maintenance)

- Each tank shall be inspected and maintained to ensure compliance with the requirements of the codes regulating it.
- The tank and all tank accessories shall be maintained to ensure that they function as intended.
- If a tank is found to be leaking, is shall be emptied of its content immediately and be replaced.
- The tank should be inspected at least once a year for presence of water. If found, water should be removed immediately.
- All openings on the tank (ex: gauging) shall be closed when not in use.
- If liquid is found in the interstitial space of a double wall tank, replace it.
- If foundation is not stable or tank is likely to topple; take action to correct the situation immediately.

SECTION - 7

Instrumentation

User's Guide

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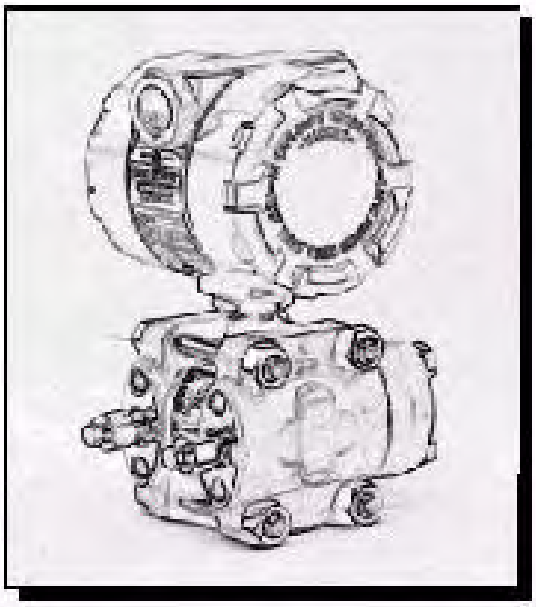

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PX750

Pressure Transmitter

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SECTION 4 Commissioning the Analog Transmitter

SECTION 5 Troubleshooting

SECTION 6 Reference Data

APPENDIX A HART® Communicator

SECTION
1

Introduction

EN

OVERVIEW

This section outlines the models covered and the organization of this manual.

⚠WARNING

The following performance limitations may inhibit efficient or safe operation. Critical applications should have appropriate diagnostic and backup systems in place.

Pressure transmitters contain an internal fill fluid. It is used to transmit the process pressure through the isolating diaphragms to the pressure sensing element. In rare cases, oil leak paths in oil-filled pressure transmitters can be created. Possible causes include: physical damage to the isolator diaphragms, process fluid freezing, isolator corrosion due to an incompatible process fluid, etc.

A transmitter with an oil fill fluid leak can continue to perform normally for a period of time. Sustained oil loss will eventually cause one or more of the operating parameters to exceed published specifications while a small drift in operating point output continues. Symptoms of advanced oil loss and other unrelated problems include:

- Sustained drift rate in true zero and span or operating point output or both
- Sluggish response to increasing or decreasing pressure or both
- Limited output rate or very nonlinear output or both
- Change in output process noise
- Noticeable drift in operating point output
- Abrupt increase in drift rate of true zero or span or both
- Unstable output
- Output saturated high or low

MODELS COVERED

This manual provides basic installation, commissioning, and troubleshooting information for the following PX750 Pressure Transmitters:

Model PX750 - Differential Pressure Transmitter

measures differential pressure from 2 inH_2O to 1,000 psi (0.497 to 6895 kPa).

Model PX750 - Gage Pressure Transmitter

measures gage pressure from 2 inH_2O to 1,000 psi (0.497 to 41369 kPa).

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Model PX750– Alphaline Draft Range Differential Pressure Transmitter
designed for monitoring low pressure flow rates with positive and/or negative static pressure capabilities and 0–½ to 0–6 inH_2O rangeability.

USING THIS MANUAL

This manual is designed to assist in basic installation and operation of Model PX750 Pressure Transmitters.

Section 2 Installation
provides a flowchart outlining installation procedures and installation wiring diagrams.

Section 3 Commissioning
provides a description of common commissioning tasks for the Model PX750 Smart Pressure Transmitter.

Section 4 Commissioning
provides a description of common commissioning tasks for the Model PX750 Analog Pressure Transmitter.

Section 5 Troubleshooting
provides basic troubleshooting techniques for common diagnostic messages associated with the transmitter and the communicator.

Section 6 Reference Data
provides range tables, a typical model structure, and bolt torque specifications for Model PX750 Transmitters.

Appendix
contains menu tree and fast key sequence for the HART Communicator.

SECTION
2

Installation

EN

OVERVIEW

This section contains a flowchart in Figure 2-1 and wiring diagrams in Figures 2-2 through 2-5 to guide you to a successful Model PX750 installation. Shielded cable should be used for best results in electrically noisy environments.

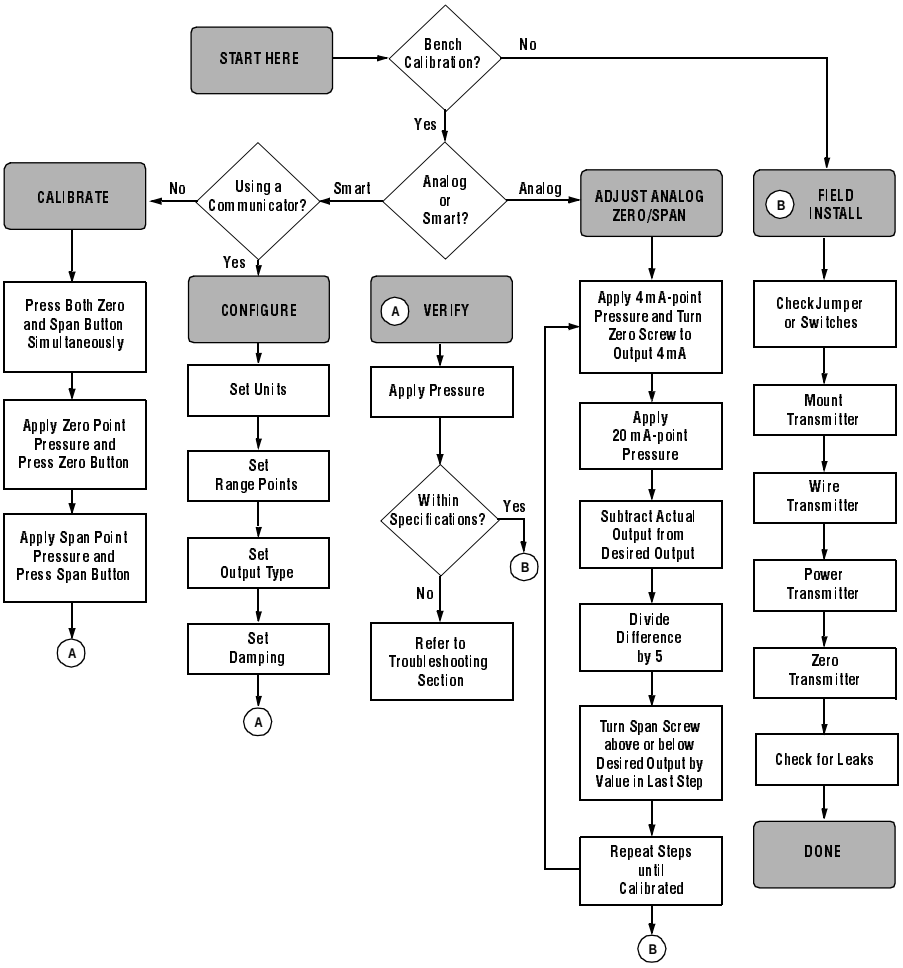
⚠WARNING

Failure to follow safe installation guidelines can cause death or serious injury. Please review the following safety messages before installing a Model PX750 Pressure Transmitter.

- To avoid output shifts in critical applications, do not plug the low side with a solid plug.
- To avoid process leaks, install and tighten all four flange bolts before applying pressure, or process leakage may result. Attempting to remove the flange bolts while the transmitter is in service may cause process fluid leaks.
- To avoid explosions, do not remove the instrument cover or make electrical connections in explosive atmospheres when the circuit is alive. Make sure the instrument is installed in accordance with intrinsically safe or nonincendive field wiring practice.
- To meet explosion proof requirements, make sure that both transmitter covers are fully engaged.

EN

FIGURE 2-1. Installation Flowchart.

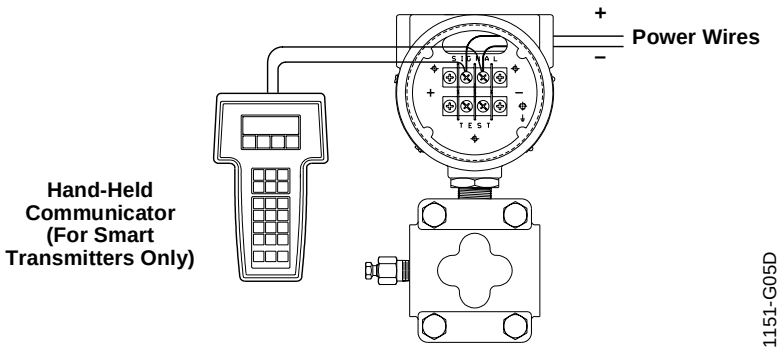


WIRING CONNECTIONS

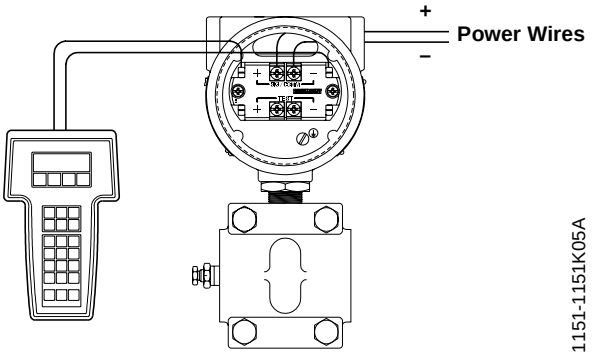
Figure 2-2 shows wiring connections necessary to power a Model PX750 Transmitter and if smart, enable communications with a hand-held communicator. Shielded cable should be used for best results in electrically noisy environments.

NOTE
A resistance of at least 250 ohms must exist between the communicator and the power supply for communications.

FIGURE 2-2. Field Wiring Diagram.



STANDARD TERMINAL BLOCK



OPTION CODE R1 TERMINAL BLOCK

FIGURE 2-3. Model PX750 Wiring Diagrams for Output Codes J and F.

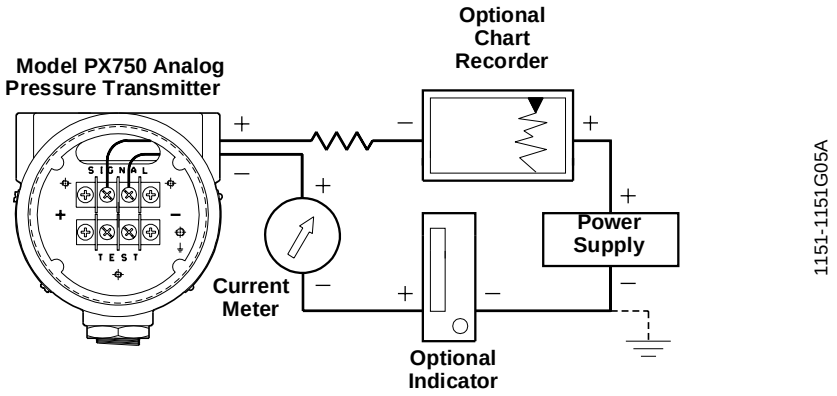
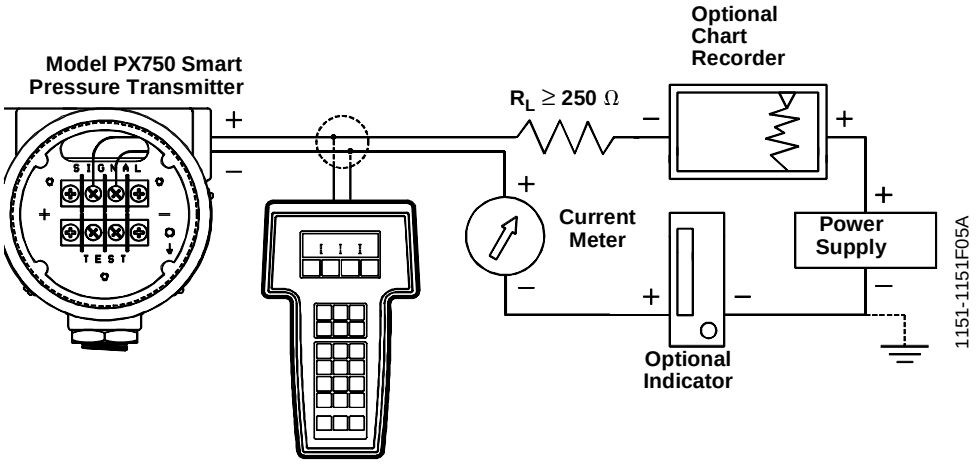


FIGURE 2-4. Model PX750 Wiring Diagram for Smart Output Code S.



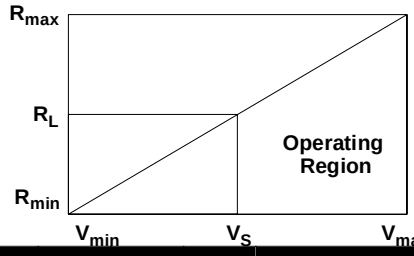
NOTE
Signal Loop may be grounded at any point or left ungrounded.

NOTE
A HART Interface may be connected at any termination point in the loop. Signal loop must have 250 ohms minimum load for communications.

Load Limitations

FIGURE 2-6. Model PX750 Power Supply Requirements.

NOTE
External power supply required.
Transmitter operates on 12 to 45 V dc with no load for Output Codes S and E.



Code	V_{min}	V_{max}	R_{min}	R_{max}	R_L at Supply Voltage (V_S)
S(1)	12	45(2)	0	1650	$R_L = 43.5 (V_S - 12)$
E, J	12	45	0	1650	$R_L = 50 (V_S - 12)$
G	30	85	0	1100	$R_L = 20 (V_S - 30)$
L	5	12	Low Power Minimum Load Impedance: 100 kΩ		
M	8	14			

(1) A minimum of 250 ohms is required for communication.

(2) Vmax for CESI is 42.5 V dc.

SECTION
3

Commissioning the Smart Transmitter

EN

OVERVIEW

This section provides summarized procedures needed to commission the Model PX750 Smart Transmitter.

⚠WARNING

Failure to follow safe commissioning guidelines can cause death or serious injury. Please review the following safety messages before commissioning a Model PX750 Pressure Transmitter.

- To avoid explosions, do not remove the instrument cover or make electrical connections in explosive atmospheres when the circuit is alive. Make sure the instrument is installed in accordance with intrinsically safe or nonincendive field wiring practice.
- To meet explosion proof requirements, make sure that both transmitter covers are fully engaged.

Configure the Analog Output Parameters

Calibrate the Sensor

Calibrate the 4–20 mA Output

FAST KEY SEQUENCES

For your convenience, fast key sequences are listed for common transmitter functions. Complete tables of fast key sequences are located in Appendix A.

EN

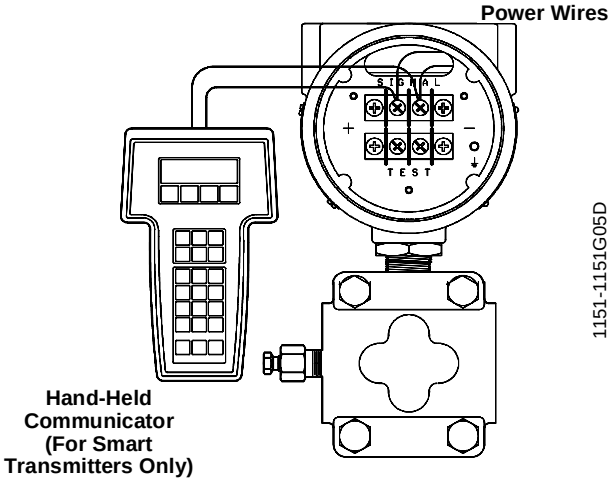
If you are unfamiliar with the communicator or how to follow fast key sequences, please refer to Appendix A for communicator operations.

The fast key boxes in this section contain codes for the HART Communicator Model 275. From the Online Menu (HART Communicator), press these key sequences to access the desired transmitter function.

TABLE 3-1. Fast Key Box.

HART Comm.	1, 5, 3, 2

FIGURE 3-1. CommunicatorWiring Connections.



CONFIGURE THE ANALOG OUTPUT PARAMETERS

Setting Process Variable Units

HART Comm.	1, 3, 2

The Model PX750 allows any of the following output units: inH_2O, inHg, ftH_2O, mmH_2O, mmHg, psi, bar, mbar, g/cm^2, kg/cm^2, Pa, kPa, torr, and atm.

Reranging

EN

Reranging matches the transmitter range points with the applied process pressures. It can be performed three ways: using the communicator, using the communicator and a reference pressure, or by using the transmitter zero and span buttons.

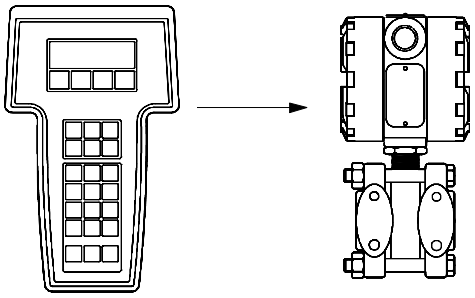
To decide which method is appropriate, consider the following:

- Reranging with the keypad changes the analog 4 and 20 mA points independently.
- Reranging with a pressure input source and the keypad allows you to maintain the same analog span.
- Reranging with a pressure input source and the zero and span screws allows you to maintain the same analog span.

Reranging with a Communicator Only

HART Comm.	1, 2, 3, 1, 1

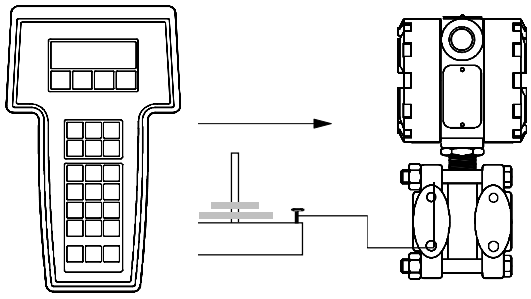
Reranging with the keypad changes the 4 and 20 mA points independently.



Reranging with a Pressure Input Source and a Communicator

HART Comm.	1, 2, 3, 1, 2

Reranging with a pressure input source maintains the same span.



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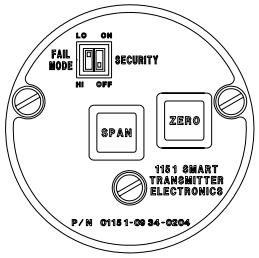
Reranging Using Transmitter Buttons

1. Locate the transmitter zero and span buttons on the transmitter faceplate, as shown in Figure 3-2.

FIGURE 3-2. External Zero and Span Buttons.



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2. Press both span and zero buttons simultaneously for 10 seconds.
3. Using a pressure source with an accuracy three to ten times the desired calibrated accuracy, apply the 4 mA-point pressure to the high side of the transmitter.
4. Press the zero button for five seconds and verify that the output is 4 mA.
5. Apply a pressure equivalent to the 20 mA-point pressure to the high side of the transmitter.
6. Press the span button for five seconds to set the 20 mA point. Verify that the output is 20 mA.

NOTE
Both the lower and upper range values must fall within the lower and upper range limits of the sensor module, and meet the minimum and maximum span criteria allowed by the transmitter.

Setting the Output Type

HART Comm.	1, 3, 5

Setting the output type changes the mathematical relationship between the input pressure and the 4–20 mA output.

The transmitter output type can be set to either linear or square root.

Setting Damping

HART Comm.	1, 3, 6

The Model PX750 has electronic damping that can increase the response time of the transmitter to smooth the output when there are rapid input variations. It can also decrease response time when a rapid response to the process is required.

CALIBRATE THE SENSOR

EN

Digital Trim

Smart transmitters are factory characterized. The information is stored in the sensor module EEPROM during the characterization process. The digital trim function allows you to make adjustments to this factory-stored curve.

Full Trim

HART Comm.	1, 2, 3, 3

A full trim is a two-point sensor calibration where two end-point pressures are applied, and the transmitter process variable output is adjusted to agree with the pressure input.

NOTE

A full trim requires a pressure source at least three times more accurate than the transmitter. For best accuracy, make sure the applied pressure is equal to or slightly less than the desired 4 mA setpoint, or equal to or slightly greater than the 20 mA setpoint.

Zero Trim

HART Comm.	1, 2, 3, 3, 1

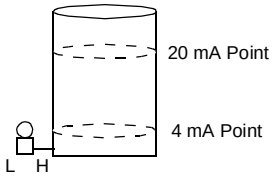
A zero trim is a simpler, one-point process variable adjustment. It must be performed with the low trim value. A zero trim may be used when an exact pressure source is not available for the second pressure needed in a full trim.

A zero trim is useful for compensating for mounting position effects or for zero shifts due to static pressure in differential pressure applications.

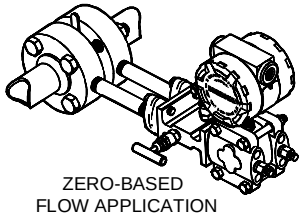
.

Zero-Based Applications:

Use the communicator “Zero Trim” function to change the 4 mA point to represent “0” pressure.



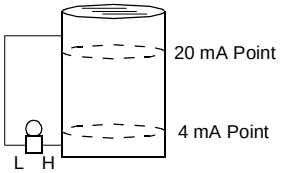
ZERO-BASED
LEVEL APPLICATION



ZERO-BASED
FLOW APPLICATION

EN

Nonzero-Based Applications:
Use the zero pushbutton to shift the 4 and 20 mA points together (maintaining span) to represent new pressure values.



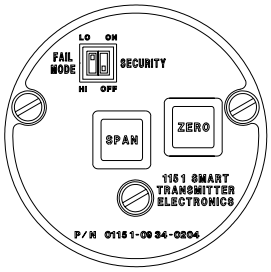
NONZERO-BASED
LEVEL APPLICATION

Zeroing Using Transmitter Buttons

Locate the transmitter zero and span buttons on the transmitter faceplate, as shown in Figure 3-3.

1. Press both span and zero buttons simultaneously for 10 seconds.
2. Apply the 4 mA-point pressure.
3. Press the zero button for five seconds.
4. Verify that the output is 4 mA.

FIGURE 3-3. External Zero and Span Buttons.



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CALIBRATE THE 4–20 MA OUTPUT

Digital to Analog Converter Trim

It may be necessary to calibrate the 4–20 output. The 4–20 mA output trim function can also be used to make adjustments to allow for calibration differences of a particular readout device in the loop.

4–20 mA Output Trim

HART Comm.	1, 2, 3, 2, 1

A 4–20 mA output trim adjusts the transmitter milliamp output to match your plant's standard. This procedure is used if you want to trim the transmitter using a current meter.

4–20 mA Output Trim Using Other Scale

HART Comm.	1, 2, 3, 2, 2

This procedure is used if you want to trim the transmitter and your readout device is in something other than milliamps (e.g. volts).

SECTION
4

Commissioning the Analog Transmitter

EN

OVERVIEW

This section summarizes procedures needed to commission the Analog Model PX750 Transmitter.

⚠WARNING

Failure to follow safe commissioning guidelines can cause death or serious injury. Please review the following safety messages before commissioning a Model PX750 Pressure Transmitter.

- To avoid explosions, do not remove the instrument cover or make electrical connections in explosive atmospheres when the circuit is alive. Make sure the instrument is installed in accordance with intrinsically safe or nonincendive field wiring practice.
- To meet explosion proof requirements, make sure that both transmitter covers are fully engaged.

The following tasks are described in this section:

CALIBRATION

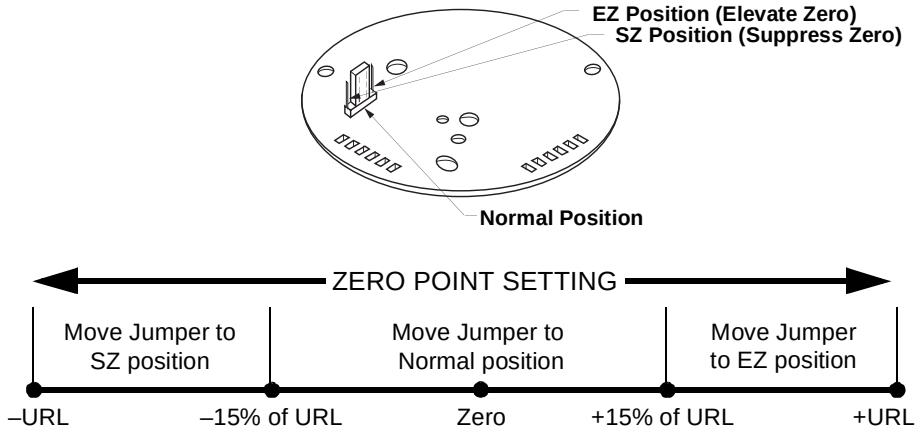
Basic calibration involves these steps:

1. **Set the user-selectable jumper pins.**
2. **Adjusting zero and span.**
3. **Adjusting damping.**

Setting the EZ/SZ Jumper Pin

When the zero point setting is greater than ±15 percent of the transmitter upper range limit (URL), it is necessary to move the user-selectable jumper pin, located on the component side of the amplifier board, as shown in Figure 4-1.

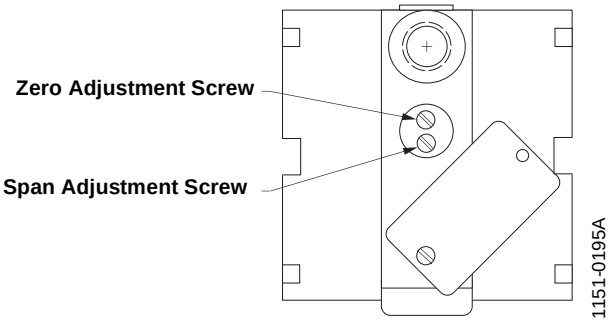
FIGURE 4-1. Analog Transmitter Jumper Positions.



Adjusting for Zero and Span

Figure 4-2 shows the zero and span adjustment screws, located beneath the nameplate on the electronics housing.

FIGURE 4-2. Zero and Span Adjustment Screws.



NOTE
The transmitter output increases with clockwise rotation of the adjustment screws.

NOTE
The zero and span adjustments are interactive. For applications requiring large elevated or suppressed values, refer to "Setting the EZ/SZ Jumper Pin" on page 1.

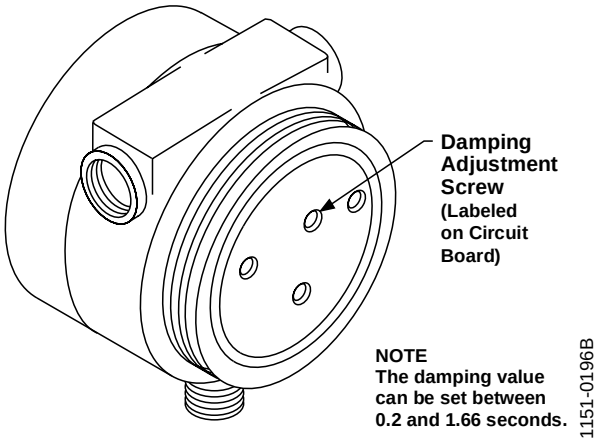
1. Apply 4 mA-point pressure and turn zero screw to output 4 mA.
2. Apply 20 mA-point pressure.
3. Subtract actual output from desired output.
4. Divide difference by 5.
5. Turn span screw above or below desired output by value in Step 4.
6. Repeat Steps 1 through 5 until calibrated.

Adjusting Damping

To change the damping setting, locate the damping adjustment screw, shown in Figure 4-3, and turn the damping adjustment screw clockwise to increase the damping to the desired value.

The damping value can be set between 0.2 and 1.66 seconds. The factory default damping position is set to the transmitter minimum of 0.2 seconds.

FIGURE 4-3. Damping Adjustment Screw.



Adjusting Linearity

The transmitter linearity is factory set for optimum performance over the calibrated range of the instrument and is normally not readjusted in the field.

EN

SECTION
5

Troubleshooting

EN

TROUBLESHOOTING

Tables 5-1 and 5-2 provide summarized troubleshooting suggestions for the most common operating problems.

⚠WARNING

Failure to follow safe operating practices can cause death or serious injury. Please review the following safety messages before troubleshooting the Model PX750 Pressure Transmitter.

- Using improper procedures or parts can affect product performance and the output signal used to control a process. To ensure safe transmitter performance, use only new parts and follow Omega documented procedures. Questions regarding these procedures or parts should be directed to Omega's customer service dept.
- Isolate a failed transmitter from its pressure source as soon as possible. Pressure that may be present could cause death or serious injury to personnel if the transmitter is disassembled or ruptures under pressure.
- To avoid explosions, do not remove the instrument cover or make electrical connections in explosive atmospheres when the circuit is alive. Make sure the instrument is installed in accordance with intrinsically safe or nonincendive field wiring practice.
- To meet explosion proof requirements, make sure that both transmitter covers are fully engaged.
- To avoid process leaks, use only the O-ring designed to seal with the corresponding flange adapter. Omega supplies two unique styles of O-rings for Omega flange adapters: one for Model PX750 flange adapters and another for Model PX751 flange adapters. Each flange adapter is distinguished by its unique groove.

EN

TABLE 5-1. Model PX750 Smart Troubleshooting Chart.

Symptom	Corrective Action
Milliamp Reading is Zero	• Check if Power Polarity is Reversed • Check for Bad Diode in Housing by Jumpering Test Terminals • Replace Transmitter Housing
Transmitter not in Communication	• Check Power Supply Voltage at Transmitter (Minimum 10.5 V) • Check load resistance (250 Ohm minimum) • Replace Electronics Board
Milliamp Reading is Low or High	• Check Pressure Variable Reading • Perform 4–20 mA Output Trim • Replace Electronics Board
No Response to Changes in Applied Pressure	• Check Power Supply Voltage at Transmitter • Check Test Equipment • Verify Calibration Settings (4 and 20 mA points) • Replace Electronics Board • Replace Sensor Module
Low Reading for Pressure Variable	• Check Impulse Piping for Blockage • Check Test Equipment • Perform Full Sensor Trim • Replace Sensor Module
High Reading for Pressure Variable	• Check Impulse Piping for Blockage • Check Test Equipment • Perform Full Sensor Trim • Replace Sensor Module
Erratic Reading for Pressure Variable	• Check Impulse Piping for Blockage • Check Damping • Check for EMF Interference • Replace Sensor Module

TABLE 5-2. Model PX750 Analog Troubleshooting Chart.

Symptom	Corrective Action
Milliamp Reading is Zero	• Check if Power Polarity is Reversed • Check for Bad Diode in Housing by Jumpering Test Terminals • Replace Transmitter Housing
Milliamp Reading is Low	• Check Test Equipment • Check Jumper Pin Position • Adjust Zero • Check Calibration • Replace Sensor Module
Milliamp Reading is High	• Check Test Equipment • Check Calibration • Replace Sensor Module
Transmitter does not Respond to Changes in Pressure	• Close Drain/Vent Valves • Check Power Voltage • Check Test Equipment • Replace Electronics Board • Replace Sensor Module
Spikes in Output	• Check Mounting Location (avoid power lines or motors)

SECTION
6

Reference Data

EN

OVERVIEW

This section contains the following reference data for the Model PX750 Transmitter:

- Transmitter Range Limits
- Bolt Torque Values
- Model Structure

MODEL PX750 UPPER RANGE LIMITS (URL)								
Range Code	bar	mbar	kg/cm^2	psi	kPa	inH_20 @20 °C	mmH_2O @20 °C	inHg @0 °C
3	0.075	75	0.076	1.082	7.461	30	762	2.203
4	0.373	373	0.380	5.409	37.305	150	3810	11.013
5	1.865	1865	1.901	27.045	186.505	750	19050	55.065
6	6.90	6895	7.031	100	690	2773	70434	204
7	21	20685	21	300	2069	8319	211302	611
8	69	68950	70	1000	6895	27730	704340	2036
9	207	206850	211	3000	20685	83190	2113020	6108

Transmitter Part	Torque Value n/m (in-lb)
Flange Bolts	37 ±3 (325 ±25)
Flange Adapter Bolts	40 ±6 (350 ±50)
Drain/Vent Seat	28 ±6 (250 ±50)
Drain/Vent Stem	7 ±1 (60 ±10)

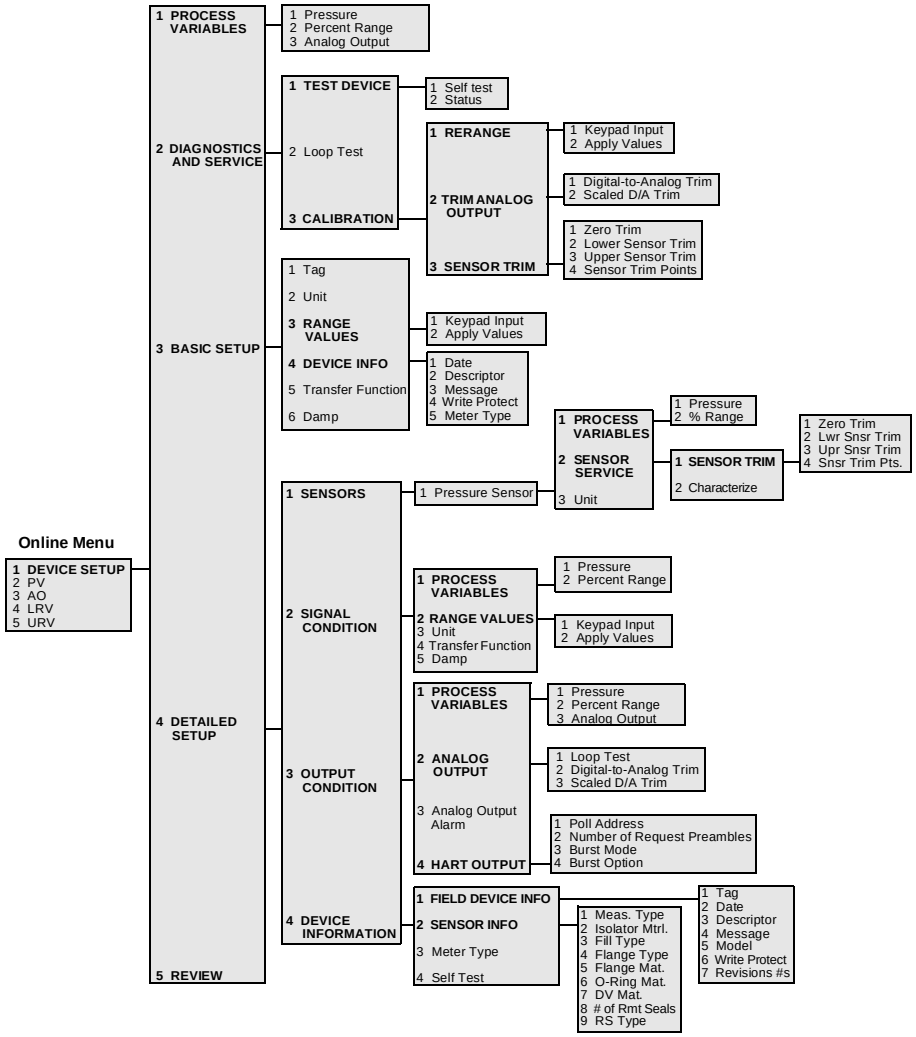
APPENDIX

A

EN

HART®Communicator

FIGURE A-1. HART Communicator Menu Tree for the Model PX750 Smart.



EN

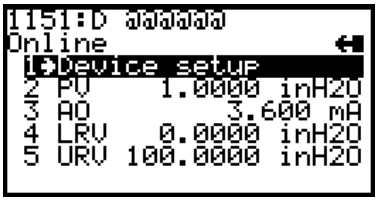
HART COMMUNICATOR

The HART Communicator provides communication capabilities for Model PX750 Smart Pressure Transmitters. The HART Communicator menu tree provides a schematic overview of configuration functions, and the fast key sequences provide direct access to software functions.

Online Menu

The Online menu appears automatically if the HART Communicator is connected to an active loop with an operating transmitter. From the Online menu, press the appropriate key sequence to access the desired function. Follow the on-screen instructions to complete the function.

FIGURE A-2. HART Communicator Online Menu.



HART Fast Key Feature

The fast key sequences for the HART Communicator use the following convention for their identification:

1 through 9–Refer to the keys located in the alphanumeric keypad located below the dedicated keypad.

NOTE
HART fast key sequences are operational only from the Online menu.

Begin fast key sequences from the Online menu. Press **HOME** (normally function key F3) to return to the Online menu from within a function.

HART Fast Key Example

The following example shows how to change the **Date**.

Following the menu tree, press 1 to reach **Device Setup**, press 3 for **Basic Setup**, press 4 for **Device Info**, press 1 for **Date**.

The corresponding HART fast key sequence is 1,3,4,1.

EN

TABLE A-1.
HART Communicator Fast Key Sequences for
Model PX750 Transmitters.

Function	HART Communicator Fast Keys
Analog Output	3
Analog Output Alarm	1, 4, 3, 3
Burst Mode Control	1, 4, 3, 4, 3
Burst Operation	1, 4, 3, 4, 4
Calibration	1, 2, 3
Characterize	1, 4, 1, 1, 2, 2
Damping	1, 3, 6
Date	1, 3, 4, 1
Descriptor	1, 3, 4, 2
Digital To Analog Trim (4–20 mA Output)	1, 2, 3, 2, 1
Field Device Info	1, 4, 4, 1
Full Trim	1, 2, 3, 3
Keypad Input	1, 2, 3, 1, 1
Loop Test	1, 2, 2
Lower Range Value	4, 1
Lower Sensor Trim	1, 2, 3, 3, 2
Message	1, 3, 4, 3
Meter Type	1, 3, 4, 5
Number Of Requested Preambles	1, 4, 3, 4, 2
Percent Range	1, 1, 2
Poll Address	1, 4, 3, 4, 1
Pressure	2
Range Values	1, 3, 3
Rerange	1, 2, 3, 1
Scaled D/A Trim (4–20 mA Output)	1, 2, 3, 2, 2
Self Test (Transmitter)	1, 2, 1, 1
Sensor Info	1, 4, 4, 2
Sensor Trim Points	1, 2, 3, 3, 4
Status	1, 2, 1, 2
Tag	1, 3, 1
Transfer Function (Setting Output Type)	1, 3, 5
Transmitter Security (Write Protect)	1, 3, 4, 4
Trim Analog Output	1, 2, 3, 2

EN

TABLE A-1.
HART Communicator Fast Key Sequences for
Model PX750 Transmitters.

Function	HART Communicator Fast Keys
Units (Process Variable)	1, 3, 2
Upper Range Value	5, 2
Upper Sensor Trim	1, 2, 3, 3, 3
Zero Trim	1, 2, 3, 3, 1

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 months from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

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RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS,
please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible.
This affords our customers the latest in technology and engineering.
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Where Do I Find Everything I Need for Process Measurement and Control? OMEGA…Of Course!

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- √ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
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- √ Cartridge & Strip Heaters
- √ Immersion & Band Heaters
- √ Flexible Heaters
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- √ Metering & Control Instrumentation
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- √ Pumps & Tubing
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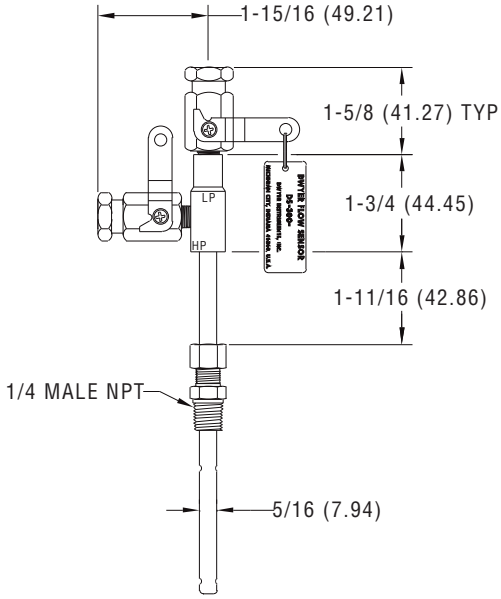
- √ Industrial Water & Wastewater Treatment
- √ pH, Conductivity & Dissolved Oxygen Instruments

M-3263 / 0799

Series DS-300 Flow Sensors

Installation and Operating Instructions Flow Calculations



Series DS-300 Flow Sensors are averaging pitot tubes that provide accurate, convenient flow rate sensing. When purchased with a Dwyer Capsuhelic® for liquid flow or Magnehelic® for air flow, differential pressure gage of appropriate range, the result is a flow-indicating system delivered off the shelf at an economical price. Series DS-300 Flow Sensors are designed to be inserted in the pipeline through a compression fitting and are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® kit. Standard valves are rated at 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 Flow Sensors are available for pipe sizes from 1″ to 10″.

INSPECTION

Inspect sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General - The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location - The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. A rule of thumb is to allow 10 - 15 pipe diameters upstream and 5 downstream. The table below lists recommended up and down piping.

PRESSURE AND TEMPERATURE

Maximum: 200 psig (13.78 bar) at 200°F (93.3°C).

Upstream and Downstream Dimensions in Terms of Internal Diameter of Pipe*

Upstream Condition	Minimum Diameter of Straight Pipe		
	Upstream		Downstream
	In-Plane	Out of Plane	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	8	8	5
All Valves**	24	24	5

* Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values.

** Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. **CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.**

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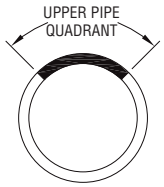
POSITION

Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

Flow sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For Air or Gas Flow

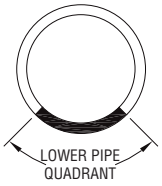
Install in upper quadrant of pipe



Condensate drains back to pipe

For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION

1. When using an A-160 thred-o-let, weld it to the pipe wall. If replacing a DS-200 unit, an A-161 bushing (1/4˝ x 3/8˝) will be needed.

2. Drill through center of the thred-o-let into the pipe with a drill that is slightly larger than the flow sensor diameter.

3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes into the fitting body.

4. Insert sensor until it bottoms against opposite wall of the pipe, then withdraw 1/16˝ to allow for thermal expansion.

5. Tighten packing gland nut finger tight. Then tighten nut with a wrench an additional 1-1/4 turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

INSTRUMENT CONNECTION

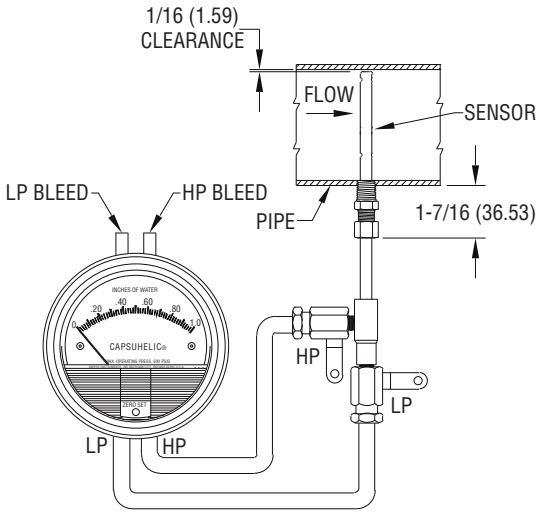
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

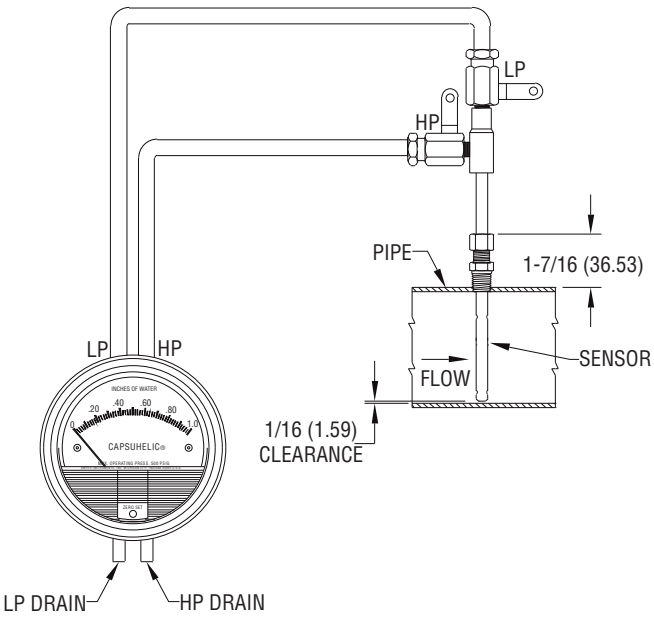
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

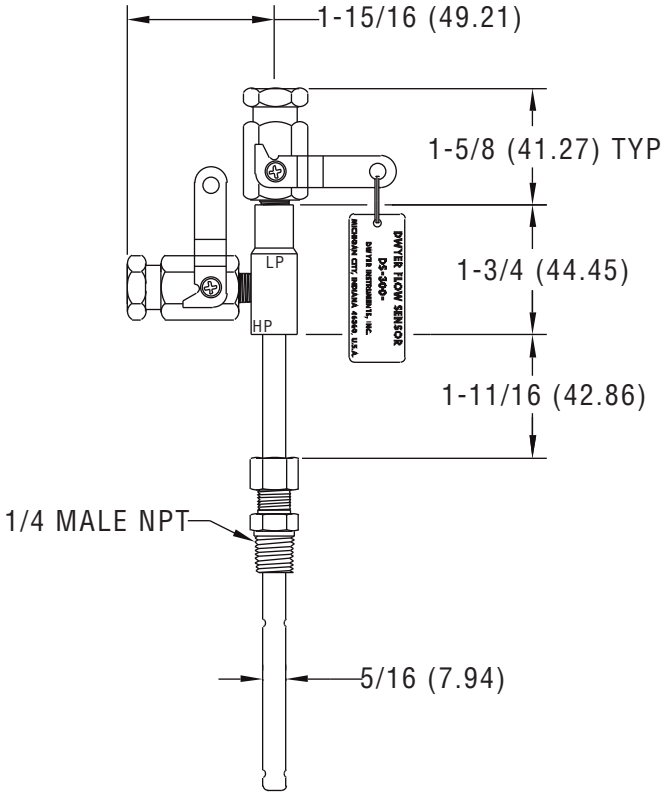
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

Water Flow



Air or Gas Flow





Flow Calculations and Charts

The following information contains tables and equations for determining the differential pressure developed by the DS-300 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

This information can be used to prepare conversion charts to translate the differential pressure readings being sensed into the equivalent flow rate. When direct readout of flow is required, use this information to calculate the full flow differential pressure in order to specify the exact range of Dwyer Magnehelic® or Capsuhelic® gage required. Special ranges and calculations are available for these gages at minimal extra cost. See bulletins A-30 and F-41 for additional information on Magnehelic® and Capsuhelic® gages and DS-300 flow sensors.

For additional useful information on making flow calculations, the following service is recommended: Crane Valve Co. Technical Paper No. 410 “Flow of Fluids Through Valves, Fittings and Pipe.” It is available from Crane Valve Company, www.cranevalve.com.

Using the appropriate differential pressure equation from Page 4 of this bulletin,calculate the differential pressure generated by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges of other gases, liquids an/or operating conditions, consult factory.

Note: the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these ranges can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient “K”	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1-1/4	0.58	1.15 to 157	4.18 to 568	113 to 170
1-1/2	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2-1/2	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16{,}590}$$

Technical Notations

The following notations apply:

ΔP = Differential pressure expressed in inches of water column
Q = Flow expressed in GPM, SCFM, or PPH as shown in equation
K = Flow coefficient— See values tabulated on Pg. 3.
D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)
p = Density of medium in pounds per square foot
S_f = Sp Gr at flowing conditions
S_s = Sp Gr at 60°F (15.6°C)

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520^*}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.
* (520°= 460 + 60°) Std. Temp. Rankine

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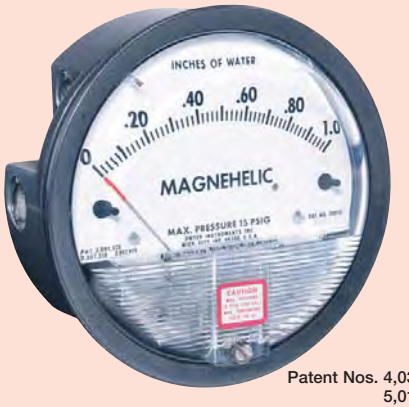
Dwyer®

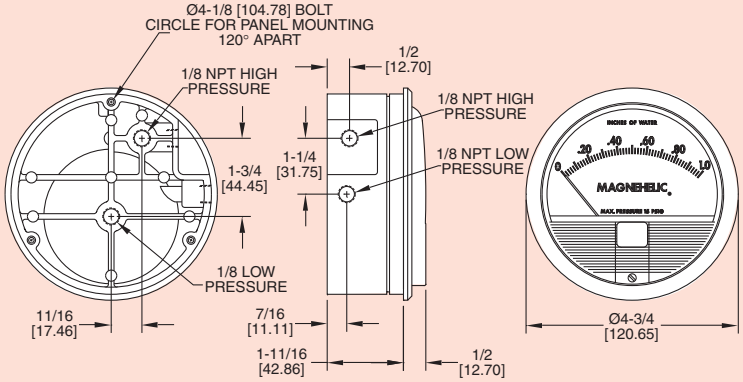
Series 2000 Magnehelic® Differential Pressure Gages

Indicate positive, negative or differential. Accurate within 2%.



Patent Nos. 4,030,365
5,012,678

Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.



Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

Select the Dwyer Magnehelic® gage for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

NOTE: Do Not use with Hydrogen gas. Dangerous reactions will occur.

Flush ...Surface...or Pipe Mounted

MOUNTING. A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional A-610 Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1¼" - 2" pipe. Although calibrated for vertical position, many ranges above 1" may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4⁹⁄₁₆" hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.

VENT VALVES

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4¹³⁄₁₆" hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Weight 1 lb., 10 oz. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult Factory.
Housing: Die cast aluminum case and bezel, with acrylic cover, Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
Accuracy: +/- 2% of full scale (±3% on - 0 and ±4% on - 00 ranges), throughout range at 70°F. (21.1°C)
Pressure Limits: -20˝Hg. to 15 psig.† (-0.677 bar to 1.034 bar); MP option; 35 psig (2.41 bar), HP option; 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 kPa), standard gages only.
Temperature Limits: 20 to 140°F.* (-6.67 to 60°C).
Size: 4˝ (101.6 mm) Diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8˝ female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb. 2 oz. (510g), MP & HP 2 Lb. 2 oz. (963g).
Standard Accessories: Two 1/8˝ NPT plugs for duplicate pressure taps, two 1/8˝ pipe thread to rubber tubing adapter and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)
*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

Transparent overlays
Furnished in red and green to highlight and emphasize critical pressures.

Adjustable signal flag
Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.

LED Setpoint Indicator
Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.

Portable units
Combine carrying case with any Magnehelic® gage of standard range,except high pressure connection. Includes 9 ft. (2.7 m) of ⅜" I.D. rubber tubing, standhang bracket and terminal tube with holder.

Air filter gage accessory package
Adapts any standard Magnehelic® for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft. (1.5 m) lengths of ¼" aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

Dwyer Instruments, Inc./P.O. Box 373/Michigan City, Indiana 46361/Phone 219 879-8000/Fax 219 872-9057 • U.K. Phone (01494)-461707 • Australia Phone (02) 9756-5355

Quality design and construction features

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

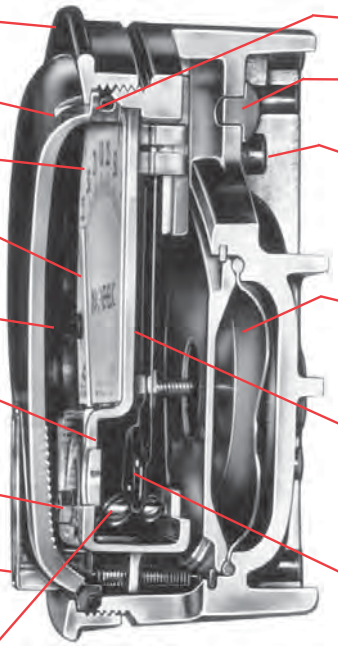
Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.



O-ring seal for cover assures pressure integrity of case.

Blowout plug of silicone rubber protects against overpressure on 15 PSIG rated models. Opens at approximately 25 PSIG.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

Dual Scale English/Metric Models		
Model Number	**Range, In. W.C.**	**Range, Pa or kPa**
2000-OD	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-700 Pa
2004D	0-4.0	0-1.0 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa

SERIES 2000 MAGNEHELIC® — MODELS AND RANGES
STOCKED MODELS in bold

The models below will fulfill most requirements. Page 5 also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

Model Number	Range Inches of Water
2000-00†	0-.25
2000-0†	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2150	0-150

Model Number	Range Zero Center Inches of Water
2300-0†	.25-0-.25
2301	.5-0-.5
2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model Number	Range PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30

*MP option standard
**HP option standard

Dual Scale Air Velocity Units

Model Number	Range in W.C.I Velocity, F.P.M.
2000-00AV	0-.25/300-2000
2000-0AV	0-.50/500-2800
2001AV	0-1.0/500-4000
2002AV	0-2.0/1000-5600
2010AV	0-10/2000-12500

For use with pitot tube.

Model Number	Range MM of Water
2000-6MM†	0-6
2000-10MM	0-10
2000-25MM	0-25
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100

Zero Center Ranges

2300-20MM†	10-0-10

Model Number	Range, CM of Water
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300

Zero Center Ranges

2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

†These ranges calibrated for vertical scale position.

Model Number	Range, Pascals
2000-60 Pa†	0-60
2000-125 Pa†	0-125
2000-250 Pa	0-250
2000-500 Pa	0-500
2000-750 Pa	0-750

Zero Center Ranges

2300-250 Pa	125-0-125
2300-500 Pa	250-0-250

Model Number	Range, Kilopascals
2000-1 kPa	0-1
2000-1.5 kPa	0-1.5
2000-2 kPa	0-2
2000-3 kPa	0-3
2000-4 kPa	0-4
2000-5 kPa	0-5
2000-8 kPa	0-8
2000-10 kPa	0-10
2000-15 kPa	0-15
2000-20 kPa	0-20
2000-25 kPa	0-25
2000-30 kPa	0-30

Zero Center Ranges

2300-1 kPa	.5-0-.5
2300-3 kPa	1.5-0-1.5

Accessories
A-310A, 3-Way Vent Valve
A-321, Safety Relief Valve
A-432, Portable Kit
A-605, Air Filter Kit
A-610, Pipe Mount Kit

Scale Overlays — Red, Green, Mirrored or Combination, Specify Locations

Options — To order, add suffix: I.E. 2001-ASF
ASF (Adjustable Signal Flag)
HP (High Pressure Option)
LT (Low Temperatures to -20°F)
MP (Med. Pressure Option)
SP (Setpoint Indicator

Special Purpose Ranges
Scale No. 2401 Square Root Specify Range
Scale No. 2402 Blank Scale Specify Range

Model 2000-00N. range -.05 to +.20" W.C. For room pressure monitoring

1011R01-0298P

Magnehelic® Differential Pressure Gage

OPERATING INSTRUCTIONS

SPECIFICATIONS

Dimensions: 4-3/4″ dia. x 2-3/16″ deep.

Weight: 1 lb. 2 oz.

Finished: Baked dark gray enamel.

Connections: 1/8″ NPT high and low pressure taps, duplicated, one pair side and one pair back.

Accuracy: Plus or minus 2% of full scale, at 70°F. (Model 2000-0, 3%; 2000-00, 4%).

Pressure Rating: 15 PSI (0,35 bar)

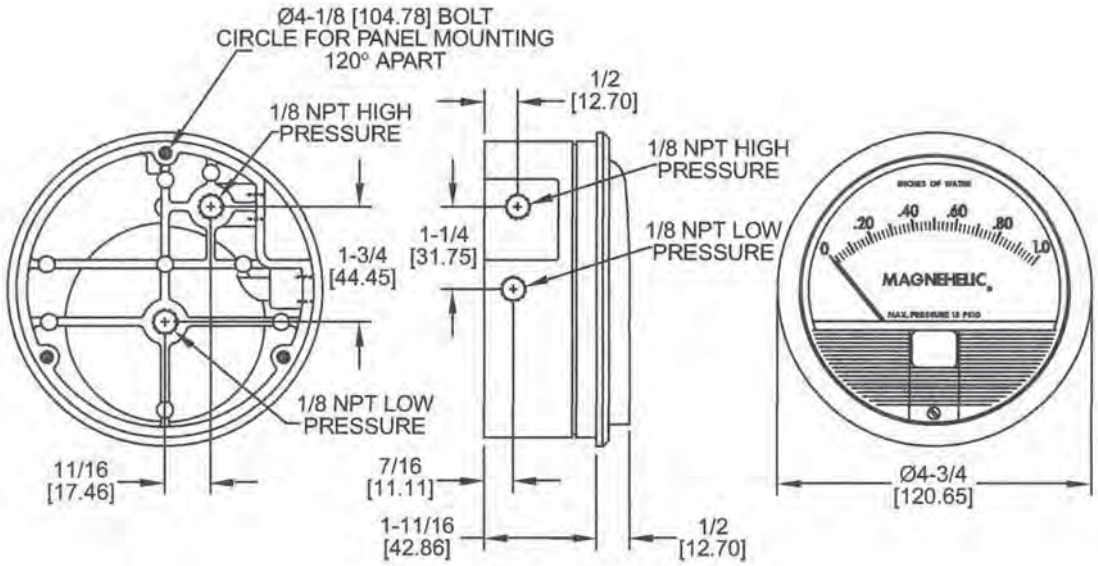
Ambient Temperature Range: 20° to 140°F (-7 to 60°C).

Standard gage accessories include two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ NPT pipe thread to rubber tubing adapters, and three flush mounting adapters with screws.

Caution: For use with air or compatible gases only.

For repeated over-ranging or high cycle rates, contact factory.

Not for use with Hydrogen gas. Dangerous reactions will occur.



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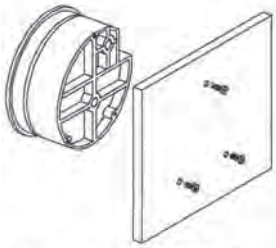
e-mail: info@dwyer-inst.com

MAGNEHELIC® INSTALLATION

1. Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F. Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines my be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.

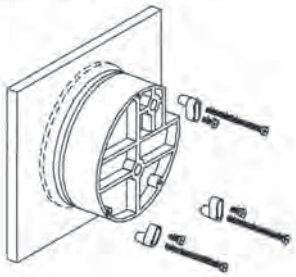
2. All standard Magnehelic gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range Model 2000-00 and metric equivalents must be used in the vertical position only.

3. Surface Mounting



Locate mounting holes, 120° apart on a 4-1/8″ dia. circle. Use No. 6-32 machine screws of appropriate length.

4. Flush Mounting



Provide a 4-9/16″ dia. opening in panel. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place. To mount gage on 1-1/4″-2″ pipe, order optional A-610 pipe mounting kit.

5. To zero the gage after installation

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

Operation

Positive Pressure: Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.

Negative Pressure: Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.

Differential Pressure: Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.

When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

A. For portable use of temporary installation use 1/8″ pipe thread to rubber tubing adapter and connect to source of pressure with rubber or Tygon tubing.

B. For permanent installation, 1/4″ O.D., or larger, copper or aluminum tubing is recommended. See accessory bulletin S-101 for fittings.

Ordering Instructions:

When corresponding with the factory regarding Magnehelic® gage problems, be sure to include model number, pressure range, and any special options. Field repair is not recommended; contact the factory for repair service.

MAINTENANCE

Maintenance: No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves, (bulletin S-101), should be used in permanent installations.

Calibration Check: Select a second gage or manometer of known accuracy and in an appropriate range. Using short lengths of rubber or vinyl tubing, connect the high pressure side of the Magnehelic gage and the test gage to two legs of a tee. Very slowly apply pressure through the third leg. Allow a few seconds for pressure to equalize, fluid to drain, etc., and compare readings. If accuracy unacceptable, gage may be returned to factory for recalibration. To calibrate in the field, use the following procedure.

Calibration:

1. With gage case, held firmly, loosen bezel, by turning counterclockwise. To avoid damage, a canvas strap wrench or similar tool should be used.
2. Lift out plastic cover and "O" ring.
3. Remove scale screws and scale assembly. Be careful not to damage pointer.
4. The calibration is changed by moving the clamp. Loosen the clamp screw(s) and move slightly toward the helix if gage is reading high, and away if reading low. Tighten clamp screw and install scale assembly.
5. Place cover and O-ring in position. Make sure the hex shaft on inside of cover is properly engaged in zero adjust screw.
6. Secure cover in place by screwing bezel down snug. Note that the area under the cover is pressurized in operation and therefore gage will leak if not properly tightened.
7. Zero gage and compare to test instrument. Make further adjustments as necessary.

Caution: If bezel binds when installing, lubricate threads sparingly with light oil or molybdenum disulphide compound.

Warning: Attempted field repair may void your warrenty. Recalibration or repair by the user is not recommended. For best results, return gage to the factory. Ship prepaid to:

Dwyer Instruments, Inc.

Attn: Repair Dept.

102 Indiana Highway 212

Michigan City, IN 46360

Trouble Shooting Tips:

•*Gage won't indicate or is sluggish.*

1. Duplicate pressure port not plugged.
2. Diaphragm ruptured due to overpressure.
3. Fittings or sensing lines blocked, pinched, or leaking.
4. Cover loose or "O"ring damaged, missing.
5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F, order gage with low temperature, (LT) option.

•Pointer stuck-gage can't be zeroed.

1. Scale touching pointer.
2. Spring/magnet assembly shifted and touching helix.
3. **Metallic particles clinging to magnet and interfering with helix movement.**
4. Cover zero adjust shaft broken or not properly engaged in adjusting screw.

We generally recommend that gages needing repair be returned to the factory. Parts used in various sub-assemblies vary from one range of gage to another, and use of incorrect components may cause improper operation. After receipt and inspection, we will be happy to quote repair costs before proceeding.

Consult factory for assistance on unusual applications or conditions.

Use with air or compatible gases only.

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Small Size – Alloys

ORDER IT!

Ordering is Easy! See Page C-12.
Easy online ordering too!

XM/XT-800 Series – Compact Analog Sensors

- Stainless or Brass Construction
- 1/4″ Resolution
- Lengths to 144 inches
- OEM Configurations Available

These compact transmitters feature the rugged durability of stainless steel or brass construction. The XM-800 series provides analog output, and can be combined with GEMS Digital Meter Receiver Stations and compact Level Cubes described in this catalog. Our versatile XT-800 Series adds a choice of signal conditioning for use with GEMS digital bargraph receivers or other digital display and control equipment.

Approvals

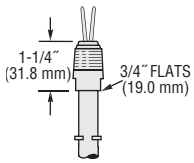
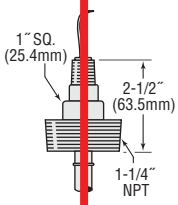
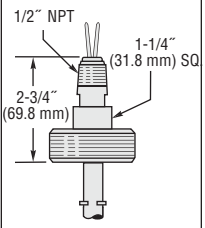
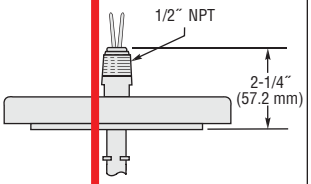
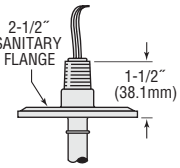
XM-800 and XT-800 Series transmitters may carry the following commercial approvals:

FM Approved, Explosion-Proof (J-Box and Stainless Steel Float required).
UL-Recognized.

XM-800 Series transmitters only:
CSA Certified

XT-800 Series transmitters only:
FM Approved, Intrinsic Safety (J-Box and Stainless Steel Float required).

1. Mounting Types

Type 1 1/2″ NPT	Type 2 1-1/4″ NPT	Type 3 2″ NPT	Type 4 3″ 150# Flange	Type 6 2-1/2″ Sanitary Flange
				

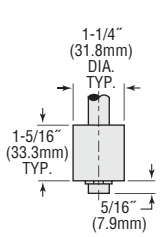
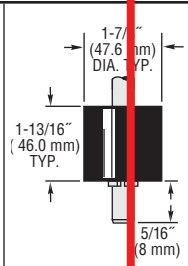
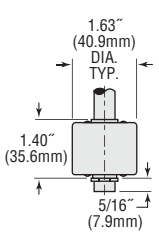
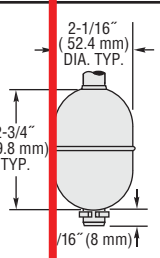
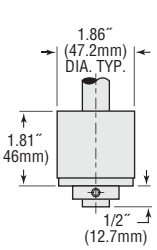
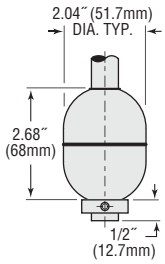
Stem Material	Brass or 316 Stainless Steel	316 Stainless Steel	
Mounting Material	Brass or 316 Stainless Steel	Carbon Steel or 316 Stainless Steel	316 Stainless Steel
Float Stop Material	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings		
Operating Temperature* With J. Box Mounted or XM Signal Conditioners	Oil: -40°F to +230°F (-40°C to 110°C), Water to +180°F (82.2°C)—Buna N Float -40°F to +230°F (-40°C to 110°C)—Stainless Steel Float		
With Stem Mounted Signal Conditioners	+5°F to +160°F (-15°C to +70°C)		
Operating Pressure	Dependent on Float Type; See Next Page		
Overall Length, Max.	72″ (183 cm) Tubing; 144″ (366 cm) Pipe (Types 3 & 4 only)		

* Consult factory for higher temperature ranges.

3-Day Qwik Configured
Available for up to 5 units
Built & Shipped in 3 Days!

2. Float Types

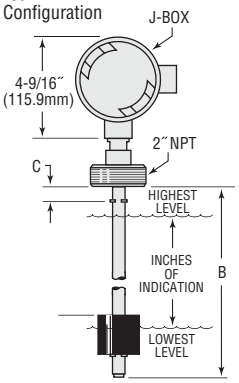
Based on the overall length required by your tank, select from two main subsets of floats below; further refine selection based on material and performance parameters.

	For Overall Lengths To 72″				For Lengths Greater Than 72″ (144″ Max.)	
Float Material	**Buna N**		**Stainless Steel**		**Buna N**	**Stainless Steel**
Float Dimensions						
Compatible Mountings	1, 2, 3, 4, 6	1, 3, 4	1, 3, 4, 6	1, 3, 4	3, 4	3, 4
Part Number	**164255**[2]	**43359**	**156490**	**43590**	**69654**	**52084**
Min. Liquid Spec. Gravity	.55	.55	.70	.75	.55	.75
Operating Pressure, Max.[1]	150 psi (10 bar)	150 psi (10 bar)	80 psi (6 bar)	300 psi (21 bar)	150 psi (10 bar)	300 psi (21 bar)
Operating Temp., Max.	Water: 180°F (82°C) Oil: 230°F (110°C)		300°F (149°C)		Water: 180°F (82°C) Oil: 230°F (110°C)	300°F (149°C)

Notes:
1. @ Ambient Temperature
2. Recommended for Type 2 mounting only.

3. To Determine Dimensions

Typical Configuration



B: Overall Length = Inches of Indication + C + X (See Table at Right)

C: Distance From Bottom of Mounting to Float Stop (Customer Specified):
- 1/4″ (6.4mm) Minimum
- 1-1/4″ (31.8mm) Minimum on Type 1, XT Series only.

Calculating Length

To find Overall Length when Inches or Indication is known:
- Inches of Indication + C* + X = Overall Length

To find Maximum Inches of Indication when Overall Length is known:
- Overall Length - C* - X = Maximum Inches of Indication

*C dimension is determined by customer.

Float Factor – X

Float Part Number	X
164255	2.0″ (50.8)
43359	2.5″ (63.5)
156490	2.062″ (52.4)
43590	3.437″ (87.3)
69654	2.687″ (68.3)
52084	3.625″ (92.1)

Inch (mm)

4. Input/Output

For XM-800 Series, no special output designation is necessary.
For XT-800 Series, specify the desired signal conditioning by Part Number.
Additional information about GEMS signal conditioning modules is found on Page C-23.

Series	Input Voltage	Output Signal	Part Number	Electrical Termination	Compatible Mountings		
					Type 1	Type 3	Type 4
~~XM-800~~	10 to 30 VDC	Proportional Voltage	—	Lead Wires (3), #22 AWG, 24″ (60.9 cm), PTFE Jacket	•	•	•
XT-800	8 to 24 VDC*	0-5 VDC	**51965**	Lead Wires, #22 AWG, 24″ (60.9 cm), PTFE Jacket	•	•	•
	14 to 30 VDC*	0-12 VDC	**51970**		•	•	•
	8 to 24 VDC*	0-5 VDC	**52536**	Junction Box		•	•
	15 to 30 VDC*	0-12 VDC	**52537**			•	•
	10 to 40 VDC	4-20 mA	**52555**			•	•
		~~4-20 mA~~	~~**112389**~~	~~Panel Mount with Plug-in Base~~	•	•	•

* Stem mounted.

Important Points!

- Product must be maintained and installed in strict accordance with the National Electrical Codes, Gems technical brochure, instruction bulletin, and any applicable electrical code in the country in which the product is installed. Failure to observe this warning could result in serious injuries or damages.
- For hazardous area applications involving such things as (but not limited to) ignitable mixtures, combustible dust and flammable materials, use an appropriate intrinsically safe interface device.
- The pressure and temperature limitations shown on the individual catalog pages and drawings for the specified level sensors must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/ temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of GEMS level sensors. Take care in the proper selection of materials of construction, particularly wetted materials.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
- Physical damage sustained by the product may render it unserviceable.

Return Policy

Cancellations and returns are accepted up to 30 days from date of order. You must contact our Returns Department for a Return Authorization (RA) number. Then return goods, freight prepaid, in the original container and include original packing slip. C.O.D. returns are not accepted. Gems Sensors reserves the right to apply restocking or cancellation charges.

Warranty

Gems Sensors, the seller, warrants its products to be free from defects in material and workmanship in normal use and service for a period of one year from date of shipment. Gems Sensors reserves the right and option to refund the purchase price in lieu of repair or replacement upon evaluation of the returned original part. Modification, misuse, attempted repair by others, improper installation or operation shall render this guarantee null and void. Imo Industries Inc., Gems Sensors, makes no warranty of merchantability or fitness for a part or purpose.

Limits of Liability: In no circumstances shall Gems Sensors be liable for special, consequential or exemplary damages of any kind or character, including contract, tort, and strict liability in tort and contract. Equipment sold by Gems Sensors is not intended for use in a nuclear installation, nor shall it be used as a "Basic Component" as same is defined under Part 21, Title 10 of the Code of Federal Regulations. In the event of such use, you agree to indemnify and hold us harmless from any and all subsequent liabilities and responsibilities which might arise in connection with such use.

Gems Sensors Inc.
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(Inside the U.S., call 1-800-847-5691 TOLL-FREE)

P/N 179685
Rev. E

Continuous Level Transmitters

XM-800/XMP-800 Analog Output (Proportional Voltage)

XT-800/XTP-800 Signal Conditioned Output (4-20mA, 0-5 VDC, 0-12 VDC)

Instruction Bulletin No. 179685

Note

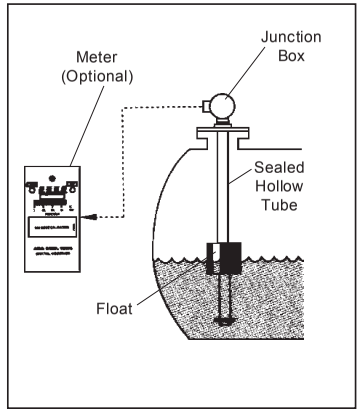
XM-800 Series includes models XM-800, XMP-800, XM-850, XM-820
XT-800 Series includes models XT-800, XTP-800, XT-850, XT-820

Designed for continuous liquid level sensing, GEMS transmitters are considered "components".

Operating Principle

The XM/XT-800 utilizes reed switch/magnet technology. A magnet-equipped float rises or lowers with corresponding liquid level. The magnetic field generated from the float actuates a series of reed switches mounted within a sealed hollow tube. The series of reed switches is combined with resistors to form a voltage divider.

When a regulated DC voltage is applied to an XM-800, the resulting voltage output is directly proportional to liquid level. An XT-800 is an XM-800 with a signal conditioned output, for use in applications that require unregulated input voltage or current output.



Installation / Mounting

Units operate normally in any attitude, from vertical to a 30° inclination, up or down.

Thread Treatment

Sealing: When threading metal threads into a metal coupling , pipe sealant or Teflon tape is recommended. Due to potential compatibility problems, when sealing plastic threaded units, a compatible pipe sealant such as "No More Leaks" from Permatex is recommended.

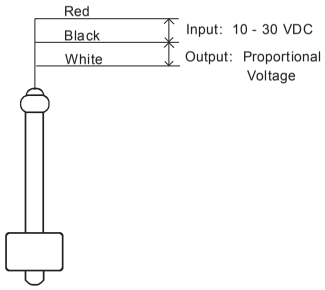
Tightening (Plastic to Metal): When threading a plastic sensor into a metal coupling, the installer should use a suitable wrench and tighten the threads 1 to 1-1/2 additional turns past hand-tight. Over-torquing of the threads will result in damage to the plastic mounting plug.

Tightening (Metal to Metal): When threading a metal sensor into a metal coupling, the installer should use a suitable wrench and tighten the threads 1-1/2 turns past hand-tight.

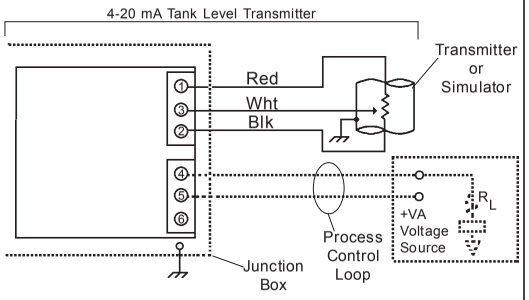
Wiring Diagrams

Note: For hazardous area applications, use an appropriate intrinsically safe interface device.

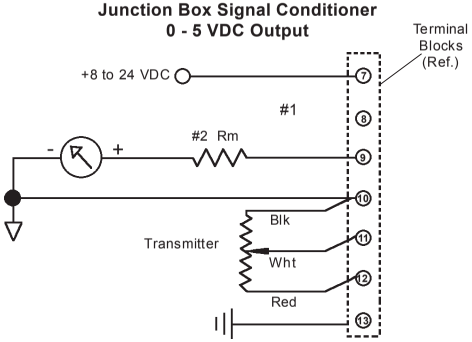
XM-800 Wiring Diagram
Analog Output (Proportional Voltage)



XT-800 Wiring Diagram
(4-20mA Output)



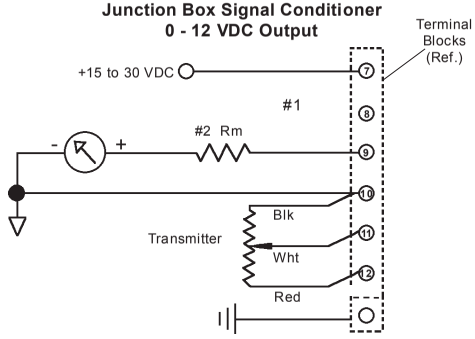
Junction Box Signal Conditioner
0 - 5 VDC Output



#1: Remove wire from terminal 9 and connect it to terminal 8 to provide "full" reference of the system.

#2: Output signal loading (Rm): 4K Ohms/V Max (.25 mA)

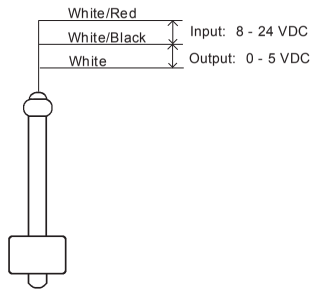
Junction Box Signal Conditioner
0 - 12 VDC Output



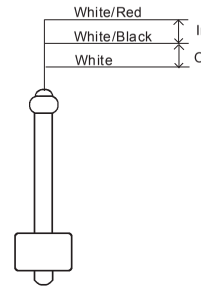
#1: Remove wire from terminal 9 and connect to terminal 8 to provide "full" reference of the system.

#2: Output signal loading (Rm): 2K Ohms/V Max (.5 mA)

Stem-Mounted Signal Conditioner
0 - 5 VDC Output



Stem-Mounted Signal Conditioner
0 - 12 VDC Output



Calibration

The signal conditioner on your XT-800 has been Factory-set. You do not need to calibrate.

Steps:

A. Calibration should be performed with the probe disconnected from the signal conditioner. Turn off power to loop. Disconnect the red, black and white wires from terminals 1, 2, and 3.

B. Adjust both the null and span potentiometers at approximately mid-range. ***(Figure 1)***

C. Wire as shown per ***Figure 2***, connecting a jumper wire in place of the black and white probe wires. Connect an ammeter in series to monitor loop current. Apply power to loop. Adjust null pot for 4mA.

D. Remove power from loop. Reposition the jumper wire in place of red and white probe wires. Reapply power and with the span pot, set the output current to 20mA.

E. Repeat Steps C and D for final adjustment.

F. If power is maintained during jumper connections, current level may increase to 36mA. This is normal. Current will return to regular readings when connections are made.

Figure 1

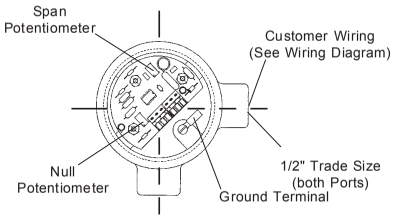


Figure 2

Using 300 Ohm Resistor

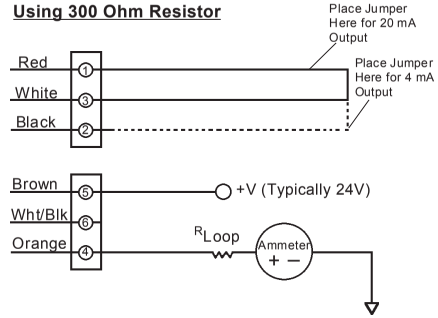
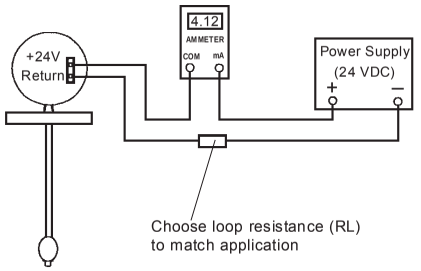


Figure 3



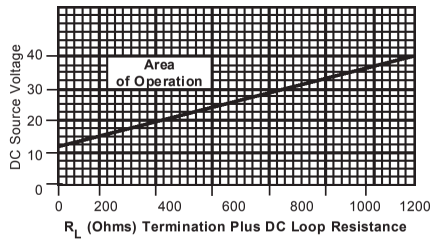
Troubleshooting

Verify proper wiring, power supply, and loop resistance. If transmitter is not functioning properly, isolate the transmitter from the system and wire per ***Figure 3.*** Meter should read 4mA with float at bottom and 20mA with float on top of transmitter. If unit is still not operating properly, please consult Factory for further troubleshooting details.

Excitation Required for Transmitters Using 4-20 mA Signal Conditioners

The minimum excitation required for operation of transmitters with 4-20 mA, DC signal converters ***(See Chart)*** can be determined for a given total loop resistance from the graph shown. (Total loop resistance = the sum of the DC termination resistance plus loop resistance.) For optimum operation, which is a function of source voltage ($+V_A$) and total loop resistance, the source voltage value used should be above the minimum load line for the related loop resistance.

Minimum Excitation Required For Loop Resistance



Series 3F – General Purpose Flanged Fittings
Series 3G – Corrosion Resistant PVC Fittings

- Flange Connections
- Polycarbonate Housing (3G)
- NPT Fitting (3G)
- CSA Approved
- Pressure Tight Assembly
- Epoxy-Coated Aluminum Housing (3F)
- Accepts Various Probes


Series 3F

Series 3G

Designed for general purpose service, Series 3F flanged, pressure-tight fittings can handle up to 7 probes. They mate with standard pipe flanges coupled to the top of the vessel. Available in a variety of materials.

Series 3G fittings are designed for general purpose use, and are made of PVC to withstand corrosive conditions. The flanged assemblies are sized to accommodate up to 7 probes and to mate with standard flanges on the tops of vessels.

Specifications

Type of Connection	
Series 3F	Flanged
Series 3G	NPT, Flanged, Bracket (Plate)
Probes	
Series 3F	1 thru 7
Series 3G	1 thru 4 (2″ fig. NPT); 1 thru 7 (3″ fig. flanged); 1 thru 7 (3″, 6″ bracket plate)
Terminal Housing	
Series 3F	Die-cast aluminum, epoxy-coated
Series 3G	Polycarbonate
Mating Probe Style	
Series 3F	3R – 1/4-20 thread; 3W, 3Y – Wire Suspended
Series 3G	3R – 1/4-20 thread; 3W, 3Y – Wire Suspended; 3T – Tapered Rod
Base Material	
Series 3F	Forged Steel, Red Brass, 316 S.S., 1018 S.S., PVC
Series 3G	PVC
Pressure/Temperature	
Series 3F	125 psig @ 350°F (cast iron); 225 psig @ 150°F (brass) 200 psig @ 100°F (316 s.s.); 275 psig @ 100°F (1018 s.s.) PVC – not rated
Series 3G	0 psig @ 150°F (PVC)
Approvals	CSA (3F)

Dimensions

No. of Probes	Nominal Pipe Flange Size	Diameter of Flange	Conduit Boss Thread Size	Terminal Housing Size (W″ x D″ x H″)
1	1	4-1/2″	1/2″ NPT	2-1/4 x 2-1/4 x 2-1/4
2	2	6″	1/2″ NPT	3-1/4 x 3-1/4 x 2-3/8
3	2	6″	1/2″ NPT	3-1/4 x 3-1/4 x 2-3/8
4	2-1/2	7″	1/2″ NPT	3-1/4 x 3-1/4 x 2-3/8
5	3	7-1/2″	3/4″ NPT	4 x 4 x 2-1/2
6	3	7-1/2″	3/4″ NPT	4 x 4 x 2-1/2
7	3	7-1/2″	3/4″ NPT	4 x 4 x 2-1/2

How to Order

Use the **Bold** characters from the chart below to construct a product code.

3F X X

Series
3F

Number of Probes
1 – One
2 – Two
3 – Three
4 – Four
5 – Five
6 – Six
7 – Seven

Body Material
A – Forged Steel (Raised Face)
B – Red Brass (Flat Face)
C – 316 S.S. (Raised Face)
D – 1018 C.S. (Raised Face)
E – PVC (Flat Face)

3G X X X

Series
3G

Number of Probes
1 – One
2 – Two
3 – Three
4 – Four
5 – Five
6 – Six
7 – Seven

Base Size and Style
A – 2″ Flange (6″ O.D.)[1]
B – 3″ Flange (7-1/2″ O.D.)
C – 3-1/4″ x 6″ x 3/4″ PVC Plate
E – 2″ NPT[1]
H – 3″ NPT

Probe Type
1 – 316 S.S. Inserts for Use with 1/4″ Rod Extensions[2]
2 – Tapered Probe Assembly[3]
3 – Wire-Suspended Probes[4]

Notes:
1. Maximum 4 probes.
2. Order 3R rods separately. See page D-28.
3. Order 3T rods separately. See page D-28.
4. Order 3W/3Y probes separately. See pages D-29 and D-30.

Custom options available. Consult factory.

SECTION - 8

Control Panel

EOS RESEARCH LTD.
ProControl Series II+

ProView Configuration File Information

***** FAX Recipient:	RON TRAMPOSCH *****
***** Customer:	CORE ENVIRONMENTAL *****
***** Site Location:	LONG ISLAND CITY *****
***** Setup:	1 *****
***** Option:	S2P *****
***** Type:	101 *****
***** Serial Number:	7807 *****
***** Date:	01/21/2015 *****
***** Time:	14:38:40 *****
***** ProView:	Version 2.203 *****

THE INPUTS INCLUDED IN THIS SYSTEM ARE:

#	TAGNAME	TAGNAME DESCRIPTION	SETUP*	RANGE
1	MSHL	Moisture Separator High Level (not currently us...	D,NO,ST	
2	MSHH	Moisture Separator High-High Level for Pump Con...	D,NO,ST	
3	HITEMP	High Blower Temp	D,NO,AL	
4	MSHALM	Moisture Separator High Level Alarm	D,NO,AL,SD	
5	SSDS	Blower Run Input	D,NO,ST	
8	RESET	Reset/Start-Up	D,NO,ST,SU	
17	FLOW	System Air Flow	A,EP,ST,SQ	0-1500 CFM

*INPUT SETUP NOTES

D - This input is a (Discrete) or ON/OFF Input.
A - This input is a (Analog) or Variable Input.
NO-This input is a (Normally Open) Discrete Input.
NC-This input is a (Normally Closed) Discrete Input.
EP-(Endpoint) This input is "Active" when its value is outside the low to high setpoint levels.
ST-(Status) This input shows a green LED in ProView when it is in its Active State.
AL-(Alarm) This input shows a red alarm bell in ProView when it is in its Active State.
SU-(Startup) This is a menu function input. When activated it will run the startup routine.
SD-(Shutdown) This is a menu function input. When activated it will run an emergency shutdown.

THE DISCRETE OUTPUTS INCLUDED IN THIS SYSTEM ARE:

#	TAGNAME	TAGNAME DESCRIPTION	SETUP*
1	SSDS	Blower	
4	MSHLA	Moisture Separator High Level Alarm Light	AI
7	TP	Transfer Pump	

*OUTPUT SETUP NOTES

AI-(Alternate Image) - This output is displayed as an icon other than the default switch.

THE PROCESS CONTROL TASKS EXERCISED BY THIS SYSTEM ARE:

Process 01: If MSHALM is ON
THEN Delay for 1 Second, Initiate Shutdown, Switch MSHLA ON

Process 02: If HITEMP is ON
THEN Delay for 1 Second, Initiate Shutdown,

Process 03: If MSHH is ON
THEN Delay for 1 Second, Switch TP ON

Process 04: If MSHH is OFF
THEN Delay for 30 Seconds, Switch TP OFF

Process 05: If SSDS is OFF AND SSDS is ON
THEN Delay for 10 Seconds, Initiate Shutdown,

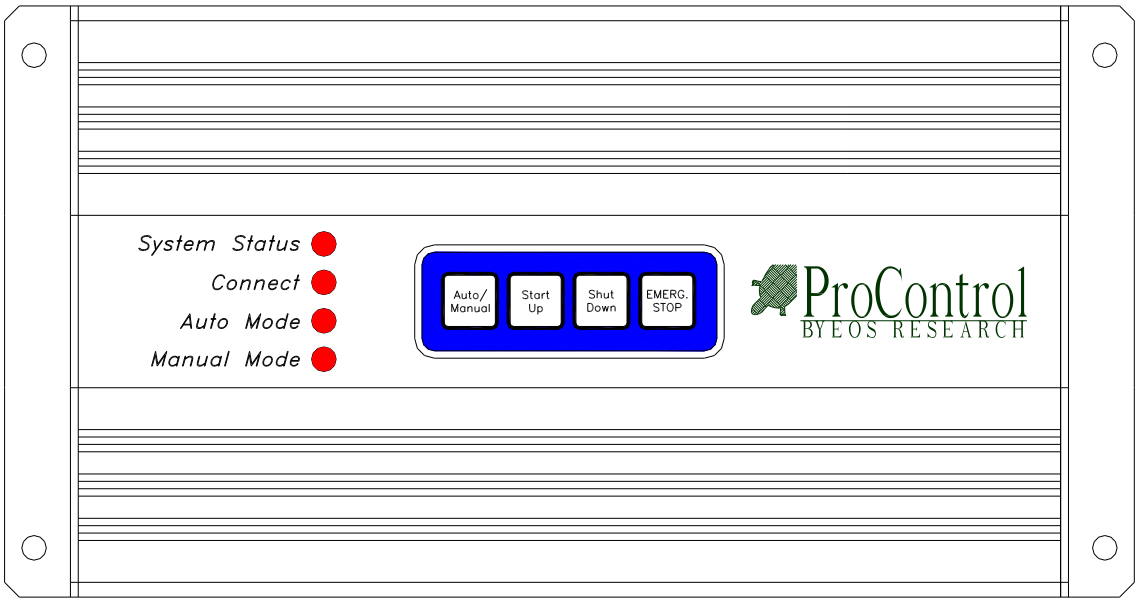
Startup 01: Switch SSDS ON AND MSHLA OFF

Shutdown 01: Switch SSDS OFF

Shutdown 02: Delay for 30 Seconds, Switch TP OFF

PROCONTROL series 2 plus

TYPE C
Product Specification



The **Type C** ProControls are our entry-level models, but don't let the low prices fool you. They're fully-capable PLC and SCADA systems with all the benefits of our other ProControl models, including stand-alone control, remote monitoring, on-board datalogging, and email/text alarm reporting. With industrially-hardened inputs, instrument power supplies, output relays, modem and keypad, the **Type C** contains everything you need for the core of your control/monitoring system. It's ideal for controlling pump stations, retrofitting to existing installations or when used to replace that old alarm dialer. With our free ProView™ software, the **Type C** becomes a sophisticated operations manager, allowing you to track flow rates and run times, receive alarm messages at your cell phone or pager, and download data for reporting purposes. So why use just an autodialer, when you can have a fully capable SCADA system for about the same price?

	Model C1	Model C2
INPUTS		
Discrete	Ten (10) protected discrete inputs. Support for 2 flowmeters or pulse accumulators with rates to 200Hz.	Eight (8) protected discrete inputs. Support for 2 flowmeters or pulse accumulators with rates to 200Hz
Analog	Two (2) 4-20ma inputs with built-in 24Vdc supply. Inputs are surge and short-circuit protected.	Two (2) 4-20ma inputs with built-in 24Vdc supply. Inputs are surge and short-circuit protected.
OUTPUTS		
Discrete	Eight (8) relay outputs rated at 1 Amp, 120VAC	Eight (8) relay outputs rated at 1 Amp, 120VAC
Analog		Two (2) 4-20ma outputs. PID loop control.

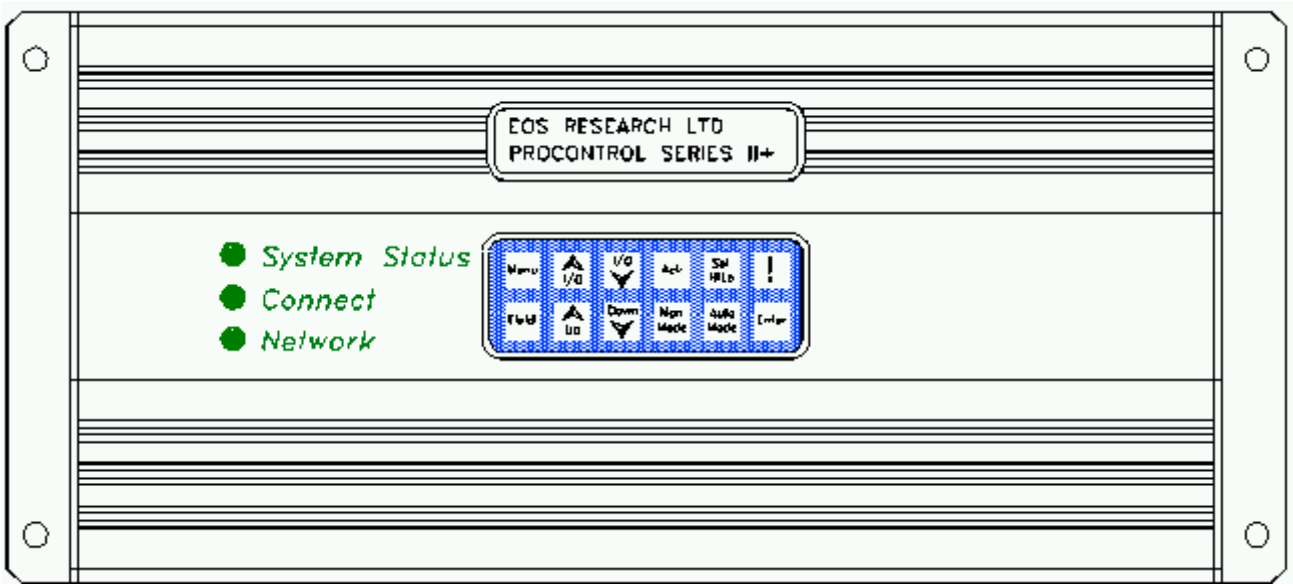
	Model C1	Model C2
DATALOGGING		
Discrete	250 points. All logging occurs on change of state.	2,000 points. All logging occurs on change of state.
Analog	500 points per channel	2,000 points per channel
Event	500 points	2,000 points
Totalizer	25 points per channel	50 points per channel
COMMUNICATIONS		
Cellular IP:	ProView™ Software, real-time monitoring from any broadband connection. Alarm and Status Emails, text messaging on alarm	
Analog phone modem:	ProView™ Software, real-time monitoring from any phone line. Alarm and Status fax reports, text/pager messages	
USER INTERFACE		
Keypad	1 x 4 membrane keypad.	
LEDs	LEDs: System Status, Communications Link, Auto Mode, Manual Mode	
PROCESS CONTROL		
System	Up to 32 regular system processes total (16 for C1) with 8 startup and 8 shutdown processes, specified by easy-to-understand Boolean (IF...THEN) logic	
Alarms	Generate shutdowns, emails, FAX reports and/or text messages.	
Analog	Four activation levels per analog input, On/Off control and alarm reporting	
Loops	PID loop control (Type C2 only) with user control of setpoint, proportional, integral and derivative gains and max change per calculation. Also open loop proportional algorithm.	
POWER		
System	10VAC, 30VA, external transformer provided	
I/O Supply	24 VDC and 12VDC available for powering sensors/instruments.	
ENVIRONMENTAL		
Dimensions	11.5" long x 6" wide x 3.5" high.	
Weight	4 lbs.	
Power Dissipation	20W max.	
Operating Temperature	-20C to +50C	
Humidity	95% R.H. non-condensing	

Crafted in the USA by people who know how to build something to last.

159 Walnut Street
Rochester, NH 03867
(603) 332-2099
(603) 332-2727 FAX
www.eosresearch.com

PROCONTROL

SERIES 2*plus* USER MANUAL



Version 2.X

LIMITED WARRANTY

EOS Research Ltd. (EOS) warrants its products to be free from defects in materials and workmanship for a period of one year from the date of purchase. Its obligation under this warranty is limited to repairing or replacing, at its sole option, any such defective products. This warranty includes parts and labor. This warranty does not apply to equipment which has been damaged by accident, negligence or misapplication or has been altered or modified in any way.

EXCEPT AS PROVIDED HEREIN, EOS RESEARCH LTD. MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MECHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not permit limitation or exclusion of implied warranties, therefore the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

IMPORTANT SAFETY PRECAUTIONS

Any complex hardware or software may be difficult to document, explain or understand. It is important to consider the consequences or unexpected or abnormal behavior which may be caused by a defect or human failure to comprehend. In order to protect people and property from damage, a thorough safety analysis should always be performed. When the consequences of a failure are serious, it is essential to protect life and property against such a failure with redundant backup systems or safety devices. It is agreed between the purchaser and EOS Research Ltd. that protection against and the consequences of any such failure are entirely the purchaser's responsibility.

This device is not approved for use in life support or medical systems.

As installed, this product may be part of a system which is required to meet various electrical, fire, safety or other codes and regulations. Compliance with these codes is the purchaser's responsibility.

Specifications subject to change without notice.

EOS Research Ltd.
159 Walnut Street
Rochester, NH 03867
603.332.2099
Fax: 603.332.2727
procontrol@eosresearch.com

TABLE OF CONTENTS

Please see the ProView manual for operation of the remote access software which is supplied with the ProControl Series **2*plus***.

1.0 SYSTEM OVERVIEW

1.1 General

The *ProControl Series* **2**^{plus} is a small but powerful microprocessor based control/ telemonitoring system. By combining a control panel and remote monitor in one unit, the Series **2**^{plus} can act as a central supervisory and data management tool for any stand-alone operation. The *ProControl Series* **2**^{plus} can perform multiple tasks:

- **Stand-Alone Control:** The *ProControl Series* **2**^{plus} is a sophisticated programmable logic controller that will efficiently supervise and control your operation. It can interface with up to 70 electrical devices (float switches, pressure transducers, pH transmitters, flow meters, pumps, blowers, etc.), and execute numerous control functions simultaneously. Automatic shutdown routines can be programmed in to protect you operation during alarm conditions. It is extremely versatile in terms of the control algorithms it can execute.

- **Remote Control and Monitoring:** The *ProControl Series* **2**^{plus} gives you a window into your operation from any remote location, using the easy-to-use Windows-based software supplied with the system. You communicate with the ProControl over a modem link, which allows you to view all of your system's operating conditions, while also providing the same access to control functions that you would have if you were at the site (e.g., turning pumps on and off, adjusting alarm setpoints, etc.). No other telemonitoring device gives you the ProControl's level of remote control capability.

- **Reporting:** The *ProControl Series* **2**^{plus} will keep you informed. It will send you periodic fax status reports of your project operations on a schedule specified by you, and will alert you immediately either by fax or by numeric or alpha-numeric pager if an alarm condition warrants attention. No longer do you have to assume what's happening at your remote operation.....the ProControl will tell you exactly.

- **Datalogging:** The *ProControl Series* **2**^{plus} is your information manager. It is a powerful datalogger that automatically records all operating conditions in its battery-backed memory. You can access your logged data remotely at any time, and download it to your office computer for further processing. The datalogging capability is an invaluable tool for reporting purposes, troubleshooting, and trend graphing.

One or more of these features can be used in your installation; they are standard in every ProControl unit.

1.2 Key Concepts

The following are the building blocks of any Series **2*plus*** monitoring and control system.

Inputs and Outputs (I/O's)

No system can be effective in the real world without communication and one of the principal ways the ProControl communicates is by responding to information collected by sensors and by issuing "commands" to other electronic or electrical devices. Sensor information constitutes an *Input* while a "command" to another device constitutes an *Output*. The Series **2*plus*** works with all of the more important types of I/O devices in general use. Appendix A demonstrates how a variety of I/O devices are connected to the ProControl.

Digital Inputs

These inputs are designed to detect the closure of switch contacts such as those found on float switches or overpressure sensors. They can respond to any normally open or normally closed dry contact. The Series **2*plus*** provides its own wetting (supply) voltage of 5 volts DC for each digital input circuit. The Series **2*plus*** can respond to changes in state as fast as 4 Hz or 3 Hz (cycles per second) depending on the model purchased. Digital inputs are "debounced" for 125 or 150 milliseconds, respectively. This means that a switch or other input that changes state (becomes open or closed) must stay in that state for 125 or 150 milliseconds before the Series **2*plus*** will respond to the change.

Eight high-speed digital inputs can also be used for traditional digital (pulse-output) flow meters. These inputs can detect signal changes at up to a 200/500 Hz rate. All high-speed digital inputs are "debounced" for 1250/500 microseconds. The faster rate applies only to those systems containing the 18.432 MHz processor.

Analog Inputs

These inputs are compatible with sensors which send out a 4 - 20 milliamp (mA) signal. Most analog sensors are available with this type of signal, examples being pressure transducers, pH transmitters, and many flow meters. These inputs allow the operator to read the actual "value" of a parameter, such as pressure, instead of an on/off signal.

Digital Outputs

Digital outputs turn things like pumps, solenoid valves, and alarm lights on and off. The Series **2*plus*** digital outputs are relay outputs designed to switch small loads directly, such as motor starters, lamps, and solenoid valves.

Analog Outputs

Analog outputs are typically used in process control schemes where a controlled piece of equipment can accept a signal which is variable over a range. This output is expressed as a percentage (0 - 100%) and is used to control pump speeds, chemical dosing rates, etc., instead of conventional on/off operation. The equipment that the ProControl sends the analog output to must accept a 4 - 20 mA signal. Often, an analog output is used in conjunction with an analog input such as a pH transmitter to form a control scheme known as *feedback control*. In essence, the input and output will work together to maintain a user set input level. This concept is described further in the next section under *Analog Output Processes*.

Tagnames

Each input and output is given a descriptive *Tagname* by the user that uniquely identifies it to the system operator. For instance, a digital input could be called "TANKHI", an analog input could be called "AIRFLO" and a digital output could be called "PUMP_1". This tagname is used by the local LCD display, the FAX report and by the ProView software. The analog inputs are also given a *Units Tagname* which identifies the unit of measure associated with the input sensor. Each tagname can be up to six characters long and each units tagname can be up to three characters long ("PSI", for instance). The tagnames can include the uppercase letters A-Z, the numbers 0-9, a blank space, and the underscore (_) character.

1.3 Control Basics

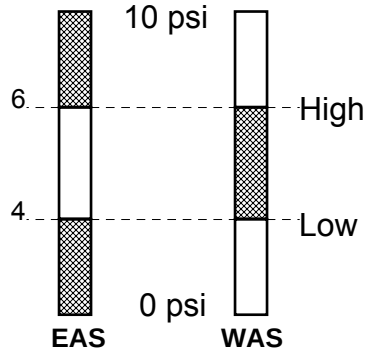
The status of all inputs or outputs can easily be monitored both locally and remotely. What gives the Series **2*plus*** its real power, however, is the ability to automatically initiate actions based on the status of the inputs and your pre-programmed instructions (this is often called *Process Control*). These actions can include switching certain outputs, faxing back a report, sending an alphanumeric or numeric page, shutting down the entire system or sounding the local alarm. Process control functions are programmed into your ProControl by EOS Research or one of our technology partners according to your specifications.

Active State

Central to the use of control on the Series **2*plus*** is the concept of *Active State*. Each input on the ProControl receives certain signals from a sensor which constitute "normal" operation and other signals which constitute an exception to normal operation.

A digital input can monitor only two states, ON or OFF (alternatively, CLOSED or OPEN). The *Active State* would be the state in which the controller would respond to the digital input, and perform certain actions or generate an alarm. For example, if a high level float switch in a tank is tripped (turned ON) by rising fluid level, we can say that its *Active State* correlates to a situation in which the fluid level is high. The active state of the float switch could cause the Series **2*plus*** to trigger an alarm, turn off a pump, or initiate some other action. The Series **2*plus*** can be set up so that either ON or OFF is the active state.

An analog input sensor can take on many states (or values) between the minimum and maximum of its measurement range. The ProControl operator, however, can set two threshold values which divide the total input span into two functional regions. These threshold values are more commonly called the *Low Alarm Limit* and the *High Alarm Limit*, although on the Series **2*plus*** these thresholds are somewhat more flexible in use than those names imply. An analog input which has transcended either its Low Alarm Limit or High Alarm Limit is said to be in its active state.



For instance, consider an analog input sensor which measures pressure from 0 to 10 PSI. The system operator could set the low limit to 4 PSI and the high limit to 6 PSI. In this case the *Active State* would usually be considered as the input state greater than 6 PSI or less than 4 PSI. This interpretation is called *Endpoint Active State* (EAS) on the Series **2*plus*** because the endpoints of the range are the areas which need to trigger action or generate alarms. The opposite interpretation is also possible and is called *Window Active State* (WAS). Any input values between 4 PSI and 6 PSI would trigger action or generate alarms.

Figure 1. Active State

If the ProControl has *Alarms Set*, when any input enters its active state, a local beeper will sound on the ProControl. The word *Alarm* here applies only to the sounding of a local beeper and is not associated with any process control. The active state condition is indicated on the LCD display and can be acknowledged by the operator. The beeper is silenced when it has been acknowledged or after 30 seconds have elapsed. The beeper only operates when the system is operating in Manual mode.

Startup Sequence

The *Startup Sequence* is a series of control algorithms or steps which run in succession and which are designed to place the system in its normal operating mode. It can be as simple as turning all the outputs on simultaneously, or as complex as a multi-stage delay with many conditions. Up to 8 or 16 individual startup steps can be declared depending on the model of the controller. The ProControl can be configured to automatically run this sequence when the unit is powered up.

Process Tasks

A *Process Task* is an ongoing control algorithm which runs continuously. Think of each process task as an IF-THEN statement, in which an action is initiated if a certain condition or combination of conditions exists. Some examples are:

- IF Tank Level Sensor 2 is on, THEN turn Pump 2 off
- IF Air Flow Rate < 10 cfm AND Reactor Temperature > 250^{o}, THEN open Bleed Valve 2

Up to 16 or 64 separate process tasks can be run simultaneously depending on the model of the controller. Process tasks can trigger FAX reports, pager alerts, and system shutdowns.

Shutdown Sequence

The *Shutdown Sequence* is a series of control steps which run in succession and which are designed to shut your system down in a manner which is best for the equipment or treatment processes involved. The shutdown sequence can be activated manually or automatically due to an alarm condition. Here is a typical shutdown sequence:

- Turn off Well Pumps 1 and 2
- Wait 5 minutes, then turn off Stripper Blower
- Open Bleed Valve 2
- When Oxidizer Temperature < 150^{o}, turn off SVE Blower

Automatic Operation

The use of the startup sequence, process tasks, and the shutdown sequence constitutes *Automatic Operation* of your system with the ProControl Series **2*plus*** (otherwise known as *Auto Mode*). The Series **2*plus*** will be placed into auto mode (automatically) when your system has been started up using the programmed startup sequence. If one condition of the programmed startup sequence is not met during the startup process, your system will be completely shut down by the ProControl as a safety measure. Once the startup sequence has been successfully completed, the ProControl begins running the process tasks continuously. **PROCESS TASKS WILL RUN ONLY WHEN IN AUTO MODE**. Please note that the audible beeper will not sound even if the ProControl has *Alarms Set* when it is in Auto Mode, since the process tasks will control these situations as the user has specified.

Manual Operation

You can override the Series **2**^{plus} programmed control functions by operating in *Manual Mode*. In manual mode, your process will respond only to operator input from the keypad of the ProControl, or to commands issued from the ProView software. **PLEASE NOTE THAT PROCESS TASKS AND THEIR ERROR-CHECKING MECHANISMS DO NOT RUN DURING MANUAL MODE!** Manual mode is useful when you wish to troubleshoot your system, but none of the system safeguards built into auto mode are available. You can place your operation into auto mode any time by issuing the command from the keypad.

Analog Output Processes

In some cases, you may want to use an analog output to control equipment that maintains an analog input at a certain constant level. For example, you may wish to automatically maintain a pH of 8.5 in a reaction tank by varying the dosing rate of a chemical feed pump. The pH you wish to maintain (8.5) is called the *SetPoint* of the analog output process. An analog input to the ProControl (in this case, a pH transmitter) is said to provide *feedback* to the unit, and combined with an analog output, constitute *feedback control*.

PID Loops

A reliable type of feedback control can be obtained through a *PID Loop*. PID stands for *Proportional-Integral-Derivative*, and is a commonly-used process control technique. We'll skip the details of the mathematics involved, but suffice it to say that a PID loop is the favored control technique for most analog output processes. With only a *Proportional* term applied in the equation, the analog output is controlled based on an error signal generated from the difference between the SetPoint and the actual analog input. The PID loop can also improve its performance as it continues to run if an *Integral* term is used and can respond to quick changes in the controlling analog input if a *Derivative* term is used. EOS Research will configure your PID loops for you and can provide further information if necessary.

Proportional Outputs

In some cases, it may be desirable to base an analog output signal on an analog input value. In this situation, no specific SetPoint is used because there is a direct relationship between the output and input values. For example, if you wanted to base the output of a metering pump on some flow rate, you might use a proportional output to relate the amount of chemical metered to the flow rate.

2.0 ON-SITE OPERATION

2.1 LCD Display

If your unit did not come with an LCD display, the following sections *do not* apply.

The 2 line x 20 character LCD display is used to display and control system operations. The display is divided into separate areas or fields, as outlined below.

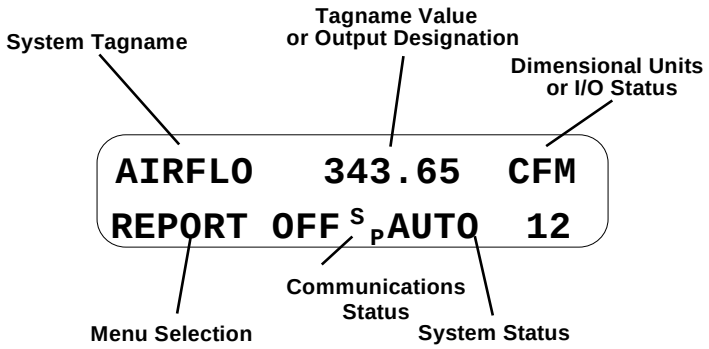


Figure 2. Display Fields

System Tagname This six-character field is used to identify the I/O point displayed. Descriptive names such as WELL1 or BLOWER are used.

Tagname Value For analog inputs, this field displays the value of the input, the high alarm limit, or the low alarm limit. For digital outputs, OUTPUT is displayed. For digital inputs, this field is unused. For analog outputs, this field displays the output percentage, the output level, or the associated input setpoint.

Dimensional Units or I/O Status For analog inputs, this three-character field displays the dimensional units associated with the input sensor, such as GPM or PSI. For digital inputs and outputs, this field displays either ON or OFF. For analog outputs, this field abbreviates percent with PCT. In the case of digital outputs, if the particular output displayed has been designated a lamp output (*see ProView manual*), and a lamp test is currently running, an asterisk (*) will appear before ON or OFF to indicate the lamp is illuminated despite the indicated output status (the output will return to this indicated status once the lamp test has been completed).

Menu Selection This field displays the current menu selection.

Communications Status This field displays one of five different descriptors which indicate any of several special functions of the ProControl. If no communications action is being taken, ">" will appear. Communications messages include: **SP** (Sending Page) - indicates that the unit is attempting to send either an alphanumeric or numeric page; **EF** (Encoding Fax) - indicates that the unit is presently encoding a facsimile report as a result of a request by either the operator or the unit itself; **SF** (Sending Fax) - indicates that the unit is attempting to send a fax report; and **DC** (Data Communications) - indicates that the unit is presently interfaced with ProView.

System Status This area displays the current system status: AUTO, MANUAL, START, or SHUTD and an associated process task number indicating the last successfully completed Auto process, current Startup process, or current Shutdown process.

2.2 Keypad

The Series **2**^{plus} keypad contains 12 buttons which are used along with the LCD Display to control the operations of the system.

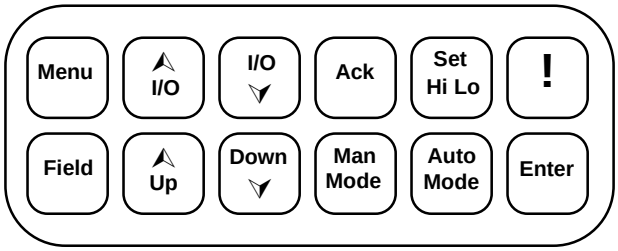


Figure 3. Series 2^{plus} Keypad

Menu — This key is used to scroll through a series of options which are displayed on the LCD screen, and which allow the user to configure various aspects of system behavior.

I/O / I/O — These keys are used to display information about particular I/O points on the LCD Screen. The keys allow the user to scroll through all of the system I/O points either forward or backward.

Ack — The Acknowledge key is used to silence the audible beeper or to acknowledge a memo sent from a remote ProView user.

Set Hi Lo — The Set Hi Lo key allows the user to change the high and low alarm limits for analog inputs or to toggle the display in the I/O Summary.

! — The Emergency Shutdown key is used to turn off all outputs and return the system to manual mode. The programmed shutdown sequence is <u>not</u> executed using this key.

Field — The Field key is used to select a character position to be edited. It is used in conjunction with any direct alphanumeric entry.

Up / Down — These keys are used to toggle system variables from one state to the next or to scroll through possible character entries when used in conjunction with the Field key.

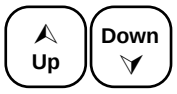
Man Mode — This key is used to place the system in manual mode.

Auto Mode — This key is used to place the system in auto mode.

Enter — The Enter key is used to initiate certain actions selected by other keys or to confirm alphanumeric editing done using other keys.

2.3 Password

When the system is first turned on the password screen is displayed and the user is prompted to enter the password to gain access to the system. "EOS" is the default password. The password on the Series **2**^{plus} was designed as a *low-level* security feature. It is not sufficient in and of itself to withstand a determined effort at system entry. The ProControl unit can be configured to bypass the password screen when the unit is powered up.




```
CUSTOMER ID TAGNAME
ENTER PASSWORD: BAA
```

Use the Up and Down keys to change the character displayed above the cursor.


```
CUSTOMER ID TAGNAME
ENTER PASSWORD: BAA
```

The Field key is used to move the cursor to the next character to be edited.


```
CUSTOMER ID TAGNAME
ENTER PASSWORD: EOS
```

The enter key submits the password for approval.

If the password was entered correctly, the following screen will be displayed for about a second before the operations screen is displayed:

```
Password Accepted
VER 2.XXX   : 1
```

ROM Version # — User Setup Version #

Otherwise, the following message will be displayed for a second and the user will be returned to the password menu:

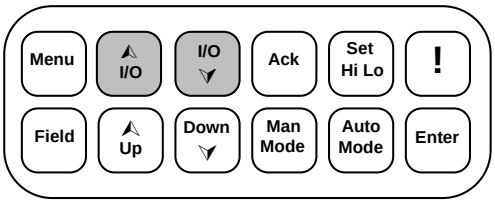
```
Incorrect Password
```

2.4 Operations Screen

After the password has been entered correctly, the operations screen is displayed. The operations screen allows the user to set system parameters and to review the status of all system inputs and outputs.

```
WELL1              OFF
ALARMS SET >MANUAL
```

2.5 I/O Keys



Pressing the I/O Up or I/O Down keys will scroll through the operational I/O points in the system. Data relevant to a particular I/O point will be displayed to right of the point's Tagname.

I/O

```
WELL2                ON
ALARMS SET >MANUAL
```

Forward scroll through I/O points

I/O

```
WELL3                OFF
ALARMS SET >MANUAL
```

Forward scroll through I/O points

I/O

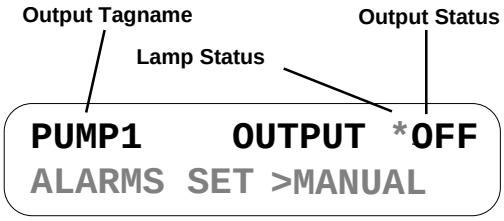
```
WELL2                ON
ALARMS SET >MANUAL
```

Backward scroll through I/O points

2.6 Digital Input Menu

A digital input displayed in the operations screen will be displayed as shown. When the input is in its Active State "ON" will be displayed in the Input Status area. Otherwise, "OFF" will be displayed.

2.7 Digital Output Menu



A digital output displayed in the operations screen will appear as shown. When the output has been turned on, "ON" will be displayed in the Output Status area. Otherwise, "OFF" will be displayed. The cursor is displayed under the first character in the status field to indicate that it can be changed. The Lamp Status character (*) will be shown for a lamp output if a *lamp test* is running regardless of the output's true state.

Up Down

```
PUMP1      OUTPUT  ON
ALARMS SET >MANUAL
```

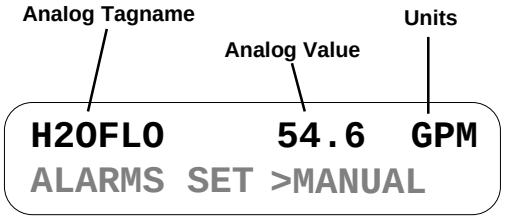
Pressing the Up or Down key will toggle the digital output state and turn the corresponding relay OFF or ON.

Field

```
PUMP1      OUTPUT  ON
ALARMS SET >MANUAL
```

Pressing the Field key will move the cursor to the Menu selection field.

2.8 Analog Input Menu



An analog input displayed in the operations screen will be displayed as shown to the left. The value of the analog input will be shown along with the dimensional units. In the case of a pulse accumulator (totalizer only), you will see only TOT where units is normally displayed.

Set Hi Lo

```
H2OFLO      20.0  GPM
LOW ALARM  >MANUAL
```

Use the Set Hi Lo key to set the low alarm limit.

Set Hi Lo

```
H2OFLO      80.0  GPM
HIGH ALARM >MANUAL
```

Press the Set Hi Lo key again to set the high alarm limit.

Set Hi Lo

```
H2OFLO   120817  GAL
TOTAL FLOW >MANUAL
```

Press the Set Hi Lo key again to see the total flow on a flow type input, and once more to return.

Up Down

```
H2OFLO      30.0  GPM
LOW ALARM  >MANUAL
```

The Up and Down keys are used to change the value of the current character, as denoted by the cursor.

Field

```
H2OFLO      30.0  GPM
LOW ALARM  >MANUAL
```

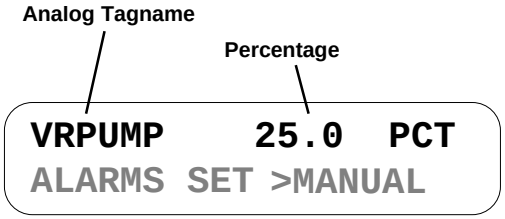
The Field key is used to move to the next character to be edited.

Enter

```
H2OFLO      30.0  GPM
LOW ALARM  >MANUAL
```

To save the low alarm limit changes, press the enter key.

2.9 Analog Output Menu



An analog output displayed in the operations screen will be displayed as shown to the left. The percentage of full scale output will be displayed as well.

Set Hi Lo

The Set Hi Lo key can be used to set the output percentage.

Set Hi Lo

Press the Set Hi Lo key again to declare the SetPoint of an associated analog input. The SetPoint is used only if a PID control loop is in use as an analog output process.

Pressing Set Hi Lo again returns to the original menu.

Up Down

The Up and Down keys are used to change the value of the current character, as denoted by the cursor.

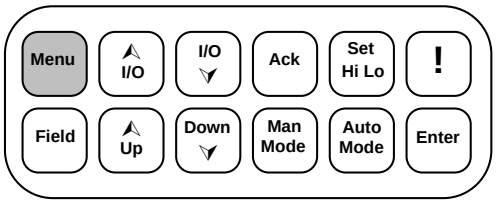
Field

The Field key is used to move to the next character to be edited.

Enter

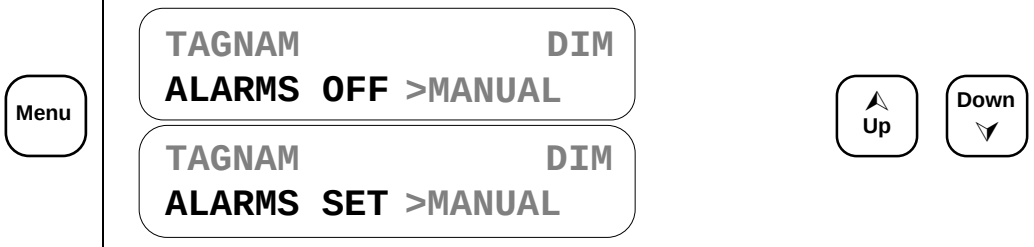
To save the output level changes, press the enter key.

2.10 Menu Key

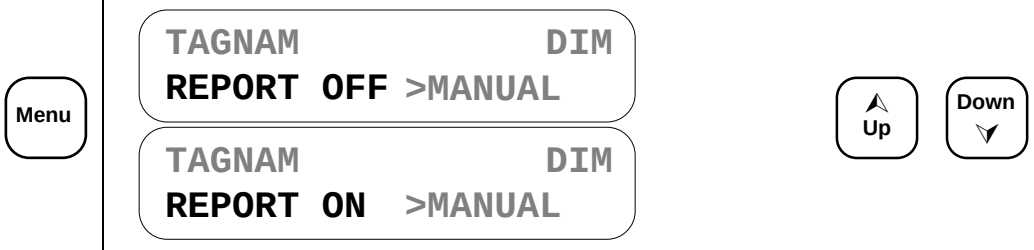


When pressed, the Menu key will scroll through a series of items which allow the user to configure various aspects of system behavior. A description of these items appear in a 10 character field at the bottom left of the display. Either the Up and Down keys or the Enter key is used to change the item.

ALARMS Use the Up and Down keys to enable or disable Alarms.

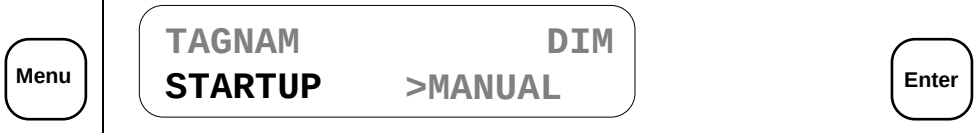


REPORT Use the Up and Down keys to enable or disable the unit's reporting capabilities (fax or page).



FAX NOW Use the Enter key to send a FAX report immediately.

STARTUP Use the Enter key to run the Startup Sequence.

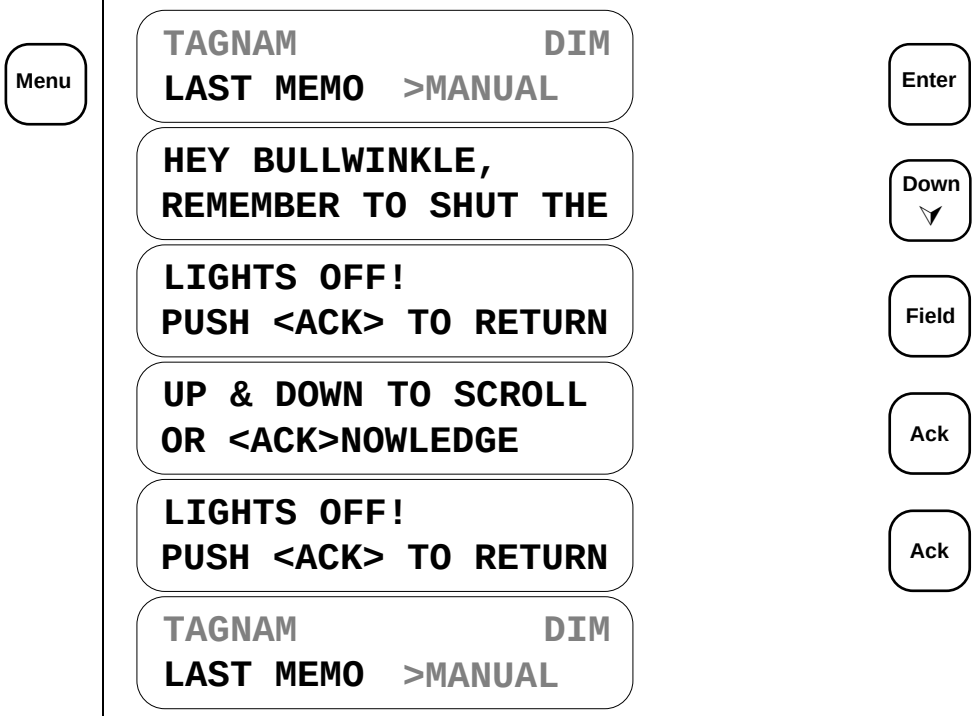


SHUTDOWN Use the Enter key to run the Shutdown Sequence.

LAST SHUTDOWN This display item shows what input or output caused the last shutdown.

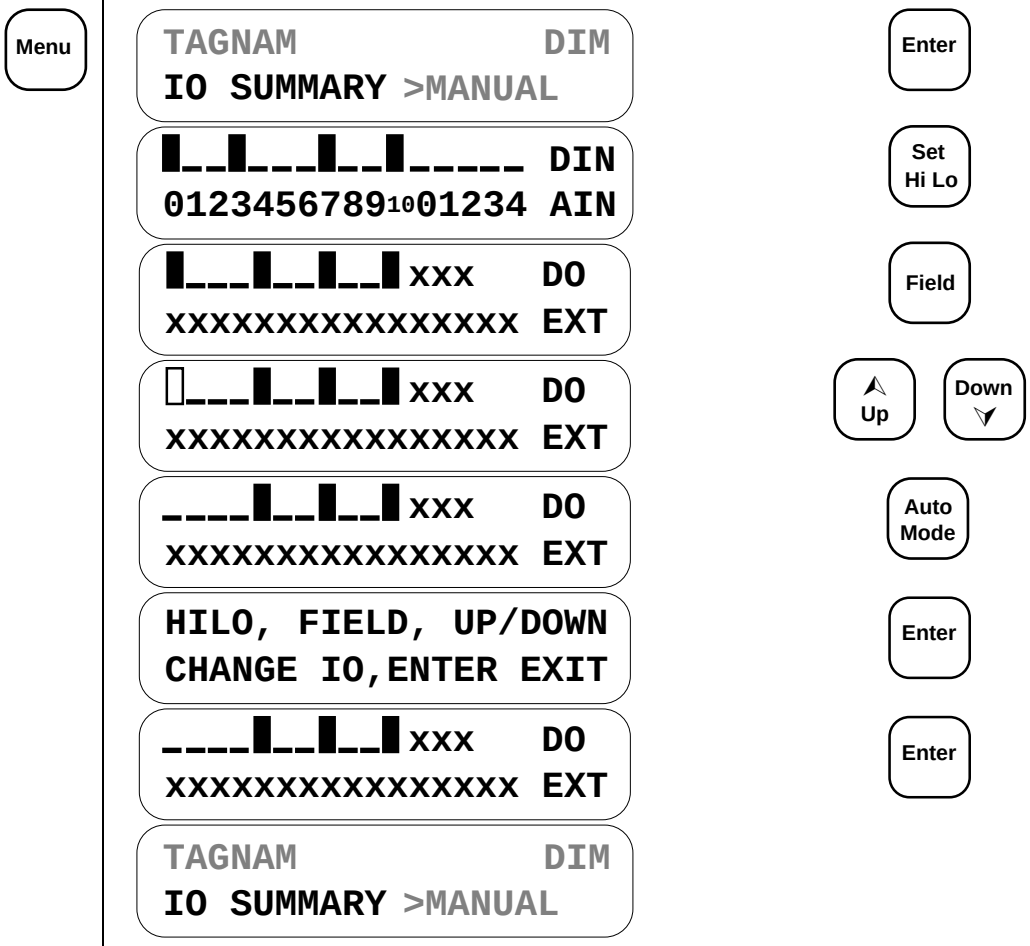
LOG OFF Use the Enter key to Log Off the system and return to the password menu.

LAST MEMO Use the Enter key to see the last memo sent from the remote ProView user. Up and Down are used to scroll through the message, and Ack is used to return to the ProControl menus. If you hit any other key you will see an informative message telling you which keys are valid. The message will be displayed for 3 seconds if no keys are pressed, but can be acknowledged before the 3-second period by pressing either the Ack or Enter keys.

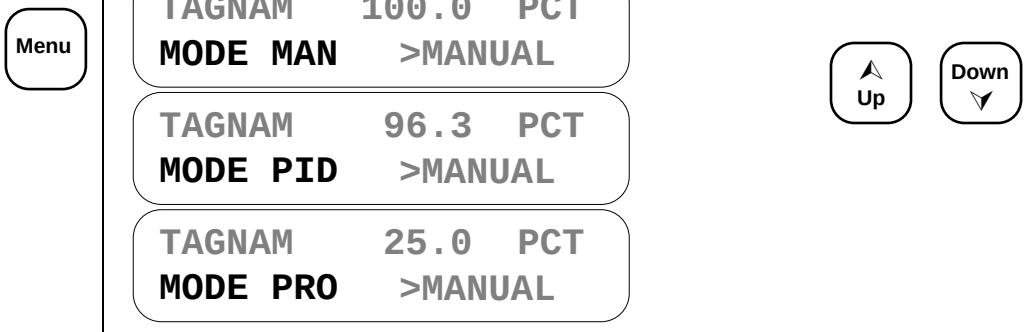


IO SUMMARY

Use the Enter key to enter the I/O summary. The analog input values 0-10 represent a percentage of full scale (i.e. 0 ≅ 4 mA, 5 ≅ 12 mA). Set HiLo is used to toggle between input/output summaries. An underscore represents an open input or an unswitched output. A block indicates a closed input or a switched output. An **x** or **X** is displayed when an output is not enabled and is unswitched or switched, respectively. An asterisk (*****) will be displayed if an output is declared as a lamp and a lamp test is currently being performed. The Field key can be used to move the blinking cursor through the outputs. The Up/Down keys can be used to toggle the state of the output whose position is covered by the blinking cursor. The Enter key will return the ProControl back to its standard menus. If you press any other keys you will see an informative message telling you which keys are valid. The message will be displayed for 3 seconds if no keys are pressed, but can be interrupted before the 3-second period by pressing the Enter key.

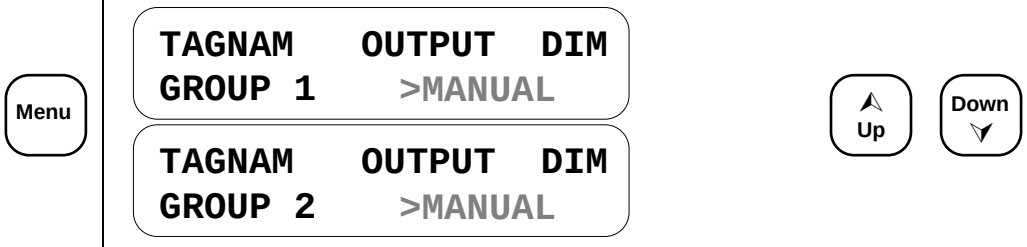


MODES Use the Up and Down keys to toggle an Analog Output from Manual control to PID control or Proportional control, depending on which analog output process is being used. This selection will only appear if an analog output tagname is displayed and the analog output is part of an analog output process.



GROUP The ProControl allows outputs to be assigned to different *Groups* to allow greater process control flexibility. In some cases, you may wish to be able to specify alternate process tasks for a given output. For instance, you can have the operation of a pump be controlled by a series of level switches in a tank, or alternately, the pump can be run on a timed cycle. By selecting the appropriate process Group, you can change the control strategy for that piece of equipment. EOS Research will configure the groups for you according to your specifications

Use the Up and Down keys to select a Group for the displayed output. This menu item is displayed only for outputs that have been configured by EOS to have alternate process Groups.



2.11 LED Indicators

Your ProControl unit has three status LEDs to the left of the keypad, which are used to indicate the following:

System Status: Normally ON when unit is powered.
One blink - The system has internally reset.
Two blinks - An internal error has occurred.

Connect: ON if user is remotely or locally connected.
ON if system is faxing or paging.
Slow blink - last fax or page failed, press ACK to clear.
Fast blink - local connect cable inadvertantly left plugged in, press ACK to clear.

Network: Rapid blinking indicates an active network connection.

3.0 REPORTING FEATURES

3.1 Fax Report

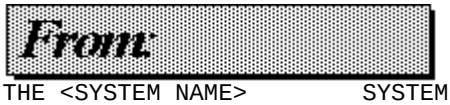
The ProControl unit will keep you informed of your system's operations with facsimile status reports. With the supplied ProView software you can configure the unit to send fax reports to up to two different numbers. You can also have these reports sent on a daily basis, at regular intervals during the day, or when triggered by specific process tasks. You can send one at any time by using the *Fax Now* option either from the menu on the ProControl's display, or through the ProView software.

The fax report you receive will contain several fields, each denoted by a shadow box. The number of fields will depend on the configuration of your system. For instance, you would not see a field indicating *Analog Outputs* if your system does not contain any of these.

The fields as you will see them are shown below. All information enclosed in brackets is variable and depends on your particular system configuration.


```
<FAX RECIPIENT>
```

will indicate the intended fax recipient's name.




```
THE <SYSTEM NAME>        SYSTEM IN <SITE LOCATION>   AT <TIME> ON <DATE>
SETUP VERSION X       :  ROM VERSION 2.x          :  MODEL B1
```

will indicate the name and location of your system, the date and time at which the fax report was initiated, your current ProView setup version, and the current on-board software version 2.X.


```
<MODE><PXX>  :   LAST SHUTDOWN AT <TIME> ON <DATE> BY <SHUTDOWN CAUSE>
                 FAX REPORT INITIATED BY <FAX CAUSE>
```

will indicate the current <MODE> of the controller and associated process. For example, if the controller is running the startup or shutdown sequence, you would see either START or SHUTD followed by the current algorithm. Similarly, in auto mode, you would see AUTO followed by the last successfully completed process task.

The LAST SHUTDOWN indicates when the system last initiated the shutdown sequence and what caused it to happen. For example, if the shutdown sequence were initiated by a key press, the cause you would see would be KEYPAD. Similarly, if the shutdown sequence were caused by a process task such as a high pressure sensor whose tagname was HIPRES, you would see HIPRES as the <SHUTDOWN CAUSE>. If multiple inputs or outputs caused the shutdown (i.e. a process task was dependent on more than one input being in the active state and/or multiple outputs being ON), the most recent one which changed will appear as the cause.

Similarly, the FAX REPORT INITIATED BY line will indicate the tagname of the I/O point which caused the fax to be sent, provided there was only one I/O point responsible. If multiple I/O points were responsible, the process itself will be indicated. Consider, for example, a process task where a shutdown was caused by HIPRES and BLOWER, and a fax was also generated. The <FAX CAUSE> would be PROCESS XX, where *XX* is the number from 1 - 64 of this process task. In the case where *Fax Now* was selected from the menu option on the LCD, the <FAX CAUSE> would be KEYPAD. The <FAX CAUSE> from a ProView generated *Fax Now* command would be REMOTE. This line will <u>not</u> appear on daily or interval scheduled fax reports.

Discrete Inputs:

```
<TAGNAME> is <STATE>   <TAGNAME> is <STATE> ...
```

will indicate the status of all of the digital inputs in four columns. Inputs which are in the active state will appear as ON and those which are in their normal state will appear as OFF.

Discrete Outputs:

```
<TAGNAME> is <STATE>   <TAGNAME> is <STATE> ...
```

will indicate the status of all of the digital outputs in four columns.

Analog Inputs:

```
<TAGNAME> is <VALUE> <DIM> LIMITS are L: <LO-LIM> <DIM> H: <HI-LIM> <DIM>
<TAGNAME> is <VALUE> <DIM> TOTAL FLOW is <FLOW>   <DIM>
<TAGNAME>                  TOTAL FLOW is <FLOW>   <DIM>
...
```

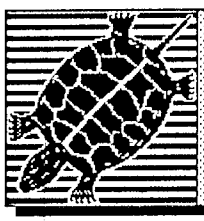
will indicate the current value, dimensional units, low alarm limit, and high alarm limit for all analog inputs which are not flow-type inputs. The precision of the values displayed can be selected through ProView. Any flow-type analog input which is responsible for maintaining a total flow will display that flow in place of the alarm limits. Any pulse-type digital input used for a digital flow meter will appear here since the information being obtained by that type of flow meter is analog in nature. In addition, pulse accumulators (volume totalizers) will appear here.

Analog Outputs:

```
<TAGNAME>   <PCT>  PCT  <MODE>      <TAGNAME>   <PCT>  PCT  <MODE>
...
```

will indicate the output percentage and mode of operation of all analog outputs. The precision is fixed to one decimal place and will range from 0.0 to 100.0, expressed as a percentage. The <MODE> of operation will be PID if the analog output is currently being used in a PID loop, or PRO if the analog output is currently being used in a Proportional scheme, otherwise it will be MAN indicating that the analog output is under manual control.

The next two pages contain examples of scheduled and alarm fax reports.



ProControl Series II+

EOS Research Ltd.

Fax Report

To:

BULLWINKLE J MOOSE

From:

THE NORTH WATER SUPPLY SYSTEM IN MAYBERRY USA @ 09:44:00 ON 12/10/1999
SETUP VERSION 1 : ROM VERSION 2.156 : MODEL B2

System Status:

AUTO P04 : NO PREVIOUS SHUTDOWN

Discrete Inputs:

WEL1LO is OFF	WEL2LO is OFF	TWR_HH is OFF	TNK_HH is OFF
RESET is OFF			

Discrete Outputs:

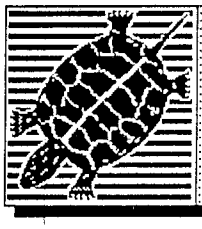
WLPMP1 is ON	WLPMP2 is ON	FINPMP is ON	CHLMET is ON
NAOMET is ON	PH_ALM is ON	CL_ALM is ON	TWRALM is OFF
WL1ALM is OFF	WL2ALM is OFF	TNKALM is OFF	

Analog Inputs:

TWRLVL is	59.2	FT	LIMITS are	L:	8.0	FT	H: 70.0	FT
TNKLVL is	0.00	FT	LIMITS are	L:	8.00	FT	H: 12.00	FT
FINFLO is	501.3	GPM	TOTAL FLOW is		14794	GAL		
FLOW_2 is	399.3	GPM	TOTAL FLOW is		12561	GAL		
FLOW_1 is	0.0	GPM	TOTAL FLOW is		0	GAL		
FIN_PH is	0.00	PH	LIMITS are	L:	6.00	PH	H: 8.00	PH
FIN_CL is	0.00	PPM	LIMITS are	L:	0.75	PPM	H: 2.00	PPM

Analog Outputs:

VSPMP1	86.8 PCT	PID	VSPMP2	100.0 PCT	PID
NAOHFD	100.0 PCT	PID	CHLRFD	20.0 PCT	PRO



ALARM Fax Report

EOS Research Ltd. — ProControl Series II+

To:

BULLWINKLE J MOOSE

From:

THE NORTH WATER SUPPLY SYSTEM IN MAYBERRY USA @ 09:34:12 ON 12/10/1999
SETUP VERSION 1 : ROM VERSION 2.156 : MODEL B2

System Status:

AUTO P04 : NO PREVIOUS SHUTDOWN
FAX REPORT INITIATED BY REMOTE

Discrete Inputs:

WEL1LO is OFF	WEL2LO is OFF	TWR_HH is OFF	TNK_HH is OFF
RESET is OFF			

Discrete Outputs:

WLPMP1 is ON	WLPMP2 is ON	FINPMP is ON	CHLMET is ON
NAOMET is ON	PH_ALM is ON	CL_ALM is ON	TWRALM is OFF
WL1ALM is OFF	WL2ALM is OFF	TNKALM is OFF	

Analog Inputs:

TWRLVL is 59.1	FT	LIMITS are	L: 8.0	FT	H: 70.0	FT
TNKLVL is 0.00	FT	LIMITS are	L: 8.00	FT	H: 12.00	FT
FINFLO is 203.5	GPM	TOTAL FLOW is	11348	GAL		
FLOW_2 is 399.6	GPM	TOTAL FLOW is	8671	GAL		
FLOW_1 is 0.0	GPM	TOTAL FLOW is	0	GAL		
FIN_PH is 0.00	PH	LIMITS are	L: 6.00	PH	H: 8.00	PH
FIN_CL is 0.00	PPM	LIMITS are	L: 0.75	PPM	H: 2.00	PPM

Analog Outputs:

VSPMP1	37.4 PCT	PID	VSPMP2	100.0 PCT	PID
NAOHFD	100.0 PCT	PID	CHLRFD	20.0 PCT	PRO

3.2 Page Alerts

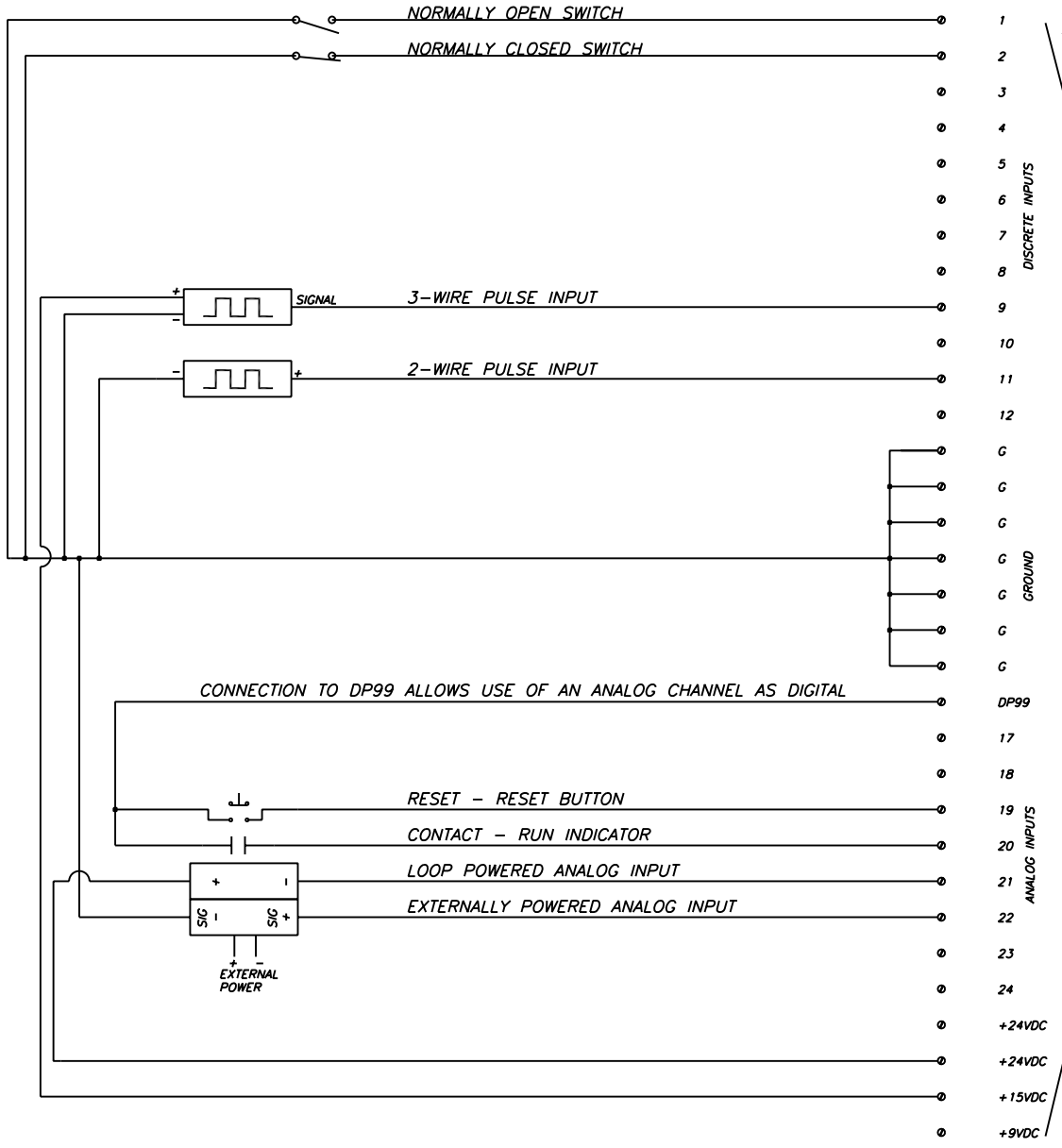
The ProControl unit can alert you to important conditions at your site via a page alert. Any system that is not in manual mode, that is, executing process tasks or the startup or shutdown sequences, can send a message up to eighty characters in length to an alphanumeric pager or up to nineteen digits in length to a numeric pager. If you are out of the office and away from a fax machine, you will still be alerted to any trouble at your site. With ProView you can select up to two pager numbers to be called. Each process task or startup/shutdown algorithm is capable of sending a message to either or both of these pagers. The pager messages are configured by EOS Research according to your specifications.

An example message for an alphanumeric pager would be:

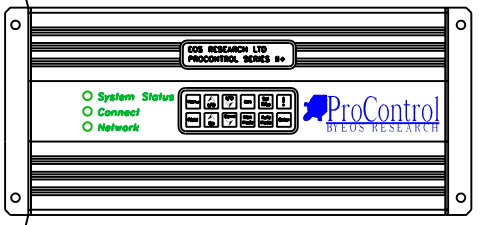
```
ANYTOWN SITE
High water level EQ Tank
System shut down!
Call Fred to fix: 555-6789
```

APPENDIX A

EXAMPLE WIRING DIAGRAM



SERIES 2*plus* Type B1-B2, A1-A2



NOTES:
1. FOR ANALOG INPUTS, MAINTAIN VOLTAGE AND TOTAL LOOP RESISTANCE PER MFG. SPECIFICATIONS.
2. INPUT IMPEDANCE FOR SERIES 2Plus ANALOG INPUTS IS 135 OHMS.
3. ACTIVE DISCRETE INPUTS WILL SOURCE 1mA WHEN GROUNDED.
4. THE ProControl SOURCES 5VDC FOR DISCRETE INPUTS.
5. DISTRIBUTE ANALOG INSTRUMENTS EVENLY ACROSS +24VDC TERMINALS.

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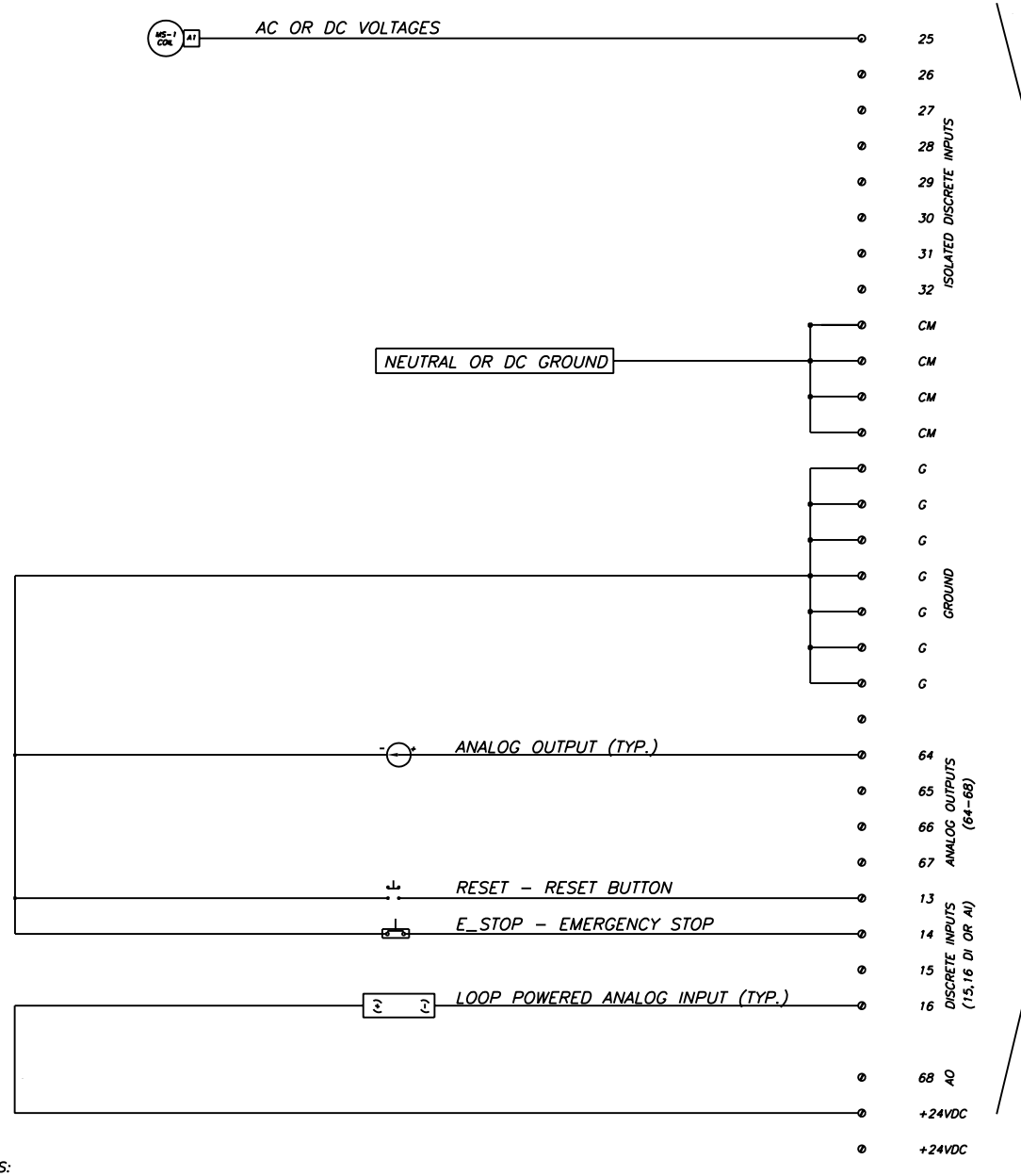
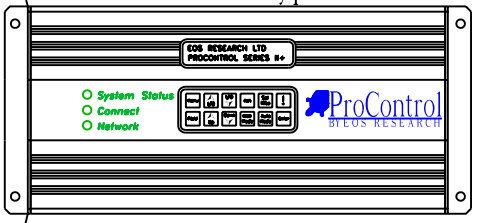
159 Walnut Street, Rochester, NH

TYPICAL ProControl WIRING
DIGITAL & ANALOG INPUTS - BOTTOM LEFT SIDE

EXAMPLE WIRING DIAGRAM



SERIES 2*plus* Type B2 ONLY



NOTES:
1. FOR ANALOG INPUTS, MAINTAIN VOLTAGE AND TOTAL LOOP RESISTANCE PER MFG. SPECIFICATIONS.
2. INPUT IMPEDANCE FOR SERIES 2Plus ANALOG INPUTS IS 135 OHMS.
3. MAXIMUM ISOLATED DISCRETE INPUT VOLTAGE 120V. ALL INPUTS MUST BE SAME VOLTAGE AND SHARE THE SAME COMMON OR NEUTRAL!
4. CM REPRESENTS COMMON FOR INPUTS 25-32. (ie. 120VAC, CM=NEUTRAL/ 24VDC, CM=DC GROUND)

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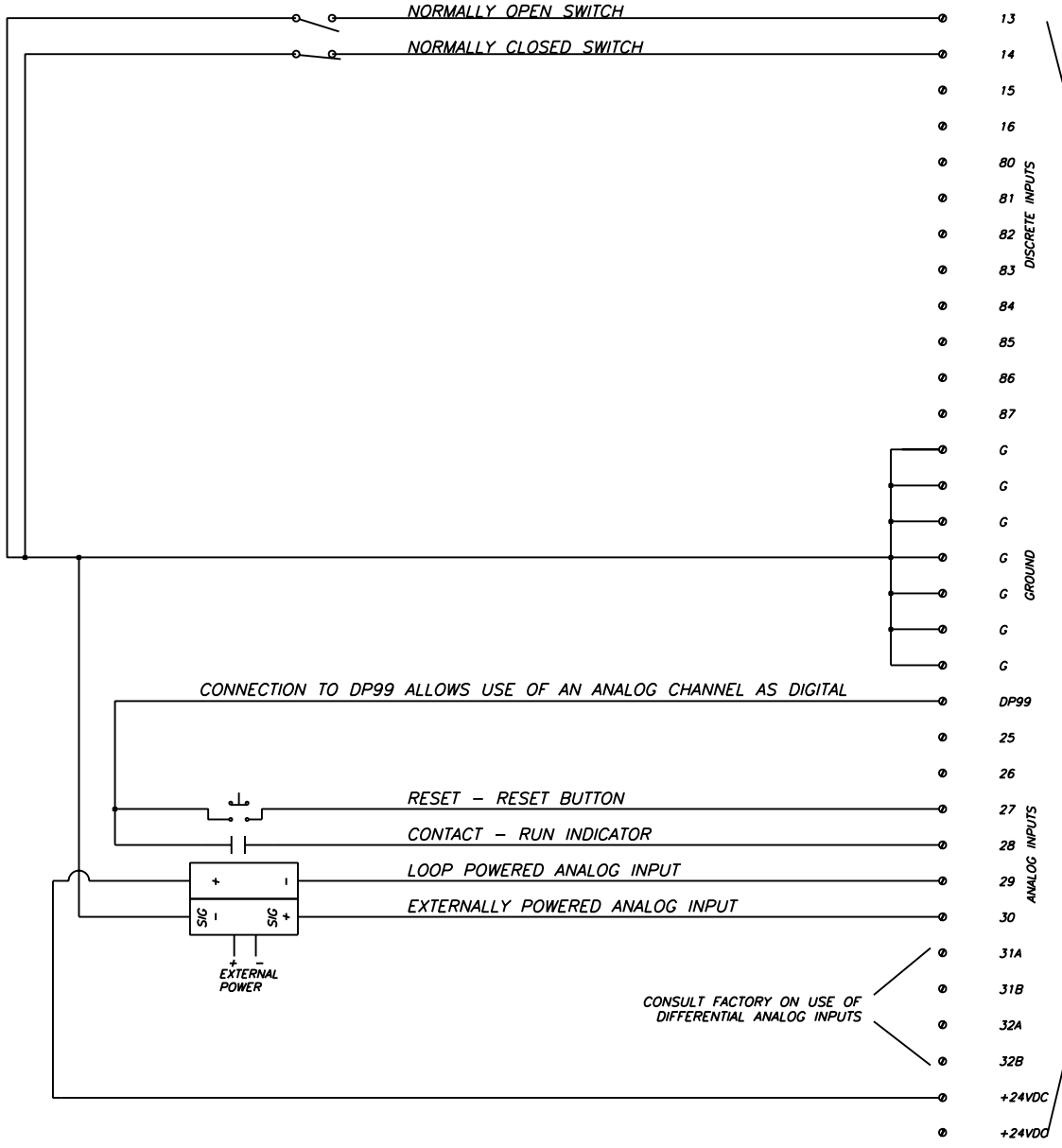
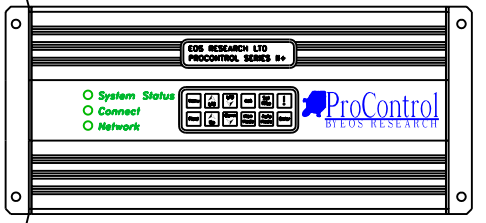
TYPICAL ProControl WIRING
DIGITAL INPUTS & ANALOG OUTPUTS
TYPE B2 - TOP LEFT SIDE

EXAMPLE WIRING DIAGRAM



SERIES 2*plus* Type A1-A2



NOTES:
1. FOR ANALOG INPUTS, MAINTAIN VOLTAGE AND TOTAL LOOP RESISTANCE PER MFG. SPECIFICATIONS.
2. INPUT IMPEDANCE FOR SERIES 2Plus ANALOG INPUTS IS 135 OHMS.
3. ACTIVE DISCRETE INPUTS WILL SOURCE 1mA WHEN GROUNDED.
4. THE ProControl SOURCES 5VDC FOR DISCRETE INPUTS.
5. DISTRIBUTE ANALOG INSTRUMENTS EVENLY ACROSS +24VDC TERMINALS.

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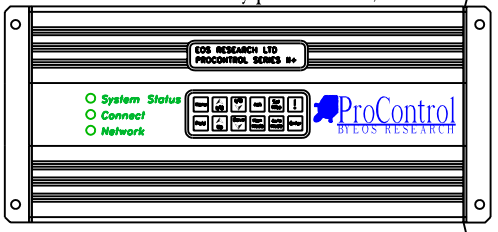
TYPICAL ProControl WIRING
DIGITAL & ANALOG INPUTS -
TYPE A - TOP LEFT SIDE

EXAMPLE WIRING DIAGRAM

SERIES 2*plus* Type B1-B2, A1-A2



RS-232/SERIAL RJ-45 LOCAL CONNECTION PORT

TEL./RS-485 RJ-11 TELEPHONE/NETWORKING PORT

NEUTRAL | LINE | GROUND | +24VDC

DISCRETE OUTPUTS

46
45 SLNVLV - SOLENOID VALVE
44 AIRCMP - AIR COMPRESSOR — MS-2 COIL
43 DISPMP - DISCHARGE PUMP — MS-1 COIL
42
41
40
CM2 COMMON FOR 40-46
39
38
37
36
35 VACALM - HIGH VACUUM ALARM — R
34 PRSALM - LOW PRESSURE ALARM — R
33 SMPALM - HIGH LEVEL ALARM — R
CM1 COMMON FOR 33-39

INPUT POWER 10VAC

10VAC TRANSFORMER SUPPLIED WITH ProControl UNIT. (REV 4 AND ABOVE)

NOTE: 20VAC-CT TRANSFORMER SUPPLIED PRIOR TO REV 4.
DO NOT USE 20VAC TRANSFORMER ON REV 4 AND ABOVE!!

NOTES:
1. OUTPUT RELAYS RATED AT 125VAC/0.5A, 24VDC/0.5A
   UNITS SHIPPED AFTER 12/1/99 RATED AT 125VAC/1.0A, 24VDC/1.0A
2. CM1 IS SWITCHED TO 33-39 AND CM2 IS SWITCHED TO 40-46 WHEN OUTPUT IS ACTIVE.
3. DO NOT USE +24VDC FROM ProControl TO DRIVE OUTPUTS. FOR TRANSDUCER POWER ONLY.

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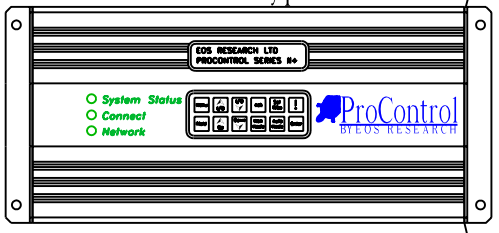
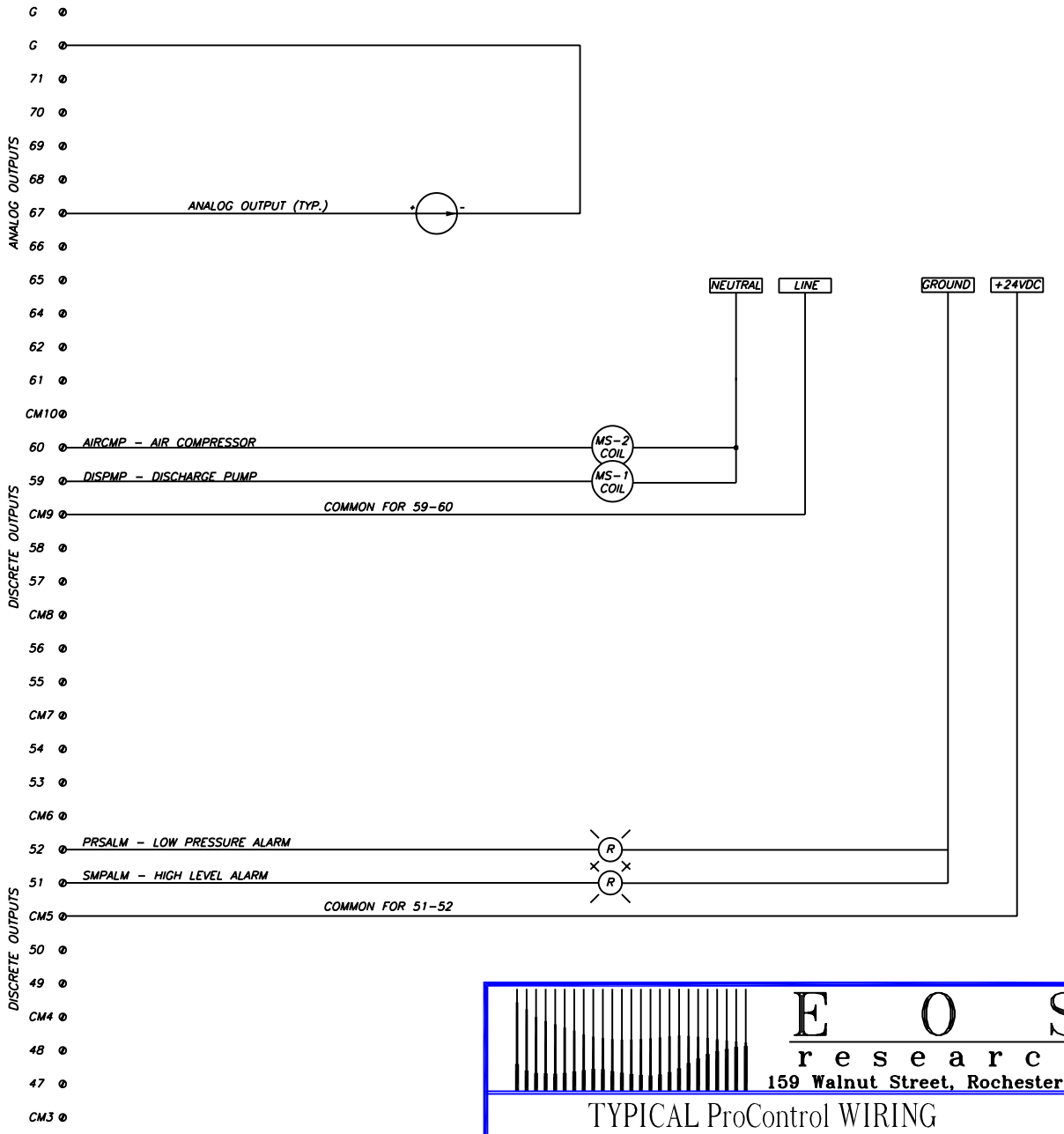
TYPICAL ProControl WIRING
DIGITAL OUTPUTS - RIGHT SIDE

EXAMPLE WIRING DIAGRAM

SERIES 2*plus* Type A1-A2





NOTES:
1. OUTPUT RELAYS ARE RATED AT 125VAC/0.5A, 24VDC/0.5A
2. CM3 IS SWITCHED TO 47-48, CM4 IS SWITCHED TO 49-50, ETC. WHEN OUTPUT IS ACTIVE.
3. DO NOT USE +24VDC FROM ProControl TO DRIVE OUTPUTS. FOR TRANSDUCER POWER ONLY.

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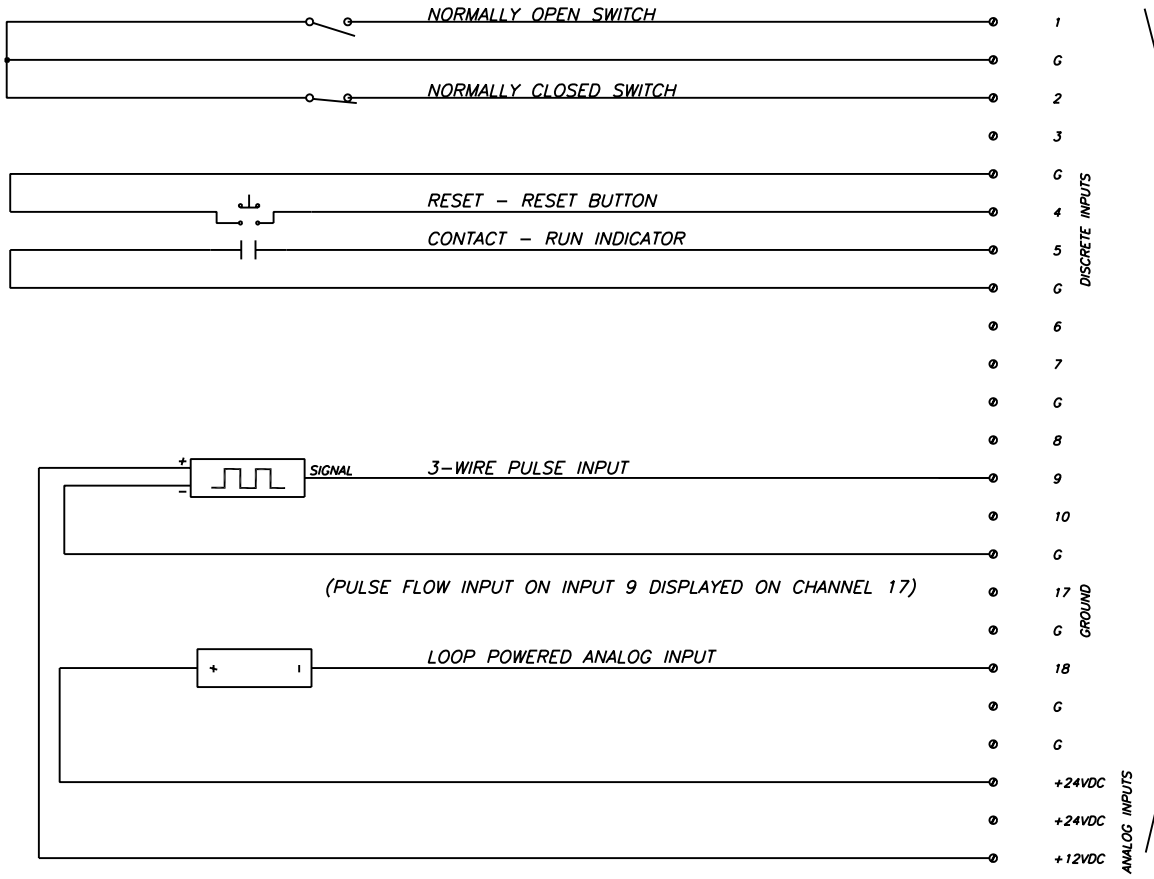
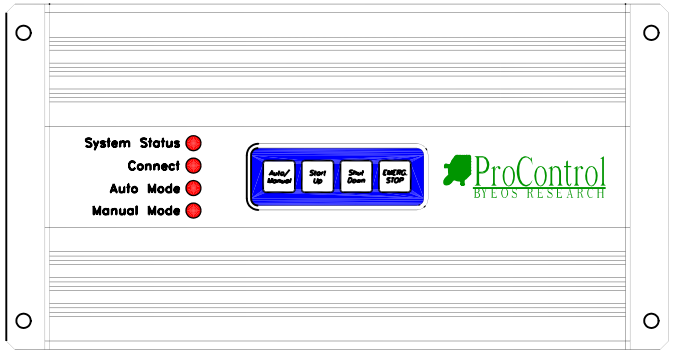
TYPICAL ProControl WIRING
DIGITAL & ANALOG OUTPUTS
TYPE A - TOP RIGHT SIDE

EXAMPLE WIRING DIAGRAM



SERIES 2*plus* Type C1



NOTES:
1. FOR ANALOG INPUTS, MAINTAIN VOLTAGE AND TOTAL LOOP RESISTANCE PER MFG. SPECIFICATIONS.
2. INPUT IMPEDANCE FOR SERIES 2Plus ANALOG INPUTS IS 135 OHMS.
3. ACTIVE DISCRETE INPUTS WILL SOURCE 1mA WHEN GROUNDED.
4. THE ProControl SOURCES 5VDC FOR DISCRETE INPUTS.
5. DISTRIBUTE ANALOG INSTRUMENTS EVENLY ACROSS +24VDC TERMINALS.

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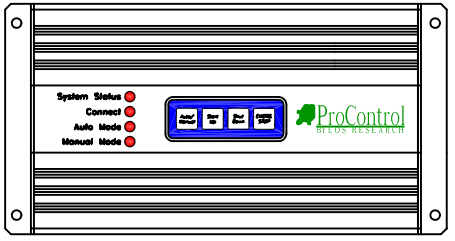
TYPICAL ProControl Type C1 WIRING
DIGITAL & ANALOG INPUTS - BOTTOM LEFT SIDE

EXAMPLE WIRING DIAGRAM



RS-232/SERIAL RJ-45 LOCAL CONNECTION PORT

TEL./RS-485 RJ-11 TELEPHONE/NETWORKING PORT

GROUND +24VDC NEUTRAL LINE

DISCRETE OUTPUTS

40 PRSALM - LOW PRESSURE ALARM (R)

39 SMPALM - HIGH LEVEL ALARM (R)

CM4 COMMON FOR 39-40

38

37

CM3 COMMON FOR 37-38

36

35 SLNVLV - SOLENOD VALVE (CR-1 COIL)

CM2 COMMON FOR 35-36

34 AIRCMP - AIR COMPRESSOR (MS-2 COIL)

33 RW_PMP - RECOVERY WELL PUMP (MS-1 COIL)

CM1 COMMON FOR 33-34

INPUT POWER 10VAC

10VAC TRANSFORMER SUPPLIED WITH ProControl UNIT.

NOTES:
1. OUTPUT RELAYS RATED AT 125VAC/1.0A, 24VDC/1.0A
2. CM1 IS SWITCHED TO 33-34 AND CM2 IS SWITCHED TO 35-36, CM3 IS SWITCHED TO 37-38, CM4 IS SWITCHED TO 39-40 WHEN OUTPUT IS ACTIVE.
3. DO NOT USE +24VDC FROM ProControl TO DRIVE OUTPUTS. FOR TRANSDUCER POWER ONLY.

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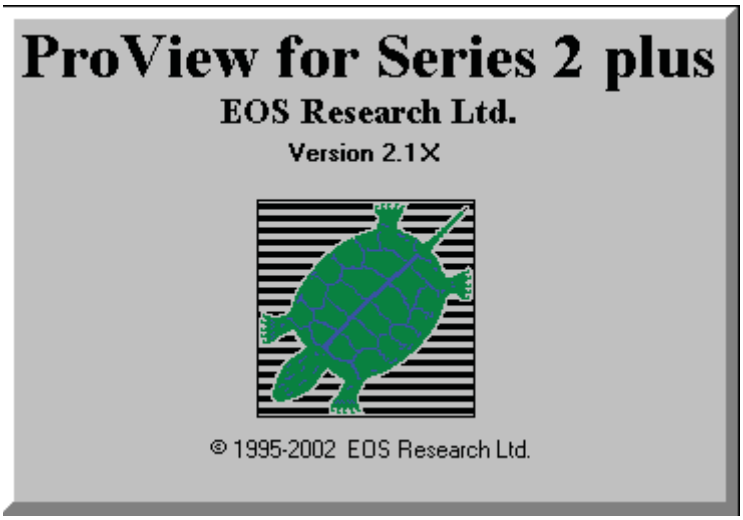
TYPICAL ProControl TYPE C WIRING
DIGITAL OUTPUTS - RIGHT SIDE

ProView™

for ProControl Series 2plus

USER'S GUIDE



Version 2.1x

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FAX: 603.431.2562
Email: procontrol@eosresearch.com

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION AND INSTALLATION

This chapter provides a brief introduction to ProView features, system requirements for running the program, and instructions for installing it.

Introduction to PROVIEW

ProView is a powerful but straightforward software package used in conjunction with the ProControl system to provide integrated stand-alone control and remote telemetry for your operation. ProView versions 2.1 and higher can serve as an on-site or remote human-machine interface (HMI) for both the Series II and Series **2**^{plus} ProControls. With ProView you can:

- Monitor system sensors
- Control equipment that are outputs on the ProControl
- Change the way the system operates
- View and change system setpoints, alarm levels, etc.
- Extract datalogged system information

In short, ProView can be used to remotely gain the same level of control over your operation as if you were at the site. Although many system parameters can be set with the ProControl's display and keypad (if included), ProView allows a more comprehensive, easy-to-access view into system operations.

In order for ProView to function, your PC must be connected to the ProControl unit. It can be connected in one of two ways. The first way is with a cable (provided with your ProControl system) that connects your PC's serial port with the ProControl unit. This method of connection is most often used at the system site using a laptop PC. The second method is via dial-up modem from your office or from anywhere that a connection to the telephone system can be established.

You should be familiar with the operation of the ProControl unit and have read the ProControl User Manual before using ProView.

System Requirements

COMPUTER: You will need an PC or compatible with a 486 (minimum) or greater microprocessor with 4MB RAM and Microsoft Windows version 3.1 or later. A minimum of 4MB of Hard Disk space needs to be available. A mouse or similar pointing device is also required.

Several functions in ProView require the use of the right mouse button. Make sure the right mouse button is not assigned to some other function such as double-click. See your mouse driver software for details.

MODEM: You need a Hayes compatible (AT) Modem that supports a data rate of 9600 baud (this means almost any commonly-available modem). The modem can be external or internal. It must be connected to COM Port 1, 2, 3 or 4.

*Some PCs are now being supplied with so-called "WinModems", which are not true hardware modems and will **not** work with ProView for communication with a ProControl system. A true Hayes-compatible hardware modem is an inexpensive investment in reliable communications.*

How to Install ProView from Windows Explorer

1. Close **all** open programs before beginning the ProView installation procedure. Close any task bars for software packages like Microsoft Office that may be lurking at the edge of your screen. *If a ProView installation fails, it is almost always the result of having other programs open at the time of installation. Certain programs, when included in the Windows Startup group, may cause the ProView installation to fail, and must be removed temporarily from the Startup group prior to installing ProView.*

2. Open the Windows Explorer and insert Disk 1 of the ProView diskettes in your **a:** drive.

3. Click on the **a:** drive, then double-click on the **setup.exe** file *Or* click on the Windows **Start** button, choose **Run…** and type in **a:setup.exe**.

4. The ProView installation program will begin and will guide you through the rest of the installation process.

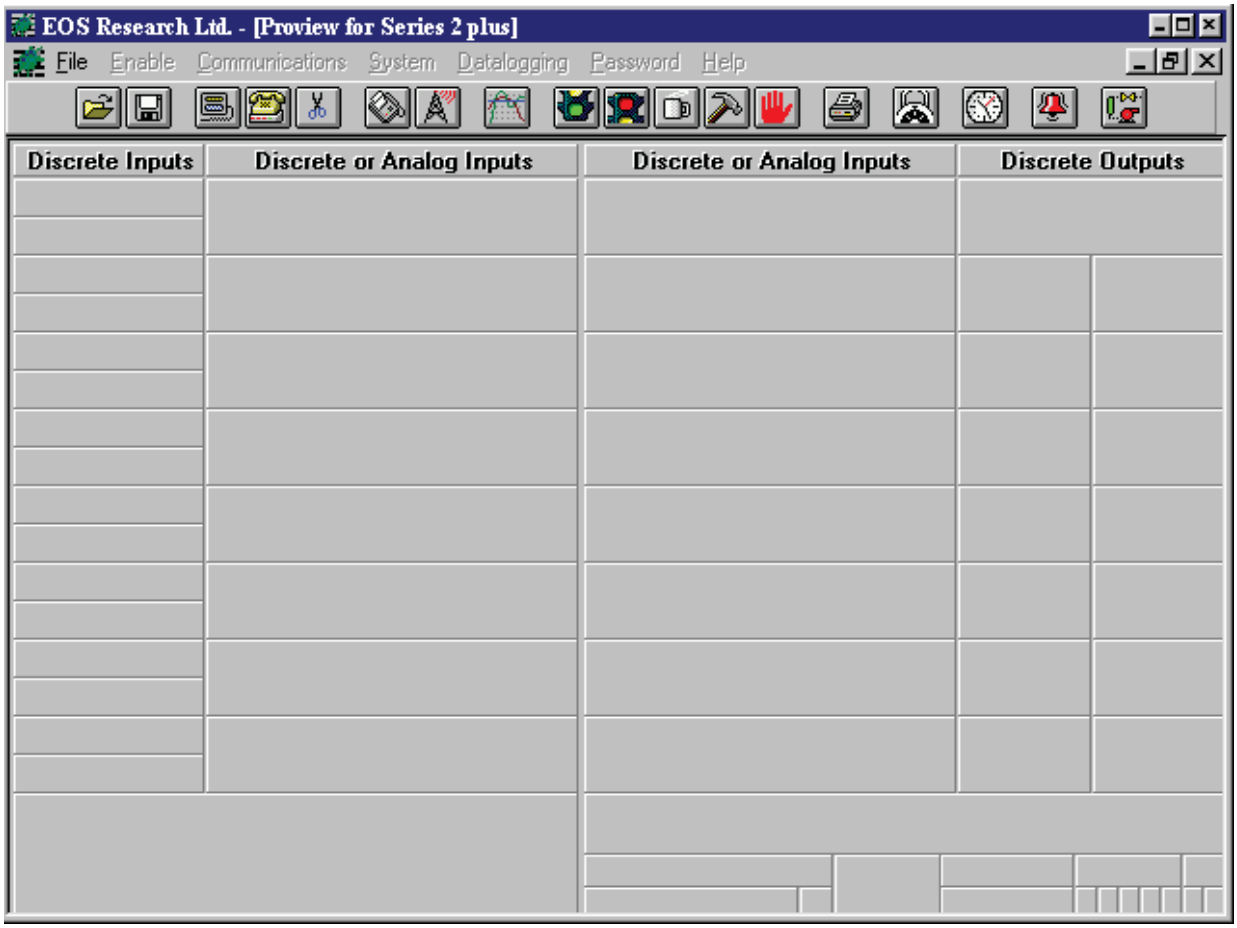
After the appropriate files from Disk #1 have been installed, you will be asked to insert Disk #2, and then Disk #3. ProView uses a default folder of C:\ProView for the program installation, but you can specify a different one if you'd like.

You will also be provided with configuration files (or ***site files***) for every ProControl unit you need to access. At a minimum, you will have a configuration file with a ".pvs" extension and one with a ".not" extension (these are normally supplied pre-configured for you on a separate diskette). Using Windows Explorer, copy these site files to the folder in which your ProView software was installed. Depending on your site configuration, you may have other files included along with the two standard site files. The files will have the extensions of .pid or .pvg. You must copy these files to the ProView folder as well.

When the installation is complete, you will see the ProView program group and icon. We recommend making a shortcut to ProView that you can then move to your main Windows screen. *Right*-click on the ProView turtle icon in the program group, then click on **Create Shortcut**. Drag your new shortcut to a prominent position on your Windows main screen.

Running ProView

After installing ProView as described above, double-click on the ProView icon. After an introduction screen, you will see the ProView Main screen.



The main screen contains a series of pull-down menus and a ***Toolbar*** that provides shortcut buttons for commonly-used commands. Placing the cursor over a Toolbar button and leaving it there for a short while produces a "balloon". A ***balloon*** is a small pop-up message that describes the action to be taken if the Toolbar button is "pushed".

Right now, since no site file has been loaded, the main screen is blank, and the toolbar is disabled. All menus except the **File** menu have been "ghosted". A selection is ghosted when the operation represented by the selection is unavailable.

Below the Toolbar are four columns of information arranged in a standard format. These columns are filled in based on the system setup and the current system status. The **Discrete Inputs** column contains information about the switches or sensors connected to inputs 1 through 16 on the ProControl unit. The two columns labeled **Discrete or Analog Inputs** contain information about the 4-20 milliamp (mA) sensors or discrete switches connected to ProControl inputs 17 through 32 (examples include analog instruments such as flow meters or pressure transducers and digital devices such as float switches). The **Analog Outputs** area

resides behind the third column, and is accessed by clicking on the **Discrete or Analog Inputs** label at the top of the column. The **Discrete Outputs** column contains information regarding the devices connected to the ProControl's output relays. The **Extended Outputs** area, behind the **Discrete Outputs** column, contains information regarding any outputs configured beyond the first 14, if available on the ProControl model you are using.

At the bottom of the screen are a series of information boxes. These show the status of certain important system parameters when ProView is connected to a ProControl unit.

A Word About Changing Settings

ProView has been designed to make it easy to view and change the settings that govern the way your system works. However, ProView must always be *connected* to the ProControl unit in order for these changes to take effect. It is important to remember that ProView itself is only a window into the operation of the ProControl unit. It does not provide any control functionality on its own. Chapter 3 discusses how to connect to the ProControl.

When a setting is changed in ProView (e.g., alarm level, password, datalog interval), a "?" is temporarily appended to the description or title of the information to indicate that the new value has been sent to the ProControl. When the "?" disappears, the data has been received by the ProControl and confirmed by ProView.

While many of the controls that change information in ProView are represented graphically, much of the information is displayed in text form. To edit text-based information, click on it and make your changes as you would in any Windows application. When you click on the text, it is highlighted to show that it has the current focus.

*After completing your text editing the changes must be saved by first pressing the **ENTER** key while the cursor is still within the text box being edited, and then clicking on the "OK" button for the current form.*

CHAPTER 2: GETTING STARTED

This chapter explains how to open a ProView site file, describes what's in all those little boxes on the screen, and shows you how to print the system configuration to a file.

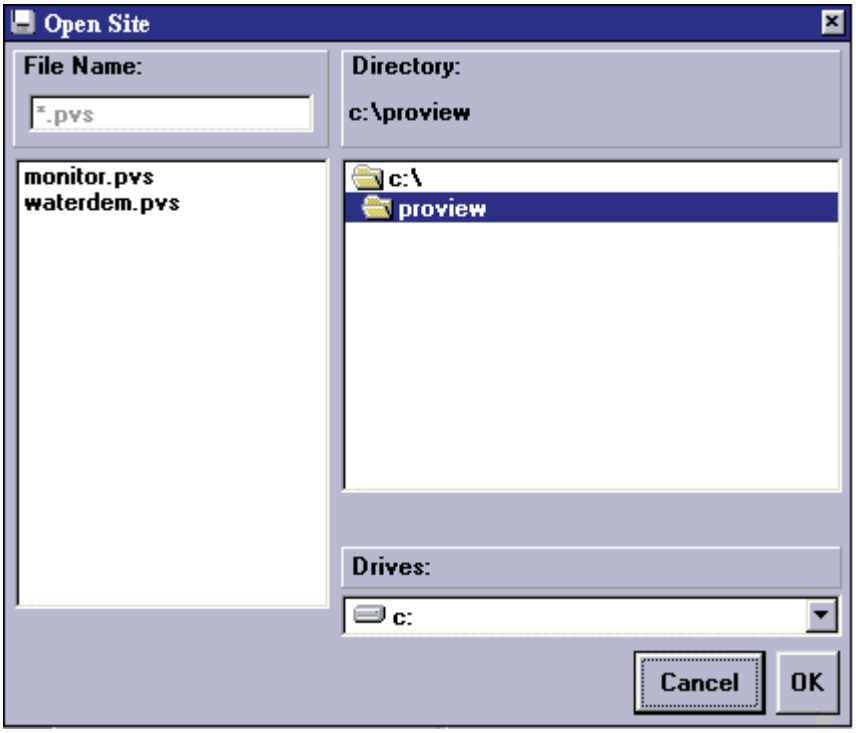
Opening a Site File

Every ProControl unit has a ***site file*** that tells the unit which inputs or outputs are enabled, what their descriptive ***Tagnames*** are and how they should respond to changes in input status. This same file is used by ProView to provide a window into what is going on within the remote ProControl unit and, by extension, with the site operation. To open a site file:

1. Click on the **File** menu, then click **Open Site**. You will see the **Open Site** dialog box. You can also use the ALT-Key combination represented by the first underlined character in the menu name. In this case, use ALT-F.

   *For opening subsequent site files, you can use the **Open Site** Toolbar button at the top of the main screen. ProView will also list the last four site files that you accessed at the bottom of the **File** menu. If you wish to open one of these, just click on the appropriate file name.*



2. In the **Drives** area of the dialog box click once on the down arrow to pull down the Drives list, then click on the drive that contains the file you wish to open.

3. In the **Directory** area of the dialog box, click on the folder that contains the file. To move "up" in the directory tree, double-click on the level to which you want to move. To move "down" in the directory structure, double-click on the appropriate folder.

4. In the **File** area you will see all files in the selected drive and folder that have the extension **.pvs** or **.pvg**. Only files with these extensions can be opened. Select the file you wish to open by clicking on the file name in the file list box, then click the **OK** button to open the selected file.

The title bar of the main screen will change to include the file name and version number. The file name and version number are enclosed within brackets.

5. In the **Security** dialog box, enter the password for your site file, and click on the **OK** button or hit Enter.

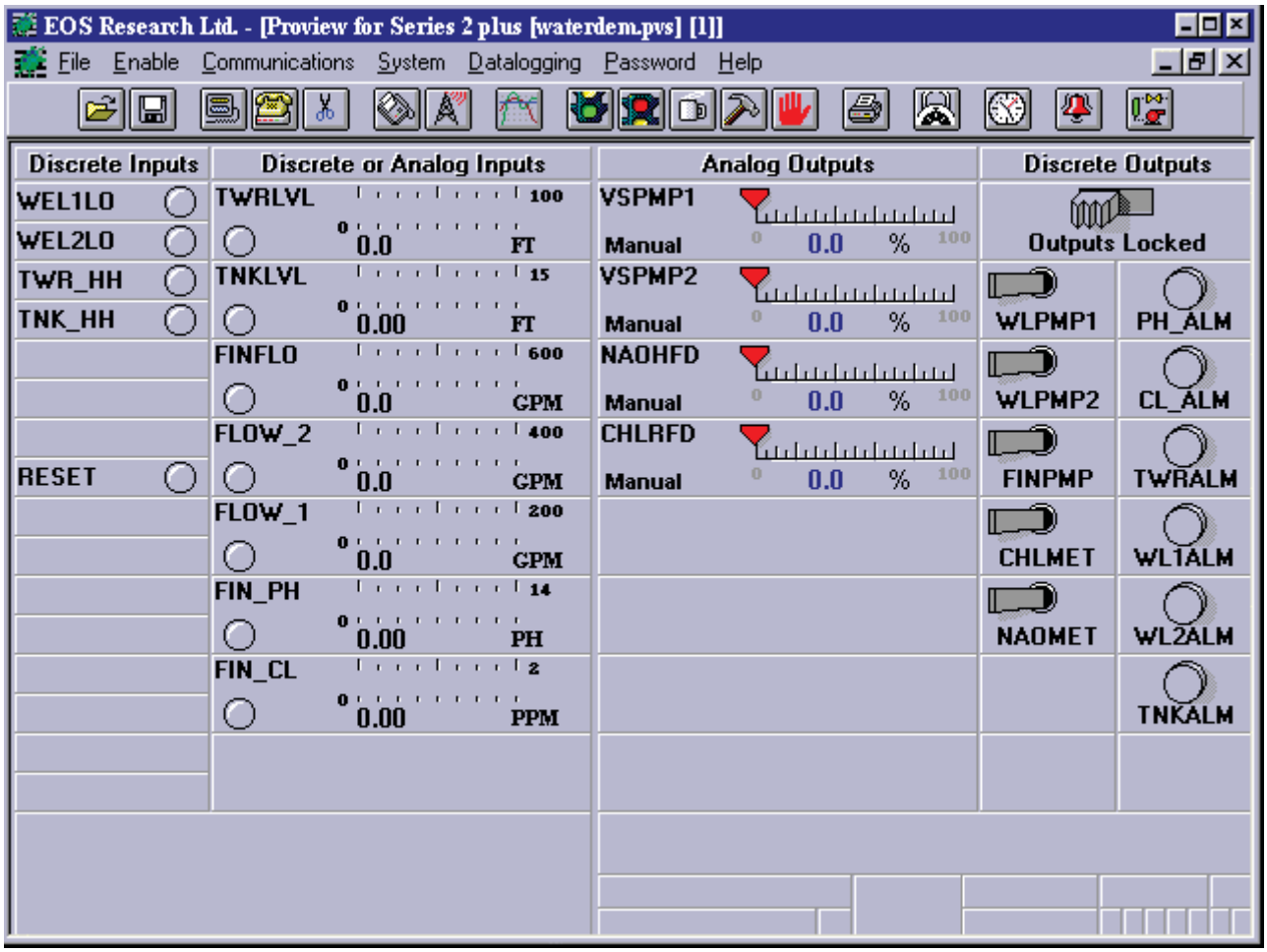
A word about passwords: *The password used in ProView can be different than the one used to access the ProControl unit through its on-board display. In either case the valid characters are 0-9 and A-Z, upper case only. Up to three characters are permitted. The password was designed as a low-level security feature sufficient to prevent inadvertent operation and to deter tampering. It is* ***NOT*** *sufficient in and of itself to withstand a* ***determined*** *effort at system entry. The default password is supplied to you with your ProControl unit by your system integrator.*

6. If the password is incorrect, the dialog box will disappear and a beep will sound. No system configuration information will be shown. You will need to select the **Password** menu and re-enter it.

7. If the password is correct, the **Security** dialog box will disappear and the system configuration information will be shown on the main screen.

FYI

ProView is supplied with a View-Only Mode password, "VOM", which may be used to connect to the ProControl to observe the system status and obtain logged data; however, no changes to any ProControl operating settings may be made when in this mode.



Examining the Main Screen

This particular site file shows five discrete inputs, seven analog inputs, eleven discrete outputs, and four analog outputs.

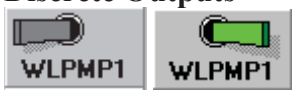
Discrete Inputs

On the left side of the screen below the heading **Discrete Inputs** are shown the tagnames of enabled discrete (or digital) inputs. To the right of the tagname is a virtual "LED". This LED's color or shape will change based on the status of the input. If a discrete input is "OFF", the LED next to the tagname is gray in color. If a discrete input is "ON", then the LED is green. If the discrete input is "ON" and has been set up as an alarm input the LED becomes a red "Alarm Bell". Some panels are blank because those inputs have not been enabled in this particular site configuration.

Analog Inputs

In the second column below the heading **Analog or Discrete Inputs** are shown the enabled analog inputs. Analog inputs can also be configured as simple discrete inputs. Below the tagname is another LED. This LED behaves in a similar fashion to those for discrete inputs; it is gray when the input is not "active", and green or red when it is in the active state (see the definition for Active State in the ProControl User Manual). A small bar graph provides a visual indication of the value of the analog input. At the left and right ends of the bar graph are numbers that represent the lower and upper limits, respectively, of the analog input values (corresponding to 4 and 20 mA). In this case FLOW_1 has been set up with a range of 0 to 200 GPM. Below the bar graph is a numerical representation of the current value of FLOW_1.

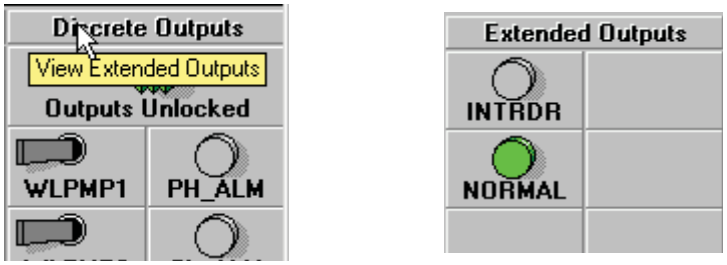
Discrete Outputs



On the right side of the screen below the heading **Discrete Outputs** are shown the enabled discrete outputs, corresponding to the relay outputs in the ProControl. In this site configuration there are 11 outputs. Above the tagname of the output is either a virtual "Toggle Switch" or lamp/button representation. By its position and/or its color it shows the state of discrete output: if the switch is left-leaning and gray the output is "OFF"; if the switch is right-leaning and green then the output is "ON".

Discrete outputs can be configured as an alarm lamp or button when this would be more appropriate. If the lamp/button appears gray then the output is "OFF". If the lamp/button appears red or green then the output is "ON".

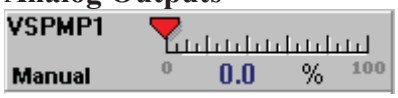
Your system may also have **Extended Outputs**, which are located on a panel behind the discrete outputs. To access these outputs, point your mouse at the words **Discrete Outputs** at the top of the column and click the left mouse button.



FYI

Regardless of what the discrete outputs look like in ProView, they all behave the same way on the ProControl itself – namely, the associated relay output is energized when the output is ON.

Analog Outputs



The third column contains the **Analog Outputs** area. It may be concealed by the second column of **Discrete or Analog Inputs**. To pull the analog outputs to the front, click on the title **Discrete or Analog Inputs** at the top of the third column of the ProView screen.

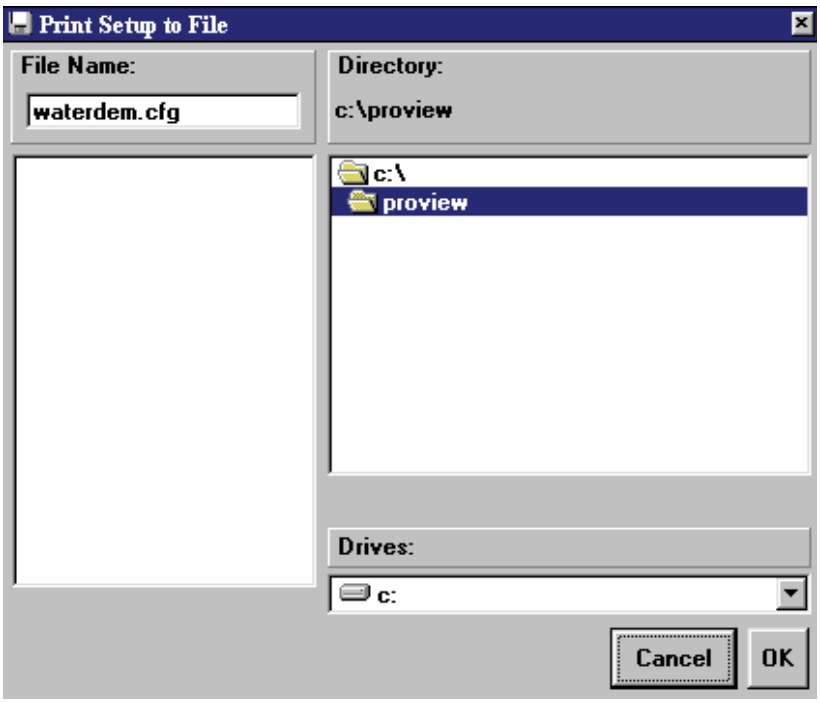
To the right of the tagname there is a slide-scale that indicates the current percentage of full-scale output (0% to 100%), displayed both graphically and with text. Below the tagname is the current mode of the output. This mode can be changed from **Manual**, which indicates the output is under user control, to **PID** or **PRO**, which would indicate that the output is involved in an output control scheme and is under automatic control. These output control schemes are described in Chapter 5 under Analog Output Options.

Printing the Setup to File

A more detailed listing of the site configuration can be made by printing the setup data to a text file. To print the setup, do the following:

1. Click on **Print Setup** in the **File** menu.
   Or
   Click on the Print Setup button. 

2. You will see the **Print Setup to File** dialog box.

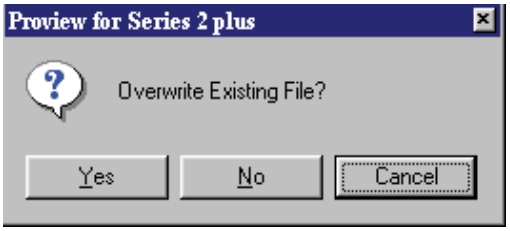


3. Specify the drive and folder in which the text file will be saved.

4. ProView will select a default file name for you, with the extension **.cfg**. However, you can give the file another name if you wish. You can also select an existing .cfg file name by clicking on the file name in the file list box.

5. Click on the OK button to print the setup to the selected file.

If you are overwriting an existing file, a message box pops up to make sure that you don't make a mistake.



A word about Files:
Do not confuse the site configuration file (.pvs), which is a binary file, with the printed setup file (.cfg), which is a text file. A text file can be viewed with a word processing program while a binary file typically cannot.

Examining the Setup File

To examine your site configuration file, use a text editor or word processor such as Notepad or Word to open the file you have just created.

The file produced by our sample site is shown below. The first section consists of identifying information about the ProControl unit and information about the inputs and outputs wired to it.

```
                    EOS RESEARCH LTD.
                 ProControl Series II+

          ProView Configuration File Information


*******************************************************
***** FAX Recipient:     BULLWINKLE MOOSE          *****
***** Customer:          MAYBERRY WATER DEPT       *****
***** Site Location:     MAYBERRY RFD              *****
*******************************************************
***** Setup:             1                         *****
***** Option:            B                         *****
***** Type:              102                       *****
***** Serial Number:     7421                      *****
***** Date:              09/06/2000                *****
***** Time:              10:17:01                  *****
***** ProView:           Version 2.153             *****
*******************************************************
```

THE INPUTS INCLUDED IN THIS SYSTEM ARE:

#	TAGNAME	TAGNAME DESCRIPTION	SETUP*	RANGE
1	WEL1LO	Well 1 Low Level	D,NO,AL	
2	WEL2LO	Well 2 Low Level	D,NO,AL	
3	TWR_HH	Water Tower High Alarm Level	D,NO,AL	
4	TNK_HH	Clearwell Tank High Alarm Level	D,NO,AL	
8	RESET	Reset Switch	D,NO,ST,SU	
17	TWRLVL	Water Tower Level	A,EP,ST	0-100 FT
18	TNKLVL	Clearwell Tank Water Level	A,EP,AL	0-15 FT
19	FINFLO	Finish Flow Rate	A,EP,ST	0-600 GPM
20	FLOW_2	Well 2 Flow Rate	A,EP,ST	0-400 GPM
21	FLOW_1	Well 1 Flow Rate	A,EP,ST	0-200 GPM
22	FIN_PH	Finish Water pH	A,EP,AL	0-14 PH
23	FIN_CL	Finish Water Chlorine Residual	A,EP,AL	0-2 PPM

*INPUT SETUP NOTES

D - This input is a (Discrete) or ON/OFF Input.
A - This input is a (Analog) or Variable Input.
C - This input is a Pulse Flowmeter Input.
P - This input is a Pulse Accumulator Input.
UPP - Units per Pulse. Number of units (i.e. Gallons) to record for each pulse
NO-This input is a (Normally Open) Discrete Input.
NC-This input is a (Normally Closed) Discrete Input.
EP-(Endpoint) This input is "Active" when its value is outside the low to high alarm levels.
WD-(Window) This input is "Active" when its value is between the low and high alarm levels.
ST-(Status) This input shows a green LED in ProView when it is in its Active State.
AL-(Alarm) This input shows a red alarm bell in ProView when it is in its Active State.
SU-(Startup) This is a menu function input. When activated it will run the startup routine.
SD-(Shutdown) This is a menu function input. When activated it will run an emergency shutdown.
MN-(Manual) This is a menu function input. When activated it place the unit in Manual Mode.
AU-(Auto) This is a menu function input. When activated it place the unit in Auto Mode.
SQ-(Square Root) This analog channel's reading is proportional to the square root of the input.
LT-(Lamp Test)This is a Lamp Test input. When activated it will turn on all Alarm Light outputs.

THE DISCRETE OUTPUTS INCLUDED IN THIS SYSTEM ARE:

#	TAGNAME	TAGNAME DESCRIPTION	SETUP*
1	WLPMP1	Well 1 Pump	
2	WLPMP2	Well 2 Pump	
3	FINPMP	Finish Water Pump	
4	CHLMET	Chlorine Metering Pump	
5	NAOMET	Sodium Hydroxide Metering Pump	
8	PH_ALM	pH Alarm	AI
9	CL_ALM	Chlorine Alarm	AI
10	TWRALM	Water Tower High Alarm	AI
11	WL1ALM	Well 1 Low Level Alarm	AI
12	WL2ALM	Well 2 Low Level Alarm	AI
13	TNKALM	Clearwell Tank High Level Alarm	AI

*OUTPUT SETUP NOTES

G1-(Group 1)- This output will not respond to processes 17-32.
G2-(Group 2)- This output will not respond to processes 01-16.
LT-(Lamp Test) - This output has been declared as an alarm light.
AI-(Alternate Image) - This output is displayed as an icon other than the default switch.

```
THE ANALOG OUTPUTS INCLUDED IN THIS SYSTEM ARE:

#  TAGNAME               TAGNAME DESCRIPTION                    SETUP*   INPUT
-- ------- ------------------------------------------------- ---------- ------
1  VSPMP1  Variable Speed Drive for Finish Water Pump         PID,FOR    TWRLVL
2  VSPMP2  Variable Speed Drive for Well 2 Pump               PID,FOR    TNKLVL
3  NAOHFD  Caustic Soda Feed Rate                             PID,FOR    FIN_PH
4  CHLRFD  Chlorine Feed Rate                                 PRO,FOR    FLOW_2

*ANALOG OUTPUT SETUP NOTES
--------------------------
PID  -This output is involved in a PID (Proportional,Integral,Derivative) control loop.
PRO  -This output is involved in an open (Proportional) control loop.
FOR  -The PID or PRO loop will run in the (Forward) direction.
REV  -The PID or PRO loop will run in the (Reverse) direction.
INPUT-This Tagname will serve as the input to the control loop.
```

Input and Output Configuration

The INPUTS section identifies all enabled system inputs from 1 to 32 and describes how they are configured. the input number is followed by its TAGNAME and the TAGNAME DESCRIPTION, which is taken from the Notes file (more on that in Chapter 5). In addition, a SETUP section further identifies each input in terms of its signal nature, analog (A) or discrete (D); its configuration if discrete as Normally Open (NO) or Normally Closed (NC); and its alarm display nature when active, Alarm (AL) or Status (ST). Discrete Inputs can also be configured as functions such as Startup (SU) or Emergency Shutdown (SD), and can be used as a lamp tester (LT) which will illuminate any Discrete Outputs that are configured as lamps. A RANGE is specified for all Analog Inputs as well as the Active State region, denoted Endpoint (EP) or Window (WD).

See the ProControl User Manual for a further explanation of Normally Open, Normally Closed, and related terminology and a description of Endpoint and Window Active States.

The DISCRETE OUTPUTS section is similar except that there are some different SETUP codes. Some outputs may be assigned to groups (G1,G2) that affect the way they are viewed by the process tasks. Outputs which display an Alternate Image (lamp image) than the standard switch image are designated AI.

The ANALOG OUTPUTS section details the setup of any enabled 4-20 mA output loops. The SETUP codes PID and PRO indicate whether or not the output is involved in one of two analog output control schemes known as PID loops or open loop Proportional control. The direction of the analog output control scheme is indicated by forward (FOR) or reverse (REV). The input that provides the reference signal upon which the analog output scheme is based is designated under the INPUT heading.

For a further explanation of PID or open loop Proportional control please see the Analog Output Options section in Chapter 5.

In this particular setup, TWRLVL is the input to the PID control loop that operates on the variable speed pump VSPMP1, with VSPMP1 maintaining a "setpoint" for the value of TWRLVL. The chlorine feed rate CHLRFD will be varied in proportion to the flow rate FLOW_2 under open loop proportional control.

Process Tasks

The next section of the setup file is a listing of PROCESS CONTROL TASKS. These determine how the ProControl unit responds to input changes while in Auto, Startup or Shutdown modes. It is important to note that the ProView software does not take any independent action itself. All automated control decisions are made by the ProControl unit, although you can change many operating parameters via ProView.

```
THE PROCESS CONTROL TASKS EXERCISED BY THIS SYSTEM ARE:

Process 01: If WEL1LO is ON
            THEN Delay for 2 Seconds, Send Report[FAX #1;Page #1],
            Switch WLPMP1 OFF
            Page Message: 'Well 1 Low Level Mayberry North '

Process 02: If WLPMP1 is OFF AND PH_ALM is OFF AND
               CL_ALM is OFF AND TWRALM is OFF AND TNKALM is OFF
            THEN Delay for 30 Seconds, Switch WLPMP1 ON

Process 03: If FIN_PH is High
            THEN Delay for 5 Seconds, Switch NAOMET OFF AND PH_ALM ON

Process 04: If FIN_CL is High
            THEN Delay for 5 Seconds, Switch CHLMET OFF AND CL_ALM ON

Process 05: If TWR_HH is ON
            THEN Delay for 2 Seconds, Send Report[FAX #1;FAX #2;Page #1;Page #2],
            Initiate Shutdown, Switch TWRALM ON
            Page Message: 'Tower's about to overflow, Bullwinkle - COME OUT NOW! '

Process 06: If TNK_HH is ON
            THEN Delay for 2 Seconds, Send Report[FAX #1;FAX #2;Page #1;Page #2],
            Switch TNKALM ON
            Page Message: 'Clearwell Tank High Mayberry North '

Process 07: If TWRLVL is High
            THEN Delay for 5 Seconds, Switch TWRALM ON

Process 08: If TWRLVL is NOT High or Low
            THEN Delay for 5 Seconds, Switch TWRALM OFF

Process 09: If TNKLVL is High
            THEN Delay for 5 Seconds, Switch TNKALM ON

Process 10: If TNKLVL is NOT High or Low
            THEN Delay for 5 Seconds, Switch TNKALM OFF

Process 11: If FIN_PH is High or Low
            THEN Delay for 5 Seconds, Send Report[FAX #1;Page #1],
            Switch PH_ALM ON
            Page Message: 'Finish Water pH Alarm Mayberry North '

Process 12: If FIN_PH is NOT High or Low
            THEN Delay for 5 Seconds, Switch NAOMET ON AND PH_ALM OFF

Process 13: If FIN_CL is High or Low
            THEN Delay for 5 Seconds, Send Report[FAX #1;FAX #2;Page #1;Page #2],
            Switch CL_ALM ON
            Page Message: 'Finish Water Chlorine Alarm Mayberry North '

Process 14: If FIN_CL is NOT High or Low
            THEN Delay for 5 Seconds, Switch CHLMET ON AND CL_ALM OFF
```

```
Startup 01: Switch WLPMP1 ON AND PH_ALM OFF AND CL_ALM OFF AND TWRALM OFF AND WL1ALM OFF AND
WL2ALM OFF AND TNKALM OFF

Startup 02: Delay for 2 Seconds, Switch WLPMP2 ON

Startup 03: Delay for 2 Seconds, Switch FINPMP ON

Startup 04: Delay for 5 Seconds, Switch CHLMET ON AND NAOMET ON


Shutdown 01: Switch CHLMET OFF AND NAOMET OFF

Shutdown 02: Delay for 2 Seconds, Switch WLPMP1 OFF AND WLPMP2 OFF

Shutdown 03: Delay for 2 Seconds, Switch FINPMP OFF
```

This sample configuration has a fairly straightforward process flow. On startup, some of the system outputs are switched on sequentially and all alarm indicators are switched off. On shutdown, all pump outputs and chemical metering devices are turned off. The process tasks are mostly self-explanatory. Some process tasks include fax and pager reporting functions. It is important to remember how and when the process tasks are run:

- Process tasks are run continuously while the ProControl unit is in AUTO mode. Process control tasks are ***event-driven***, i.e., they occur once when the "IF…" conditions are true (subject to any delays). No automatic action is taken in MANUAL mode.

- Startup and Shutdown processes are run in sequence. When the Startup sequence is finished, the unit is placed in AUTO mode and the **Process Tasks** are run. If any Startup process in the sequence fails, then all the non-lamp outputs are turned "OFF" and the unit reverts to MANUAL mode. A Startup process fails when any IF condition is not satisfied for 60 seconds after the Startup process begins (there may not be any IF conditions in your Startup sequence). The Startup sequence begins when the ProControl or ProView operator initiates it. The Startup sequence can also begin when power is first applied to the ProControl unit if the "Auto Startup" option has been enabled.

- The Shutdown sequence works in a similar manner. When the Shutdown sequence is finished, the ProControl unit reverts to MANUAL mode. If any Shutdown process in the sequence fails (is not run after 60 seconds), then all the non-lamp outputs are immediately turned "OFF" and the unit reverts to MANUAL mode. The Shutdown sequence can be initiated either by the ProControl or ProView operator or by a process task (Process 5 does this in our example).

Process Capability

The ProControl runs process tasks which are based on Boolean IF ___ AND ___ THEN ___ logic. There are 64 available processes, 16 of which can be used as part of a startup sequence, and 16 of which can be used as part of a shutdown sequence. Each process can:

- be based on several, simultaneously existing I/O conditions
- include short or long delays for de-bouncing or simple time delay
- use memory variables (registers) for linking processes
- cycle outputs with timers or during certain times of the day
- perform system shutdowns

- send reports to fax and/or pagers

FYI

If you wish to modify the ProControl programming, please contact your Control System Integrator for assistance.

CHAPTER 3: ESTABLISHING COMMUNICATION

This chapter explains how to connect to the ProControl unit using ProView by local serial cable and by remote modem.

By itself, ProView does not reveal very much about your site's operation. It must be connected to the ProControl unit in order to yield any data.

Local Connection

To establish a local connection, perform the following:

1. Use the local serial cable supplied with the ProControl to connect the computer you are using to a ProControl unit. One end of the cable terminates with a female 9-pin connector. Use this end to plug into the serial port on your computer. The other end of the serial cable is terminated with a 9-pin RJ-45 "Ethernet" connector. Use this connector to plug into the "RS-232/Serial" port on the right hand side of the ProControl unit.

! *Be sure to disconnect the serial cable from the ProControl unit after you are finished. If you do not, remote communications and alarm reporting will **not** be possible.*

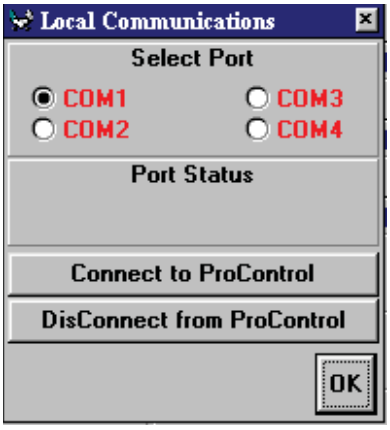
! *If the ProControl unit is powered OFF for any reason, wait 45 seconds after power up before plugging in the cable to attempt a local connection. Otherwise, the ProControl's modem may not be properly configured.*

2. Click on **Local Connection** in the **Communications** menu. You can also use ALT-C.

Or

Click on the **Local Connection** toolbar button. 

You will see the **Local Communications** dialog box.



3. Select the COM port to which the ProControl is connected by clicking on the "radio button" next to the COM port you want to use. COM ports 1 through 4 are supported.

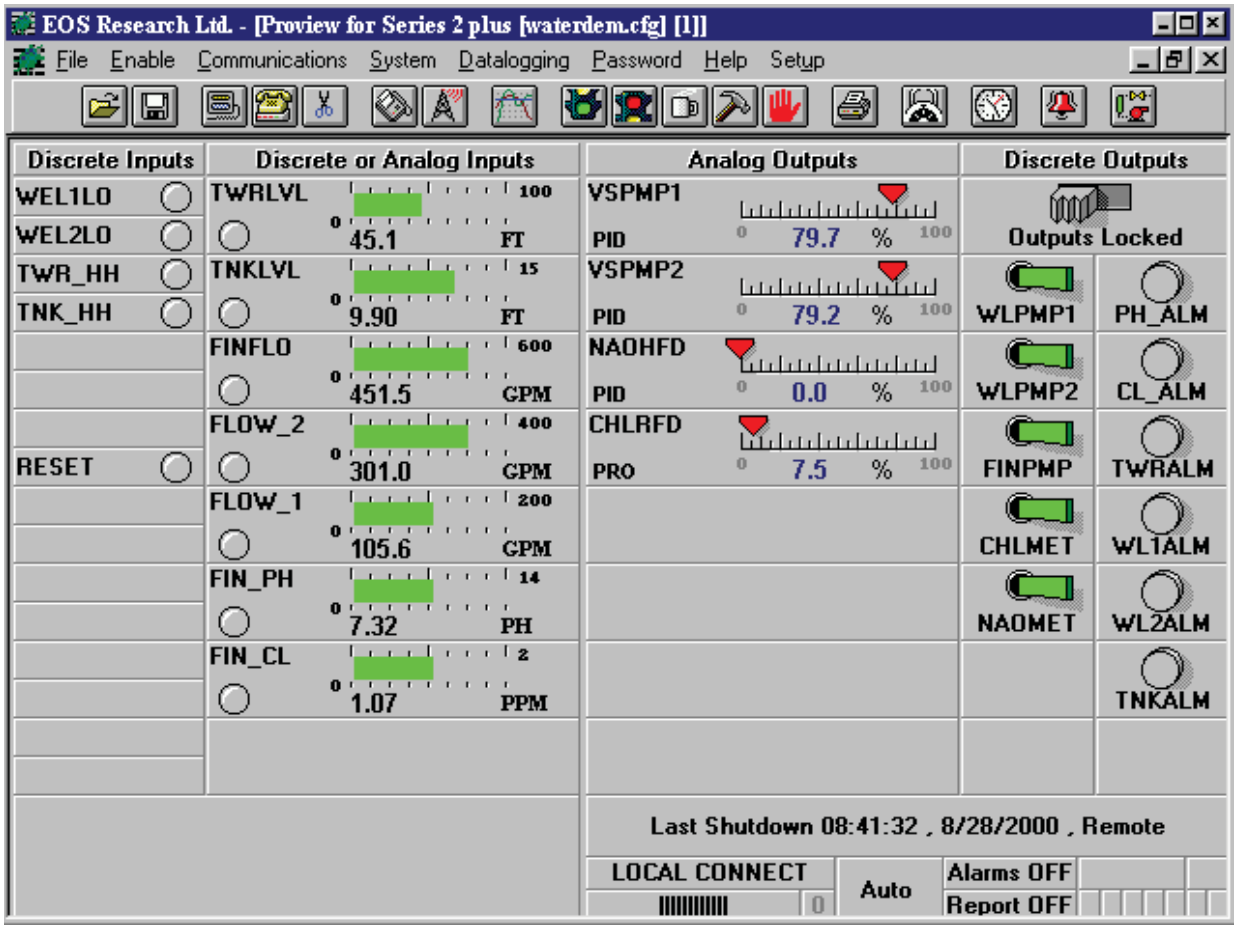
4. Click on the **Connect to ProControl** button.

5. You will see status messages in both the **Port Status** area of the **Local Communications** dialog box and in a small information box near the bottom of the main screen. Usually you will see "Trying Local..." followed by "LOCAL CONNECT" if the attempt is successful. If the attempt is unsuccessful you will see message boxes outlining the suspected problem.

6. After connecting, click on the **OK** button to hide the **Local Communications** dialog box.

After establishing a local connection, ProView will perform an initial scan of site conditions. This will take a few moments during which time the mouse pointer will turn into an hourglass. After the initial scan, data will be updated on the screen every second or so.

Here is a view of the main screen after a local connection has been established:



Note that the screen has been updated to reflect the current operating conditions at the site. At the bottom of the screen, various message panels have been filled in as well.

Remote Connection

For a remote connection, the procedure is a little different. Follow these steps:

1. Make sure that your modem has been installed properly and that the phone line is plugged in to the proper port on the modem.

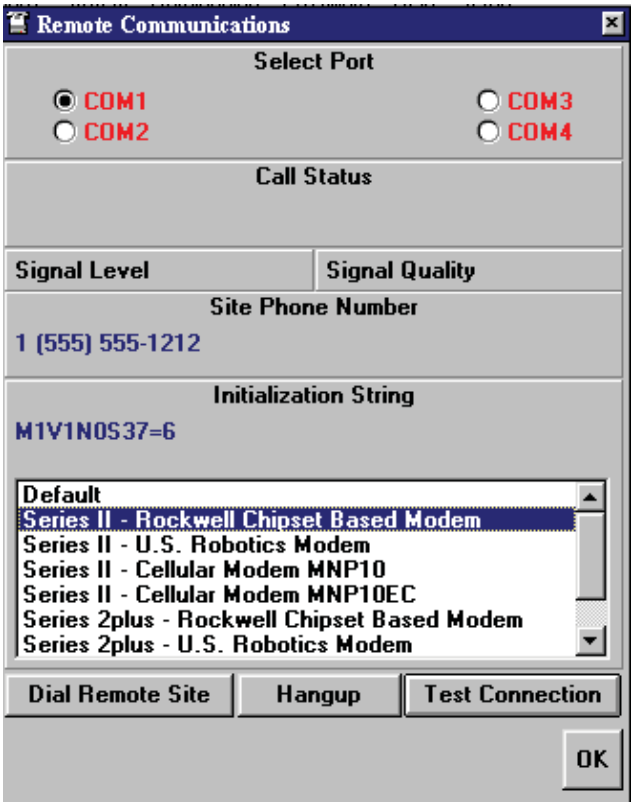
Your modem must be Hayes (AT) compatible and capable of operation at 9600 baud.

2. Click on **Remote Connection** in the **Communications** menu. You can also use ALT-C.

Or

Click on the **Remote Connection** toolbar button. 

You will see the **Remote Communications** dialog box.



3. Select the COM port to which your modem is connected by clicking on the "radio button" next to the COM port you want to use. COM ports 1 through 4 are supported.

4. Check to see that the **Site Phone Number** is the one you want to dial. If not, click on the phone number and change it. If you need to dial an 8, 9 or some other prefix first to get an outside line, add

a comma or two after the prefix to obtain a pause before dialing the main number (e.g., 8,555-1212). Do not add parentheses or dashes.

5. Examine the **Initialization String** to see if it is correct for your type of modem. For Series 2^{plus} systems, you will usually use the **Initialization String** for Rockwell Chipset or U.S. Robotics modems. If these do not work, use the Default string instead.

6. Click on the **Dial Remote Site** button.

7. You will see status messages in both the **Call Status** area of the **Remote Communications** dialog box and in the lower portion of the main screen. Usually you will see the following messages:

Trying Remote...	ProView is attempting to contact your PC's modem
OK	ProView has successfully connected to the modem
Setup...	ProView is sending the initialization string to the modem
Dialing...	ProView is dialing the site phone number
CONNECT 9600	Connection has been established with the remote modem
REMOTE CONNECT	Connection has been established with the remote ProControl unit

8. If the attempt is unsuccessful you will see message boxes outlining the suspected problem.

9. After connecting, click on the **OK** button to hide the **Local Communications** dialog box.

Ending a Connection

The simplest way to end a connection, to hang up in essence, is to click on the **Disconnect** button on the Toolbar.  This works for either a local or remote connection.

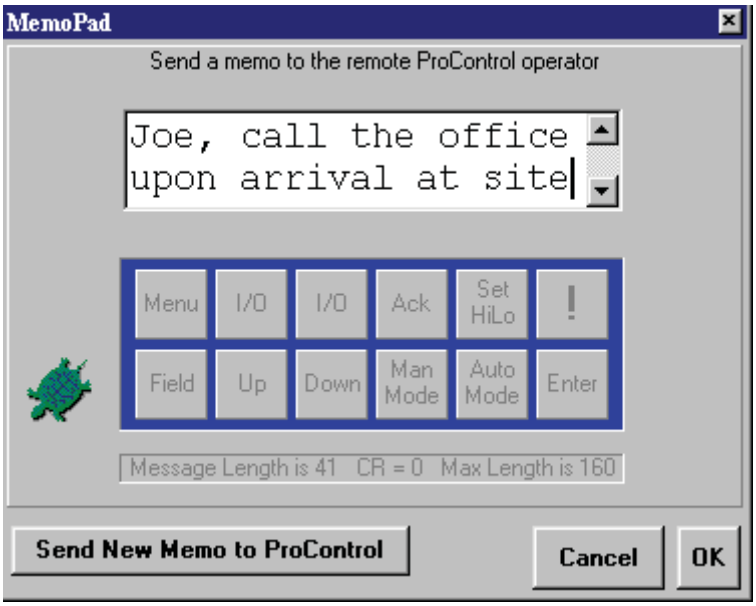
Alternatively, you can re-open the **Local** or **Remote Communications** dialog box and click on either the **Disconnect from ProControl** button (Local) or the **Hangup** button (Remote). After ending the connection, you should see **NOT CONNECTED** in a message box near the bottom of the screen. 

Sending a Memo

A useful feature of the ProControl is the ability to transmit short memos to a site operator. From ProView, you can send a message of up to 160 characters to the display of the ProControl unit. The site operator must acknowledge your memo before returning to his normal display. This feature is useful in communicating with a person at the remote site while the phone line is in use for a connection to the ProControl.

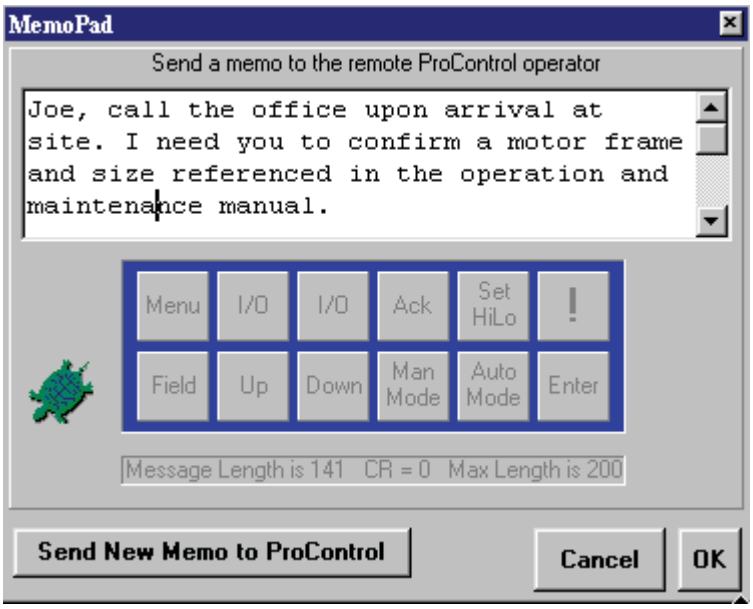
To send a memo, follow these steps:

1. From the **Communications** menu, select **Send Memo**.



2. Type your memo onto the screen of the **MemoPad**. It will appear on the ProControl's display exactly as it appears to you on the MemoPad, two lines at a time. Words will automatically wrap around to the next line, but you may hit Enter (Carriage Return or CR) to jump to the next line if necessary. However, the fewer <CR> characters you use, the longer the text message you can type, since each <CR> represents 20 characters. The **Message Length** counter will keep track of the number of characters you have used. The **Max Length** counter will decrease to let you know how many more characters can be entered.

3. By clicking the right mouse button when the pointer is over the text window, the text window will become larger, allowing you to view more text without having to scroll up and down.



4. Click the **Send New Memo to ProControl** button to send the memo to the ProControl's display, **OK** to temporarily save the memo but not transmit it, or **Cancel** to abort the entire procedure.

5. The **Ack** button on the MemoPad will flash red and your PC will beep to indicate when the ProControl operator has acknowledged your memo.

CHAPTER 4: MANAGING YOUR SITE

This chapter explains how to change the way your ProControl system operates by switching between Manual and Automatic modes, initiating a startup or shutdown sequence, and changing other general system settings.

Switching Between System Modes

There are four modes of operation for the ProControl: Manual, Automatic, Startup and Shutdown. To initiate a switch to a different mode, simply click on the appropriate Toolbar button  or click on **Process Operations** in the **System** menu.

Goto AUTO Mode:  Clicking on the coffee cup will place the ProControl into Automatic mode.

Goto MANUAL Mode:  Clicking on the hammer will place the ProControl into Manual mode.

STARTUP System:  Clicking on the green traffic light causes the ProControl to initiate a Startup sequence.

SHUTDOWN System:  Clicking on the red traffic light causes the ProControl to initiate a Shutdown sequence.

Emergency OFF:  Clicking on the red hand will cause an Emergency Shutdown, which turns off all outputs immediately and places the ProControl in Manual mode.

Be sure you understand the safety risks and other implications of issuing these commands. When the icons are clicked, the actions are ***immediate*** *and equipment may start up or shut down automatically.* ***Most importantly, switching the ProControl to Manual mode will defeat any safeguards programmed into the system and allow equipment to continue running without any process control.*** *Manual mode should only be used on a short-term basis for system troubleshooting or clearing alarm conditions, preferably with de-powered equipment circuits.*

You can monitor the current system mode by looking at the message panel at the bottom of the main screen.

The system is currently in Manual mode.

The system is currently in Auto mode.

The system is currently in Startup mode, the last startup task run was startup task #2.

The system is currently in Shutdown mode, the last shutdown task run was shutdown task #2.

The last action to initiate a Shutdown is listed in another message panel at the bottom of the screen. In the example below, the shutdown was initiated by a remote user.

System Operations

Following are several other operational parameters that can be set by ProView.

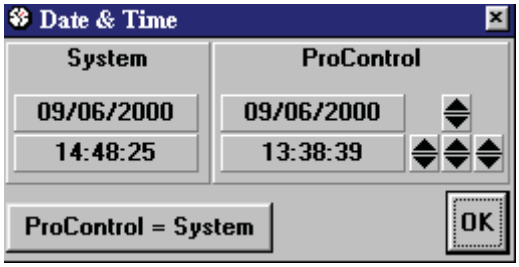
Date & Time

The ProControl unit maintains an internal real-time clock which it uses to time-stamp datalogged information and control other important system functions. To set the **Date & Time**:

1. Click on the **System Time** toolbar button. 

Or

Choose **System Operations** from the **System** menu and click **System Time**. You will see the **Date & Time** dialog box.



2. The left side of the dialog box displays the current date and time kept on your PC. The right side of the dialog box is the date and time according to the ProControl unit. Follow the procedure outlined below if you need to change the time.

3. To set the ProControl's clock equal to the PC's clock click on the **ProControl = System** button. To set the ProControl's clock to a specific time use the time spinners  . The upper spinner changes the date and lower set of three spinners change the hour, minute and second (left to right, respectively).

4. To set your PC's time (System time) use the Windows Control Panel.

FYI

Daylight Savings Time is not supported by the ProControl's clock. You will need to make any necessary changes manually.

Changing the time by a large amount can lead to discontinuities in the datalogging history of your ProControl unit, particularly if you move the ProControl's time forward. See the section on Datalogging Setup in Chapter 5 to check on your system's datalogging status.

Alarms

An alarm is only an **audible** indication to the operator that an input signal is in its ***active state***. On the ProControl unit, the beeper sounds if the **Alarms** are **Set**, the unit is in Manual mode and an input is in the active state. The Alarm continues to sound until it either is acknowledged by the operator or times out by itself. In ProView, a "Beep" sounds from the PC if the **Alarms** are **Set**, and an input that has been configured as an **Alarm Input** enters the active state. No acknowledgment is necessary.

The current status of the alarm feature is displayed in a message box at the bottom of the main screen. Alarms OFF

To enable or disable Alarms, click on the **Alarms** toolbar button,  which toggles this feature on and off.

Or

Click on **Set Alarms** in the **Enable** menu.

Remote Reporting

A report is a fax or a pager message sent by the ProControl unit. In order for any reporting to occur, **Remote Reporting** must be enabled. The current status of the reporting feature is indicated in a message box at the bottom of the main screen. Report OFF

To enable or disable remote reporting, click on **Remote Reporting** under the **Enable** menu. A check mark is displayed if reporting is enabled.

Log Off Remote User

This function is used occasionally to reset the remote ProControl's display to the password menu. It is often used to ensure that an on-site user does not change any ProControl settings while you are remotely connected, and to ensure that password protection is restored if the last user did not Log Off locally.

To Log Off the remote user, choose **System Operations** from the **Systems** menu, and click on **Log Off Remote User**.

Initiate FAX NOW!

This function is the equivalent of pressing FAX NOW on the ProControl unit. It is used to generate and send a current fax status report to the currently enabled fax numbers. Fax reports must be enabled in the **FAX Report Setup** dialog box and ProView must be connected via modem (remotely) for this command to proceed.

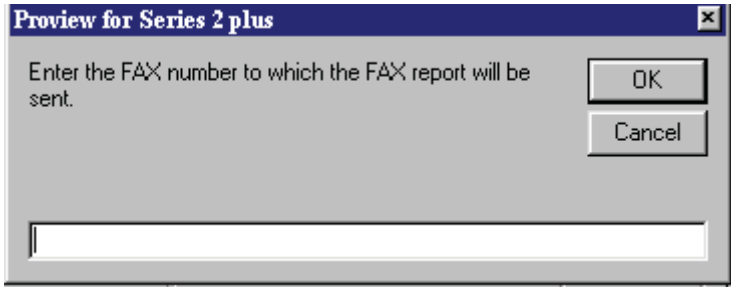
ProView will disconnect from the ProControl unit (hang up) after issuing this command to free the remote phone line for fax use. Normal FAX back operations and times will not be affected.

To initiate the fax, choose **System Operations** from the **Systems** menu, and click on **Initiate FAX NOW!**

Initiate New FAX NOW!

This function is identical to **Initiate FAX NOW!** except that you can specify a number that is not currently enabled to receive faxes from the ProControl. You can use this for testing the fax capabilities or to send a fax update to a third party.

To initiate the fax, choose **System Operations** from the **Systems** menu, and click on **Initiate New FAX NOW!**



ProView will alert you first that you will be disconnected from the system in order for the fax to proceed. Enter the FAX number to which the fax report will be sent, making sure you include a prefix or the numeral 1 and the area code, if necessary. Click the OK button to send the fax report.

CHAPTER 5: CHANGING SYSTEM PARAMETERS

This chapter explains how to change the settings that govern much of the operation of your system, such as the state of a discrete output, analog alarm levels and fax and datalogging setups.

Switching an Output State

The state of a discrete output can be changed manually by clicking on the "switch" associated with its tagname. ProView includes a "locking" feature for discrete outputs as a safety measure to prevent inadvertent output changes; you must "unlock" the outputs in order to turn them on or off. The outputs are locked and unlocked by clicking on the "slide switch" at the top of the **Discrete Outputs** section of the main screen.

You should leave the slide switch in the **Locked** position whenever possible.

Bear in mind that if the ProControl unit is in Auto mode, any discrete output change you make may be "overridden" by a process control task. Do not turn outputs on or off unless you are familiar with the process control in effect for your system.

1. 

To change the state of a discrete output, click on the toggle switch.

2. 

The toggle switch will change positions, and a "?" will appear for a moment after the tagname. This indicates that the command was sent to the ProControl unit but that confirmation of the state change has not yet been received.

3. 

The "?" will disappear after confirmation of the state change has been received from the ProControl unit.

Depending on your site configuration, you may be able to change certain parameters that affect how the discrete outputs in your system operate in Auto mode.

Process Groups

The ability to set a ***Process Group*** is a rarely-used feature that prevents an individual output from being switched by certain process tasks when in Auto mode. If your ProControl has been configured for Process Groups, you can switch between Group 1 (ignore processes 17 – 32) and Group 2 (ignore processes 1 – 16).

Do NOT enable process groups unless your ProControl has been configured specifically to use this feature! *Be sure you understand the safety risks and other implications of issuing these commands.*

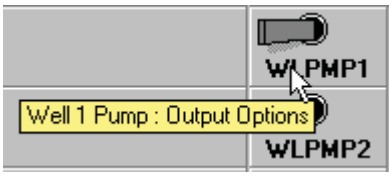
Output Cycle

Some of your outputs may have been configured as "Switched" outputs, where the output is turned on and off according to a timed cycle, or during a specific time of day.

Output Options

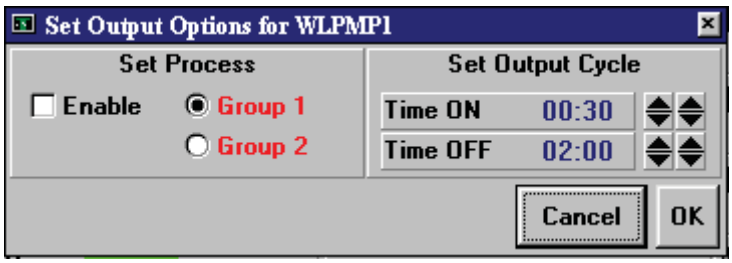
To change an output option, do the following:

1. Place your mouse pointer over the output's tagname until a balloon appears. Click the *right* mouse button until you see **Output Options**.



2. Click the *left* mouse button.

3. You will see the **Set Output Options** dialog box. The **Set Process** or **Set Output Cycle** panels may not be visible if those options do not apply. Both panels will be disabled if ProView is not connected to a ProControl unit.



4. To enable a Process Group click on the **Enable** check box and click either the **Group 1** or **Group 2** radio buttons in the **Set Process** panel. Once again, ***Do NOT enable process groups unless your ProControl has been configured specifically to use this feature!***

5. If the output has been configured to run in a switched mode, you will be able to change the **Output Cycle** times by clicking on the value you want to change and entering the new time in an **hours:minutes** format (be sure to hit Enter after you type in the new time). Alternatively, click on the up or down spinners to increase or decrease the time you want to change.

6. Click on the **OK** button to confirm the changes and send them to the ProControl unit. Click on **Cancel** to get rid of any changes.

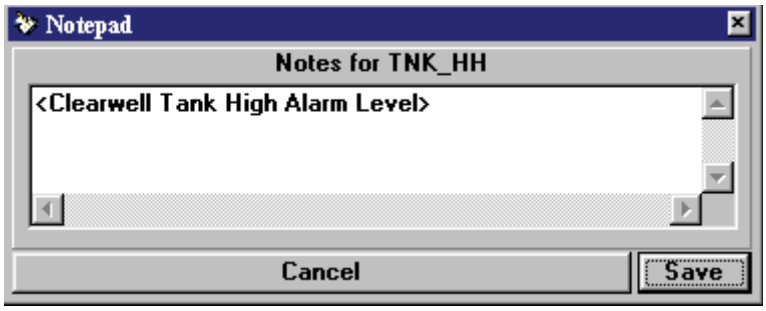
Notes

Each I/O point can have its own set of associated ***Notes***. The notes are stored on your PC in a file with a **.not** extension along with your **.pvs** file. You can attach notes which explain the functional purpose of the I/O point or define the I/O point in more detail. This can eliminate uncertainty that may result from the limitation of six characters in each point's tagname.

To edit an I/O point's notes do the following:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, and *right*-click until you see **Notes**.

2. Click the left mouse button to enter the "Notes" feature. The **Notepad** dialog box appears.



3. Click in the **Notes** window to edit or add descriptive text. Any notes enclosed in angle-brackets (i.e. <note>) will appear within the balloon when you position the mouse pointer over the tagname, and at the top of the main screen.

4. Click the **Save** button to save your notes and/or definitions or press **Cancel** to exit without saving. You must also save the site file before exiting ProView to retain any changes made in Notes.

FYI

Sometimes it is a good idea to provide a more complete description of what an input or output does in the Notes; e.g., "Causes System Shutdown" or "Turns ON when Tank is Full". Feel free to customize the notes to suit your purposes; they are stored locally on your PC and do not affect the operation of the ProControl itself.

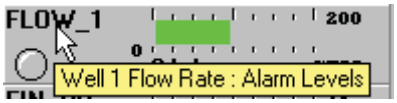
Analog Alarm Levels

The analog alarm levels define what parts of an analog input's range are considered "active" and which are not. This affects not only the color of LED's and bar graphs on the main screen but also can affect process control if the analog input is used in a process task. Depending on how your system has been configured, you

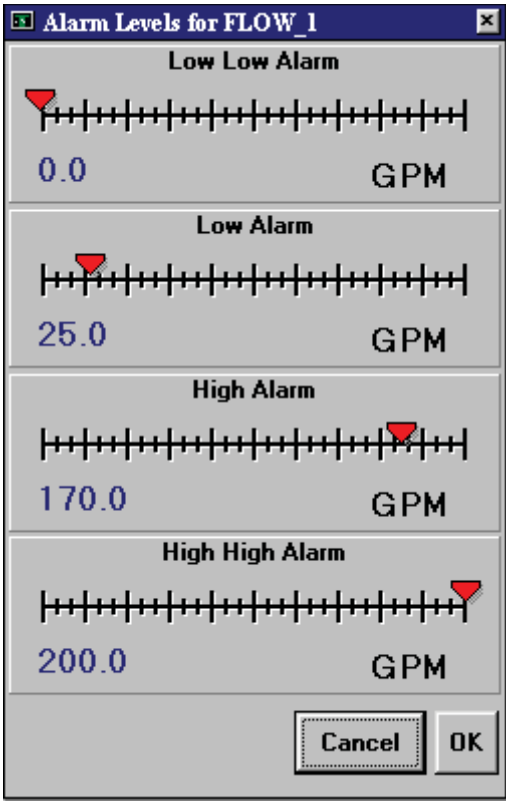
will be able to set up to four "activation levels" that define when an input becomes active. Some ProControl configurations allow you to set a ***Low Alarm Limit*** and a ***High Alarm Limit***, while others allow you to additionally define a ***Low-Low Alarm Limit*** and a ***High-High Alarm Limit***. These activation levels are somewhat more flexible in use than their names imply, in that they are not only used to trigger alarms. If an alarm limit value is exceeded, it could be used to simply turn on a pump or reset a switch, for example.

To set an analog alarm level, do the following:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, *right*-click until you see **Alarm Levels**.

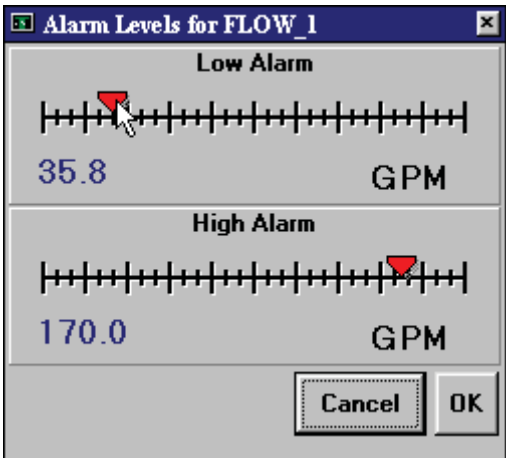


2. Left-click and the **Alarm Levels** dialog box appears.

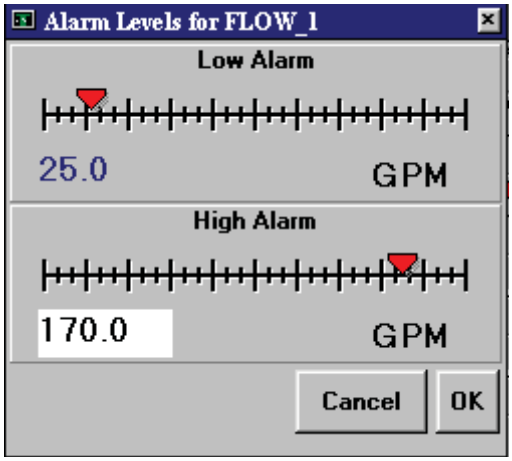


3. The present alarm levels are shown in text as well as in the position of the sliders. Note that the **High Alarm** value must be greater than the **Low Alarm** value, and the **High High Alarm** value must be greater than the **Low Low Alarm** value.

4. You may adjust the alarm values by clicking and holding a red slider and moving it to the left or right. As you move the slider the numeric value is updated to reflect the change you are making. The alarm level will be set to a new value when you release the mouse button.



5. Alternatively, you may click on the alarm level text and edit the value for the alarm level. This is usually a better way to input a precise value. Be sure to hit the Enter key to send the new value to the ProControl unit. Click on the **OK** button to hide the **Alarm Levels** dialog box.



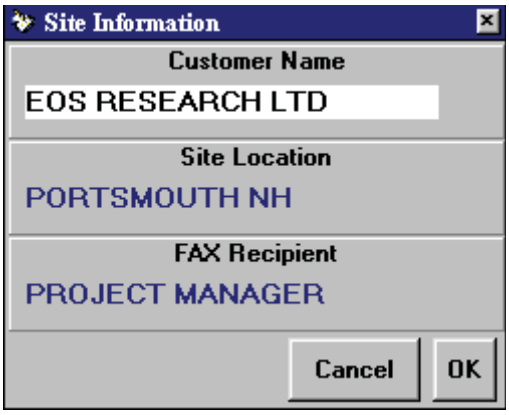
! *Remember that any changes you make to the alarm levels are **immediate** and may impact the process control for your system. Be sure you understand the safety risks and other implications of issuing these commands.*

Site Information

Site Information refers to data used in the fax report and in the various files printed by ProView.

To view or change the Site Information do the following:

1. Click on **Site Information** in the **File** menu. The **Site Information** dialog box appears.



2. To change the **Customer Name**, **Site Location** or **FAX Recipient** click on the text you want to change and edit it. Only uppercase letters, numbers and blank spaces are allowed. The **Customer Name** field also appears on the main screen of the ProControl unit's display.

3. Click on the **OK** button to confirm the changes and send them to the ProControl unit. Click on **Cancel** to get rid of any changes.

FAX Report Setup

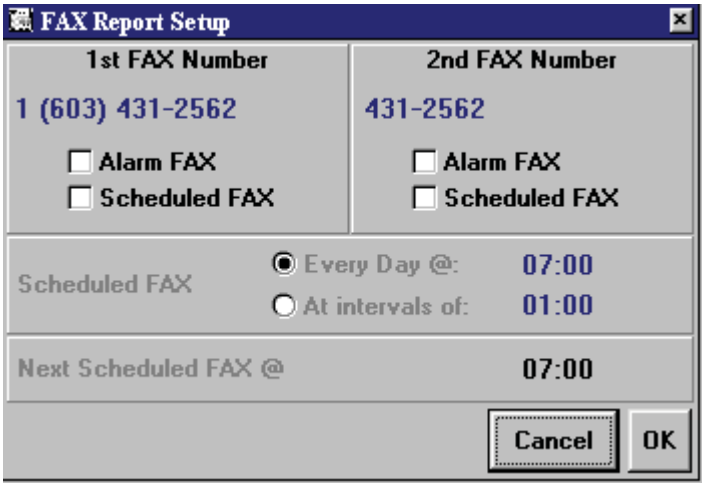
This setup screen is used to change when and where the ProControl's fax report is sent, and whether individual fax recipients are enabled.

To view or change the FAX Report Setup, do the following:

1. Click on **FAX Report Setup** in the **Communications** menu.

Or

Click on the **FAX Report Setup** toolbar button.  You will see the **FAX Report Setup** dialog box.



2. If **Remote Reporting** is not enabled, the contents of the dialog box will appear "grayed out" or disabled.

3. The first and second FAX number panels determine what kinds of fax reports are sent by the ProControl unit and where they will be delivered. There are two kinds of fax reports generated by the ProControl. A **Scheduled FAX** report occurs on a regular basis to provide a status report, while an **Alarm FAX** report will be sent when issued by a Process Task that has been configured to do so (usually to report an alarm condition). To enable either type of fax report click on the **Alarm FAX** or **Scheduled FAX** check boxes. If you enable Scheduled FAX reports the Alarm FAX reports for that same number are automatically enabled as well. You cannot enable only Scheduled FAX reports.

4. To change the phone number to which the ProControl will fax reports click on the phone number and edit it. The ProControl can fax to two different phone numbers. It will make up to three attempts to send the fax. If the first try is unsuccessful, the second try will be initiated 5 minutes later, and a third attempt will be made 5 minutes after that. If the third try is unsuccessful the fax attempt will be abandoned and the ProControl will enter a fax failure into the Events log (see Chapter 6). The ProControl will try both phone numbers (if they are both enabled) on the first try before moving on to a second attempt.

5. In the **Scheduled FAX** panel, you can select when the regularly scheduled faxes are sent. Choose the **Every Day @** button and edit the time to the right of it to have a report sent at the same time every day (24-hour clock). To have a report sent at a specific time *interval,* choose the **At intervals of** button and enter the time interval in HH:MM format. When you hit Enter, the data will be sent to the ProControl unit.

6. The **Next Scheduled FAX** variable indicates when the next *scheduled* fax report will be sent. You can also change it yourself if, for instance, the ProControl is set to fax every hour but you would like it to skip a few hours before resuming. To set the **Next Scheduled FAX** time click on the time in that panel and enter the new time in 24 hour format. Note that if you enter a Next Scheduled FAX time that is earlier than the current time as determined by the ProControl's clock, you will prevent any scheduled faxes from being sent until the next day at that time.

7. Click on the **OK** button to confirm the changes and send them to the ProControl unit.

Paging Setup

This setup screen is used to change where the ProControl's alarm pager messages are sent, and whether individual page recipients are enabled. You will need to contact your paging service directly to obtain some of the information necessary for proper paging setup. The paging capability is similar to the ProControl's fax capability in that you can send information to two pagers and it will make three attempts at reaching each number.

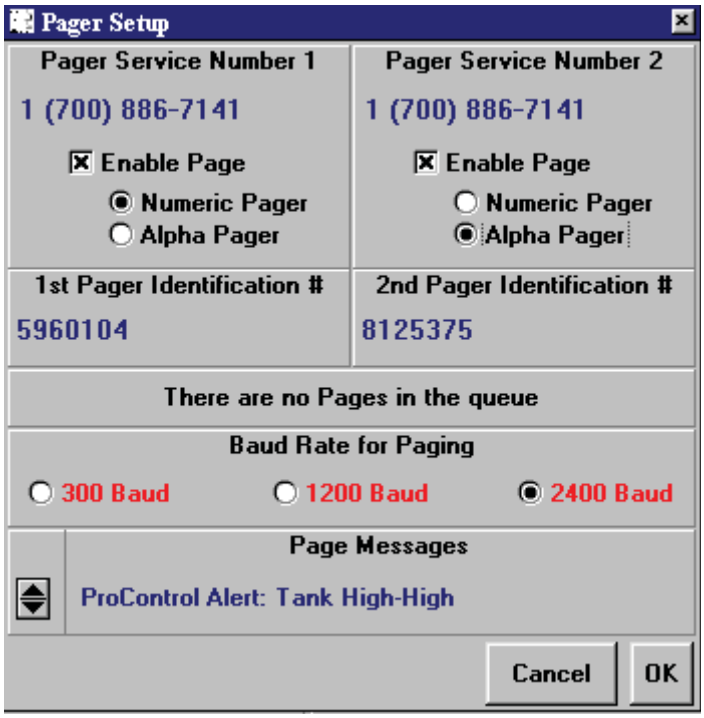
You will need to obtain your pager company's modem dial-up phone number and your pager's modem dial-up ID (this is often different than your regular pager ID). This information is generally not available from the customer service staff at the pager company. You may need to ask for someone in technical support who is familiar with pager modem dial-up.

To view or change the **Paging Setup** do the following:

1. Click on **Paging Setup** in the **Communications** menu.

   Or

   Click on the **Paging Setup** toolbar button.  You will see the **Pager Setup** dialog box.



2. In the **Pager Service Number** panels, enter the telephone number for your pager company's modem dial-up.

3. Click on the **Enable Page** check box, and choose **Numeric Pager** or **Alpha Pager** (text).

4. Enter the pager ID number you obtained from the pager company in the **Pager Identification #** panels.

5. The next panel indicates whether there are any queued pages. In other words, if a page has not yet been successfully completed and you have dialed into the ProControl with ProView, you may be interfering with the ProControl's attempts to send a page.

6. Select the baud rate in the **Baud Rate for Paging** panel, which is the speed at which the page information is sent to your paging company. It is generally recommended that you use 300 baud for the greatest reliability. Even at 300 baud, the ProControl takes only a few seconds to transmit the information to your pager company.

7. The **Pager Message** field allows you to view and/or change the information which will be transmitted to your pager from specific events. If you are using a numeric pager, this message cannot exceed nineteen digits in length and may contain only numerals. If you are using an alphanumeric pager, this message can be up to 80 characters in length. After you edit the message, hit Enter to send the updated message to the ProControl unit. Use the up and down spinners to view the other Process Tasks that cause pages to be sent. You should be familiar with the process control of your system before attempting to make changes to these messages.

8. Once you have finished making your changes click **OK** to close the dialog box.

Datalogging Setup

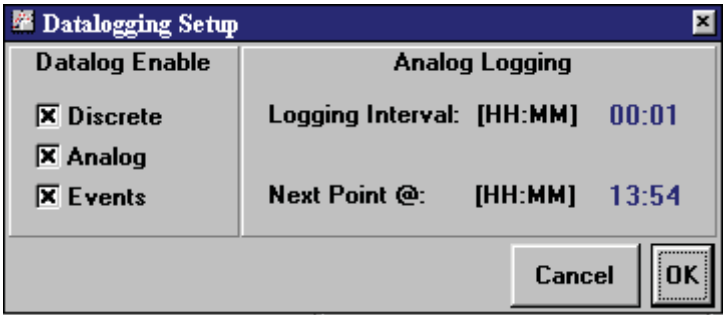
There are three different types of datalogging on the ProControl. Discrete input and output changes are logged as they happen. Events are also logged as they happen, and include changes in control mode (e.g., Auto, Manual), local and remote connections to the ProControl, system startup/shutdowns, fax or page failures, and execution of *Process Tasks*. Analog input and output values are logged at specific time intervals determined by the user. The **Datalogging Setup** dialog box is used to determine how datalogging is carried out in the ProControl unit.

To view or change the **Datalogging Setup** do the following:

1. Click on **Datalogging Setup** in the **Datalogging** menu.

Or

Click on the **Datalogging Setup** toolbar button.  You will see the **Datalogging Setup** dialog box.



2. To enable a type of datalogging click on the **Discrete**, **Analog** or **Event** check boxes located in the **Datalog Enable** panel.

3. To change the logging interval for analog inputs click on the time value indicated for **Logging Interval** and edit it. This interval can range from 1 second to 24 hours, expressed in minute/second

format or hour/minute format (default). Clicking on the **HH:MM** adjacent to the **Logging Interval** will toggle between hour/minute format and minute/second format.

4. The **Next Point @** variable is set by the ProControl every time a data point is logged to show you when the next analog data points will be logged. You can change this value if you wish the ProControl to delay before resuming analog datalogging. Click on the time associated with **Next Point @** and enter the new time in either HH:MM or MM:SS format. Note that if you enter a **Next Point @** time that is earlier than the current time *as determined by the ProControl's clock*, you will prevent any analog datalogging from occurring until the next day at that time (or next hour if using MM:SS format).

4. Once you have finished making your changes click **OK** to close the dialog box.

FYI

When setting your analog logging interval, be aware of the available memory in the ProControl unit you are using. If, for instance, your ProControl has a capacity of 5,000 analog data points per input channel and you specify a 5-minute logging interval, there will be available memory for approximately 17 days worth of analog data. Changing the log interval to 10 minutes will make the memory last twice that long. Once the memory is full, the oldest data is purged to make room for the current data.

Changing the Password

You can change the password for opening a site file in ProView or for access to the ProControl unit from its keypad. The passwords do not have to be the same. If you change the password while ProView is connected to a ProControl unit, the new password will be used for both ProView and the ProControl unit. If you change the password while not connected to a ProControl unit, the new password will be used only for that site file in ProView. In order to save the new password for the site file in ProView, you must save the site file (**File…Save Site**). However, any change to the password in the ProControl unit itself is immediate.

To change the password, follow these steps:

1. Click on the **Password** menu.

Or

Click on the **Password** toolbar button.  You will see the **Security** dialog box.

2. Click on the **Change Password** button. You will prompted to enter the **Old Password** in the text box. Click the **OK** button or hit the enter key. If you do not enter the password correctly, a beep sounds and the security dialog box disappears.

3. You will then be prompted to enter the **New Password** in the text box. Recall that the password can be up to three characters consisting of the numbers 0-9 and the letters A-Z. After clicking on the **OK** button or hitting the enter key, you will be prompted for the new password again.

4. If both new password attempts were identical, the new password will be accepted and the **Security** dialog box will disappear. If ProView is connected to the ProControl, the new password will be in effect for both ProView and the ProControl unit.

Analog Output Options

If your ProControl system is configured with analog outputs, you will be able to adjust the output level, or the parameters used in a control algorithm associated with that output. Your system integrator should have already configured your analog outputs with these algorithms if they apply to your process. Analog outputs can be involved in one of two different types of control scheme: **PID** or **Proportional** control. A **PID** (Proportional-Integral-Derivative) Loop is a feedback-based loop that maintains an analog input at a user-defined ***Setpoint***. The ProControl automatically adjusts the analog output using a mathematical formula that includes ***Gains*** for the proportional, integral and derivative terms. PID control is a commonly-used process control technique, descriptions of which can be found in most control theory texts.

FYI

If you are familiar with PID control terms, note that the PID gains used by the ProControl are defined differently than some of the terms in traditional use. **Proportional Gain** *on the ProControl corresponds with the classic definition of* **proportional band.** *However, the* **Integral Gain** *and* **Derivative Gain** *are the* ***inverse*** *of* **integral (or reset) time** *and* **derivative time.** *Hence, an* ***increase*** *in any of these gains tends to* ***increase*** *the corresponding proportional, integral and derivative action.*

A **PRO** (Open-loop Proportional) algorithm generates an analog output signal that is directly proportional to the value of an analog input. The analog output percentage is computed by multiplying a constant of proportionality by the associated input's percentage of full-scale.

If a control scheme is not assigned to an analog output (or if the output has been placed in **Manual** mode), you can change the output value by clicking on the slider for that output and dragging it up or down, or by highlighting the number beneath the slider scale and typing a new value.

You can modify the PID parameters of a PID-controlled analog output (the **P**, **I** and **D Gains**) if your analog output is not responding smoothly or quickly enough to changes in its associated input. The proportional (**P**) gain specifies the output level based on the error between the **Set Point** (desired input level) and the actual input level. Integral (**I**) gain smoothes the output level based on the tracking history of the input to the **Set Point** and provides a means of better steady state control. Derivative (**D**) gain will allow the output to respond to quick changes in the input and provides a means of establishing good transient or instantaneous control.

In the case of a **PRO** output, you can modify the **P Gain** to alter how much the output value changes as the associated input changes. A value of 100 indicates that the output will be 100% when the input is at full scale. A value of 50 indicates that the output will be 50% when the input is at full scale

The **Max Change** parameter allows you to regulate how much the analog output can change in one control cycle (one control cycle is about 1/4 of a second).

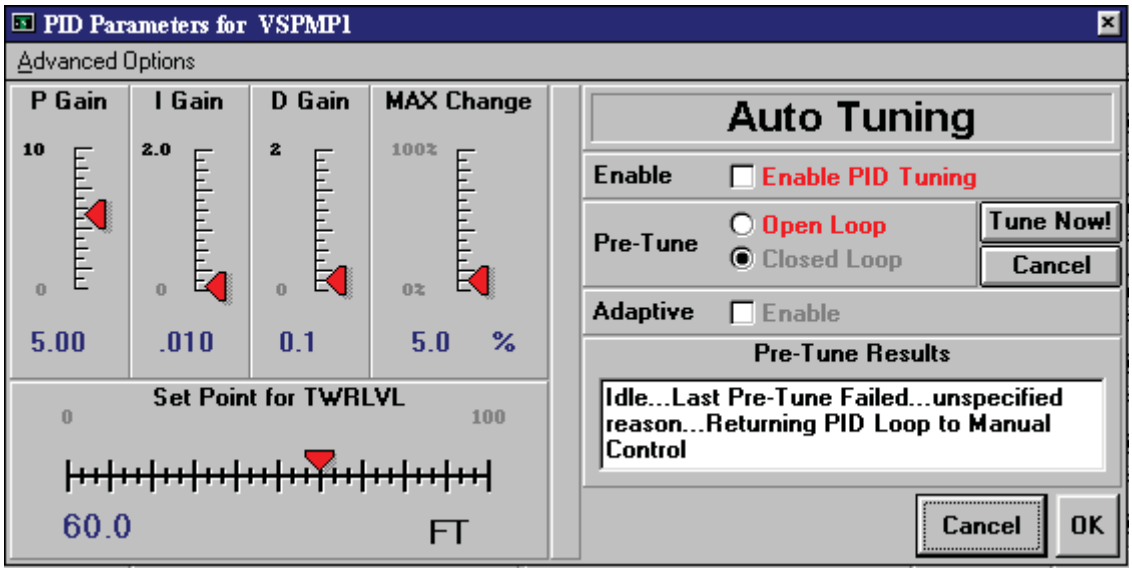
Be sure you fully understand PID and proportional control concepts before adjusting any of these parameters. Large changes in output can result from changing the gains or the set point, which can cause equipment damage or unforeseen safety hazards. For help in choosing appropriate gains for your process, contact EOS Research technical support.

To change the **PRO** or **PID** parameters, **Set Point**, or **Max Change** parameters:

1. It is highly recommended to first place your analog output into **Manual** mode. Click on the **PID** (or **PRO**) beneath the Tagname and wait a second for it to change to **Manual**.

2. Position the mouse pointer over the analog output's tagname until a balloon appears, and *right*-click until you see **PID Options**.

3. Left-click and the **PID Parameters** dialog box appears.



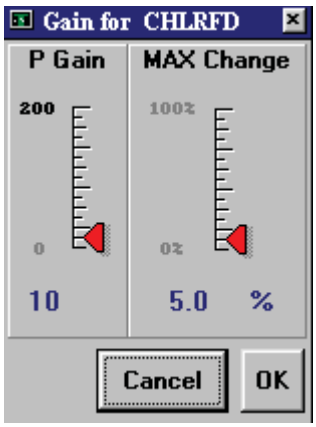
4. To change any of these parameters, you can either click and drag the sliding scale or click the numerical text and enter the value through the keyboard. You can also change the upper limit on all of the gain scales.

5. Click the **OK** button to save your changes. If not, click the **Cancel** button.

6. To restart your PID loop, click the word **Manual** underneath the Tagname and wait a second for it to change to **PID**. Your new parameters are now in use by the ProControl.

One type of auto-tuning algorithm is provided with ProView, and can be used to calculate optimal PID parameters for certain types of process loops. Contact EOS Research technical support to see if auto-tuning may benefit your process.

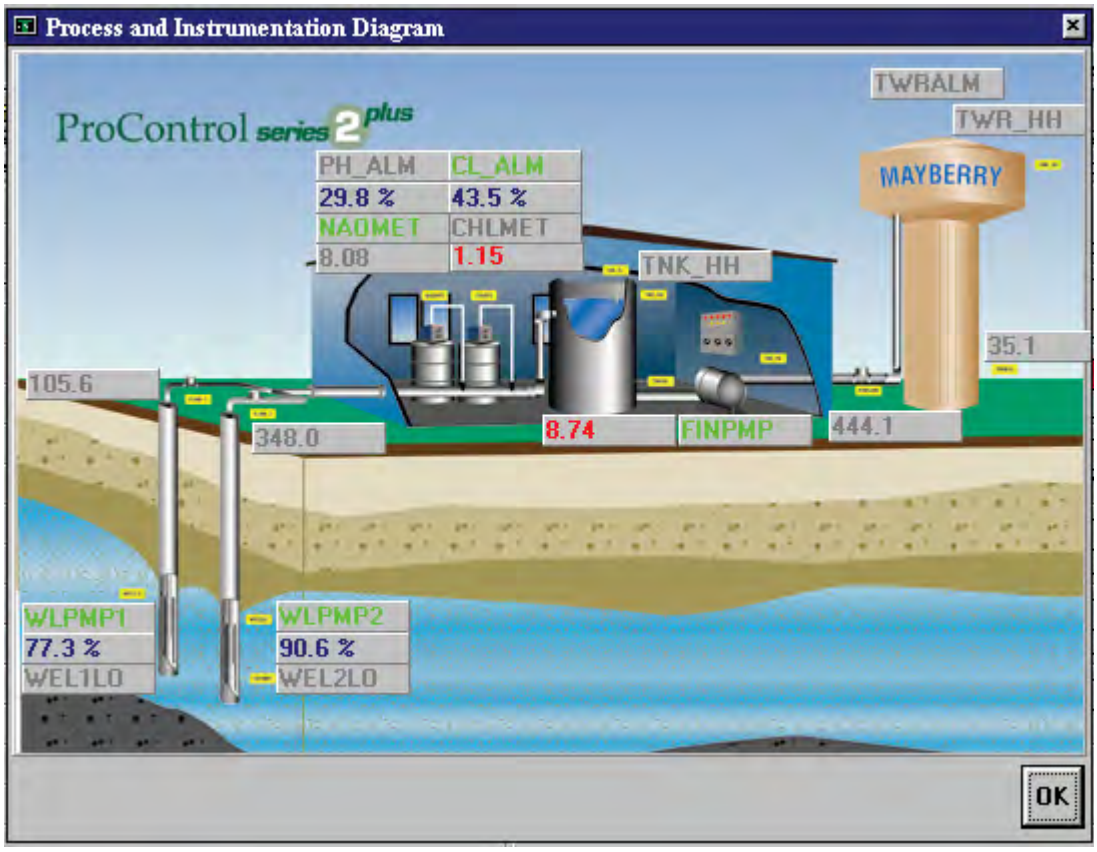
If the analog output is configured for proportional output, the dialog box on the right will be displayed. You can make changes as outlined above.



Process and Instrumentation Diagram

The **P&ID** option allows you to pull up an alternate "process and instrumentation diagram" representation of your system, which can be used to display operating data that is superimposed on a process diagram (or map, or picture of your dog, etc.). The P&ID option is designed to provide an alternate human-machine interface (HMI) for ProView with customizable graphics. Note that the P&ID screen is not interactive like the main ProView screen is; that is, data can be displayed on this screen, but commands cannot be issued from it.

Typically, your system integrator would configure this screen for you. The P&ID capability must be enabled by the integrator in order for you to use this feature. If this option has been included in your system configuration, you can view this diagram by clicking on the P & ID icon  .



The **Process and Instrumentation Diagram** contains a graphical representation of your system. Digital inputs and outputs are displayed as tagname boxes that change color when the I/O point is active (red or green). Analog I/O are displayed as numerical values, with analog outputs also containing the **%** symbol to distinguish them from analog inputs. Click the **OK** button to go back to the main ProView screen.

As discussed above, the P&ID screen is typically supplied by your system integrator. However, if you would like to make changes to the P&ID screen, follow the procedures outlined below. If you want to change the background image, you can create a new **.pid** file. The P&ID must be a bitmap format file (.bmp) that can be

created with Paintbrush™ or other drawing programs. The bitmap image can be any size you choose, the file name must be the same as your ProView site file (**.pvs**) with the filename extension changed to **.pid**, and it must be placed in the same folder as your .pvs file.

When you open the P&ID screen in ProView, you can move or remove the I/O boxes as you choose. Remember to **Save** the site file before you exit ProView to store these changes.

To change the appearance of the P & ID:

1. To move a descriptive box containing either a tagname or value, hold the shift key and click the left mouse button when positioned on the appropriate box. This will enable you to drag and re-position the box wherever you choose.
2. To remove a descriptive box, double-click on the box. Once you have removed a box, it will no longer be available to you unless you restore all boxes.
3. To restore all descriptive boxes, position the mouse at the bottom of the P & ID window in the gray area. Then hold down the control and shift keys while simultaneously clicking the left mouse button.

CHAPTER 6: WORKING WITH LOGGED DATA

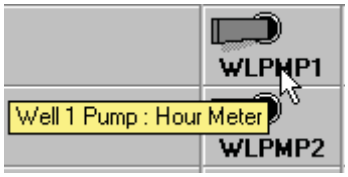
This chapter explains how to gather and analyze logged data that is being stored in the ProControl unit's battery-backed memory.

Hour Meters

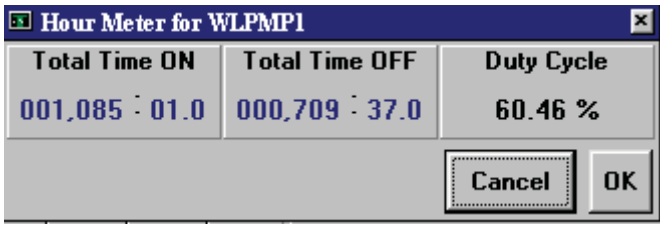
The ProControl maintains **Hour Meters** for inputs and outputs to indicate how long the I/O point has been ON and OFF. The hour meters are particularly useful in keeping track of equipment "run" times (discrete outputs), but are also maintained for discrete and analog inputs. For analog inputs, the hour meters indicate the time the input has been in and out of its *Active State* (see the definition of Active State in the Series 2^{plus} User Manual). The hour meters are updated every second on the ProControl unit. The ON and OFF times are displayed at a resolution of 1/10 (0.1) of a minute.

To read the Hour Meters, follow these steps:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, then *right*-click until you see **Hour Meter**.



2. Click the left mouse button to view the hour meter. The **Hour Meter** dialog box appears.



3. The **Hour Meter** box displays information in the form of **Hours : Minutes.10th Minutes** for both ON time and OFF time. The **Duty Cycle** or ratio of ON time to total time is also displayed. It may take a few seconds for the display to be updated once the dialog box appears.

4. To edit the **Total Time ON** or **Total Time OFF**, click and highlight the total time text and make the required changes. Press the enter key to confirm the changes and send the new value to the ProControl unit. Resetting the time values to zero, for instance, can be used when a motor is changed out, to keep track of lubrication intervals, etc.

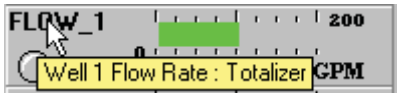
5. Click on the **OK** button to close the **Hour Meter** dialog box.

Totalizers

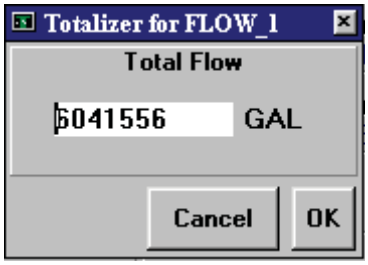
If your site configuration includes an analog input to which a flow meter or pulse counter is connected, it may also include a **Totalizer**. Totalizers provide the ability to view the cumulative total of a flow-based input or accumulated pulses from a counting device.

To view the **Totalizer** do the following:

1. Position the mouse pointer over the I/O point's tagname until a balloon appears, then *right*-click until you see **Totalizer**.



2. Click the left mouse button to view the totalizer. The **Totalizer** dialog box appears.



3. The **Total Flow** for this input since the totalizer was last reset is displayed. It is updated every second while the dialog box is visible and while ProView is connected to the ProControl unit.

4. If you would like to set the totalizer to a different value, click on the value displayed in the dialog box. Enter the new value for the totalizer and press the enter key.

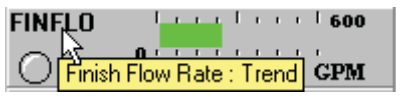
5. Click on the **OK** button to close the **Totalizer** dialog box.

Trend Graphing

ProView can display a real-time trend graph while you are connected either locally or remotely to the ProControl. A 5-minute trend can be displayed in the lower left hand side of the ProView window.

To start trend graphing:

1. Position the mouse pointer over an analog input's tagname until a balloon appears, then *right*-click until you see **Trend**.



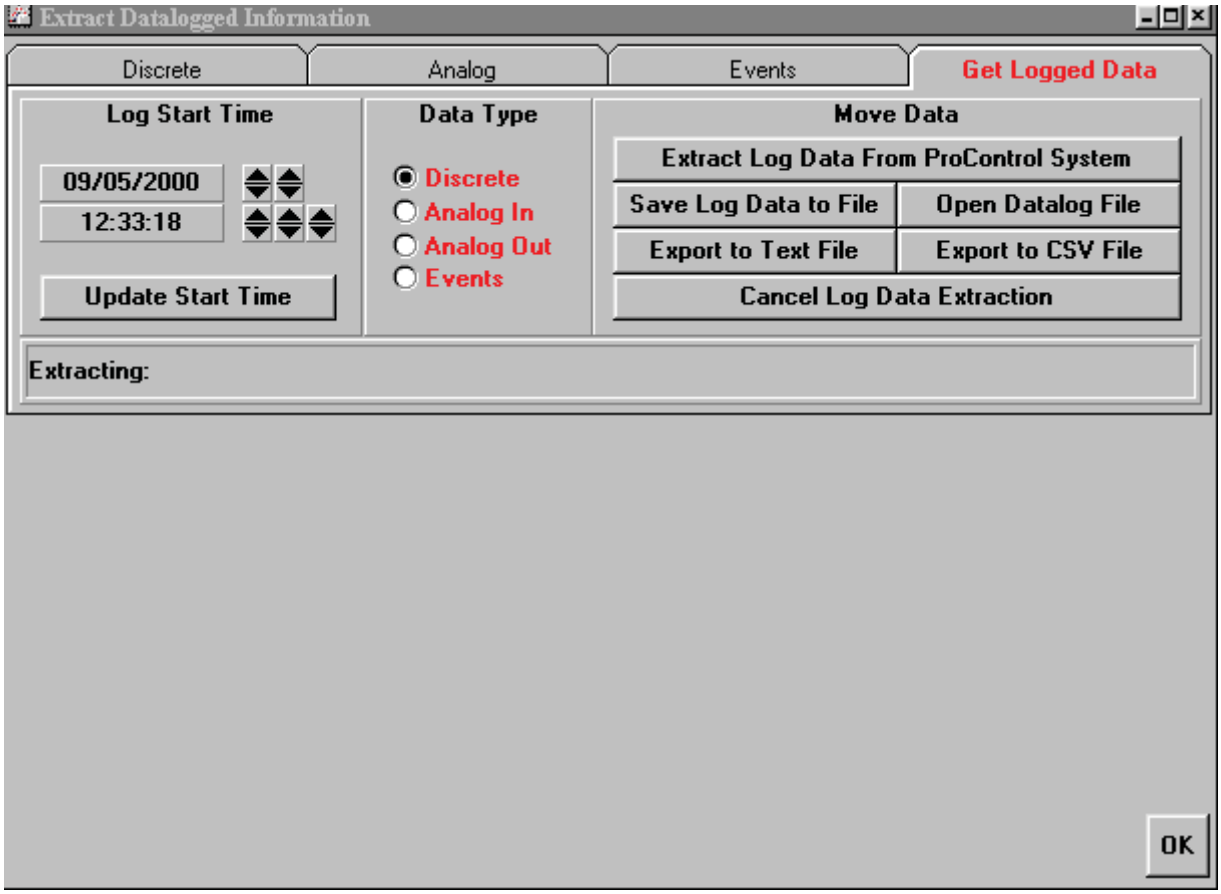
2. Click the left mouse button to produce the **Trend** window for that input.

3. The trend window provides a 5-minute history of the real-time data for that analog input. You will see the trend "drift" from right to left across the window, and it will be updated as long as you are connected to the ProControl. If you wish to observe another trend, click on the tagname of another analog input and the trend window will be refreshed with the new data.

4. To stop trending and empty the trend window, click on the **Trend for…** text block in the trend panel.

Downloading Logged Data

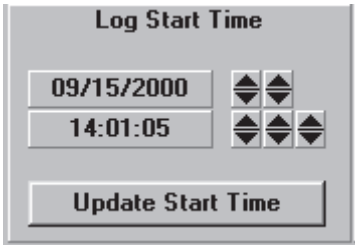
Operations data is stored electronically in the ProControl's memory in accordance with the datalogging setup (Chapter 5). To view the logged data, click on **Get Logged Data** in the **Datalogging** menu. This opens the **Extract Datalogged Information** dialog box.



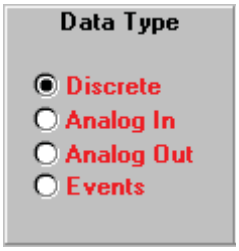
Getting Logged Data

To extract datalogged information from the ProControl unit, do the following:

1. Select the start time in the **Log Start Time** panel. ProView will extract all data that has been logged since this time. Change the start time by clicking on the spin buttons to increase or decrease the Month, Day, Hour, Minute or Second. Click on the **Update Start Time** button to reset the start time to the current time.



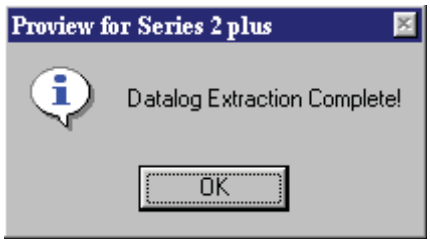
2. Select the type of data you wish to extract. Click on the **Discrete**, **Analog In**, **Analog Out** or **Events** radio button.



3. Click on the **Extract Log Data From ProControl System** button.

4. ProView performs a scan of available data. You can then monitor the progress of the data extraction.

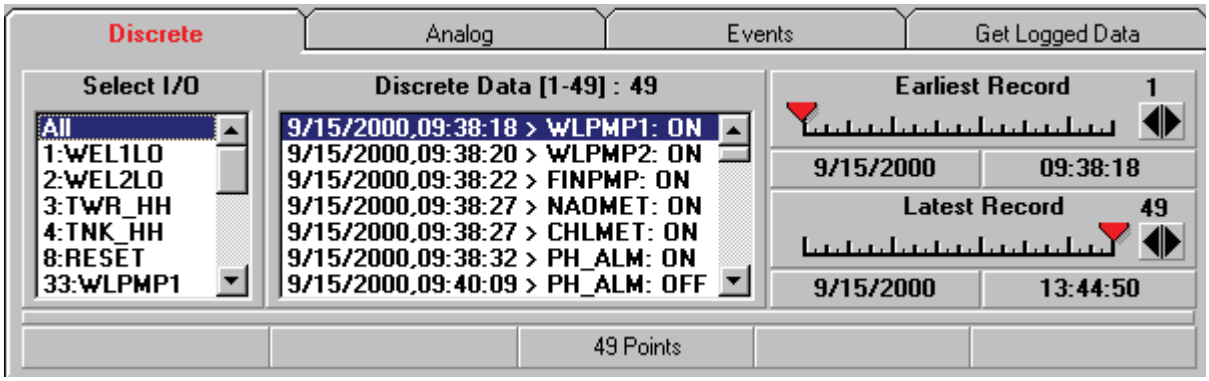
5. A message box will appear when the data extraction process is complete.



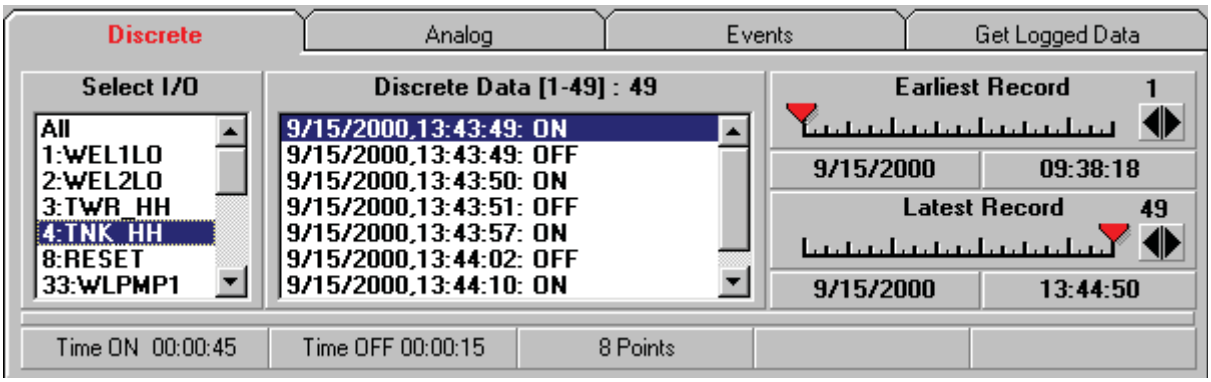
Looking at Discrete Data

To examine the discrete datalog record that you have extracted click on the **Discrete** tab.

The **Discrete** data window appears. On the left, the **Select I/O** list box contains a list of all enabled discrete inputs and outputs. In the middle is the **Discrete Data** record. On the right, the **Earliest Record** extracted is shown as 9:38:18 on 9/15/2000. The **Latest Record** is 13:44:50 on 9/15/2000. A total of 49 records were extracted. Clicking on **All** in the **Select I/O** list box will show the entire discrete record in the **Discrete Data** window. You can scroll through the discrete records in the window.

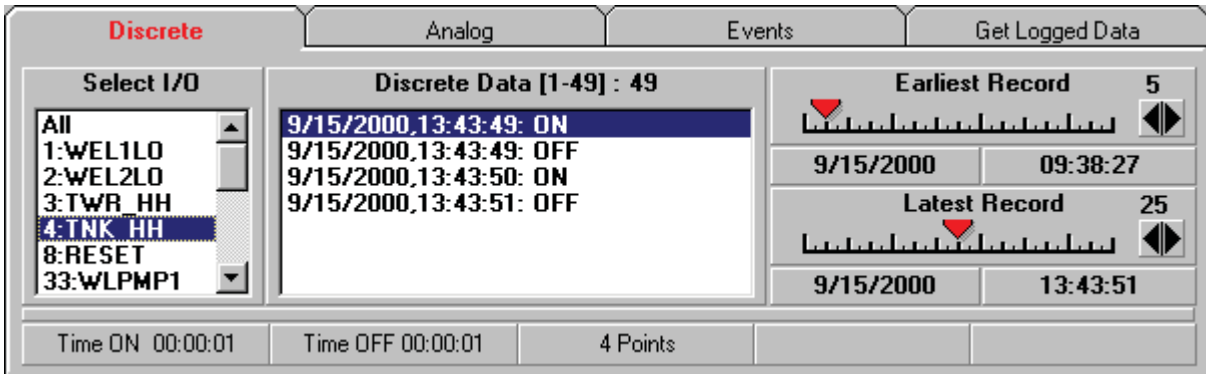


The **Select I/O** list box can be used to filter the data record to include just one discrete input or output. In the example below, the **TNK_HH** input has been selected. Whenever a single input or output is selected, statistics are generated regarding the selected input or output, spanning the period of time from the first state change to the last one in the record. There are 8 data points for **TNK_HH** below, and the input was ON for 45 seconds and OFF for 15 seconds for the period of time between the first and last record.



Moving the **Earliest Record** and **Latest Record** sliders or spin buttons will filter the total record with respect to time. Click and hold a slider and move the mouse to the left or right. You can also click on the spin buttons to change the time window. When you are finished filtering the time, click again on the input you wish to examine in the **Select I/O** list box to see the results of your changes. In the example below, the

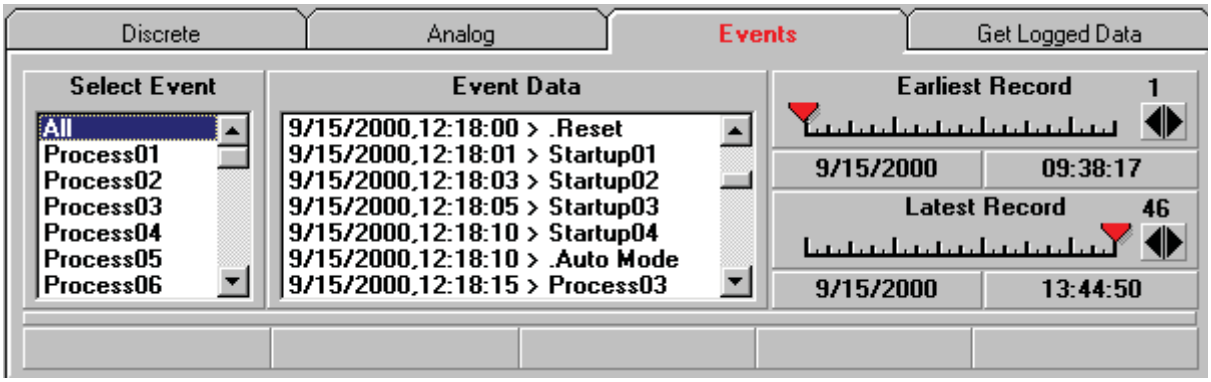
total record has been limited to records 5 through 25. Within this time interval, 4 state changes of **TNK_HH** occurred.



Looking at Events Data

First, go back to the **Get Logged Data** tab and extract the **Events** data. After the data has been extracted, click on the **Events** tab to examine the event datalogging record.

The **Events** data window appears. The **Select Event** list box contains a list of all enabled processes and other ProControl events. In the middle is the **Event Data** record. The **Earliest Record** and **Latest Record** extracted are shown to the right.

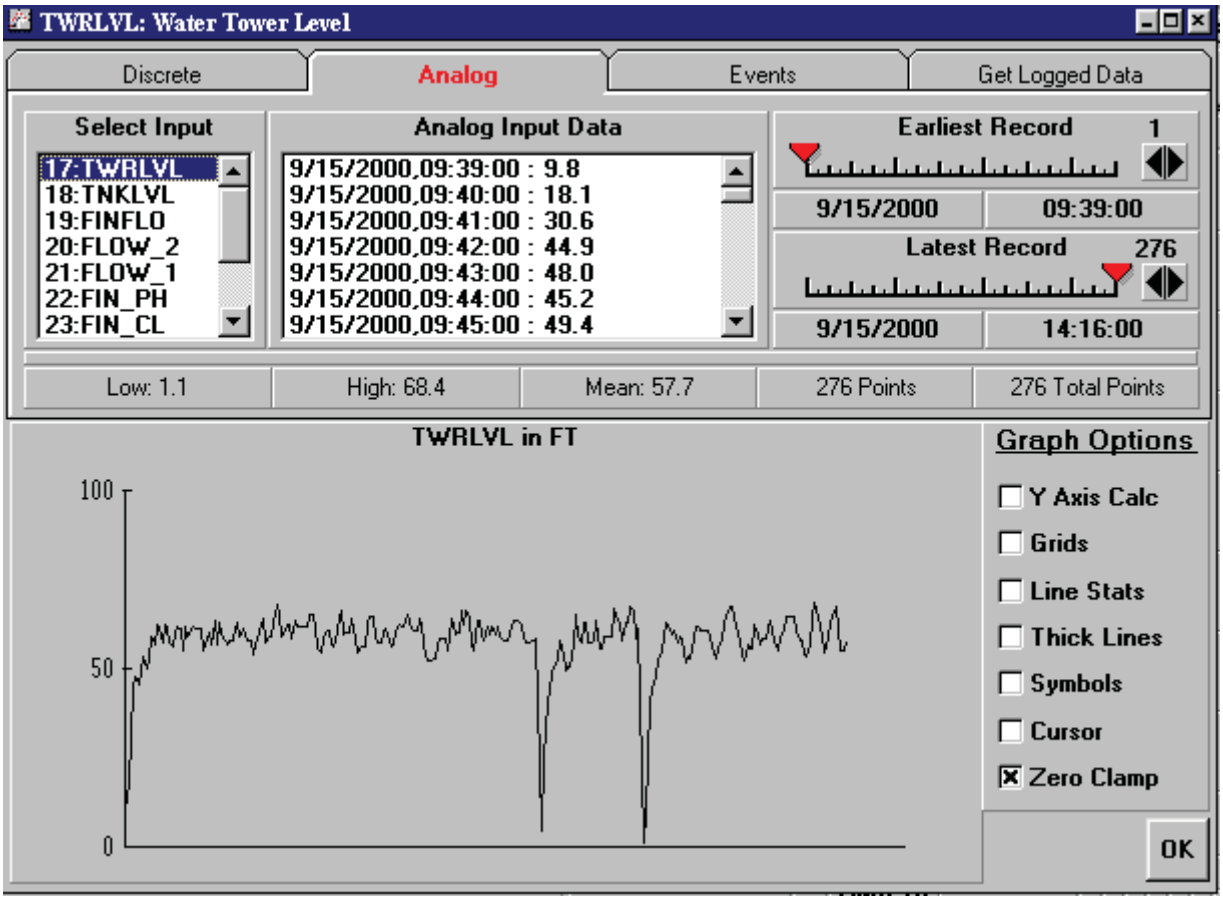


To view the data, follow the same procedure described for **Discrete Data**. Clicking on **All** in the **Select Event** list box will display all the events that were extracted. By clicking on an event in the **Event Data** window, a description is provided in the **Process Description** window below.

Looking at Analog Data

First, go back to the **Get Logged Data** tab and extract the **Analog In** or **Analog Out** data. After the data has been extracted, click on the **Analog** tab to examine the event datalogging record.

The **Analog** data window appears. The **Select Input** list box contains a list of all enabled analog inputs and outputs. In the middle is the **Analog Input Data** record. The **Earliest Record** and **Latest Record** extracted are shown to the right. By clicking on an input or output in the **Select Input** list box, a graph will be displayed in the window below.



In the example above, a water tower level is shown as it varies over time. Immediately above the graph, statistics are shown regarding the selected analog point (in this case there are 276 data points with a **Low** of 1.1, a **High** of 68.4 and a **Mean** of 57.7). As with the digital and events data, the **Earliest Record** and **Latest Record** sliders and spin buttons can be used to filter the total record with respect to time, which is helpful in focusing on a smaller portion of the graph. If you filter the data in this way, be sure to click on the input tagname again in the **Select Input** list box to see the results of your changes.

Graphing Options

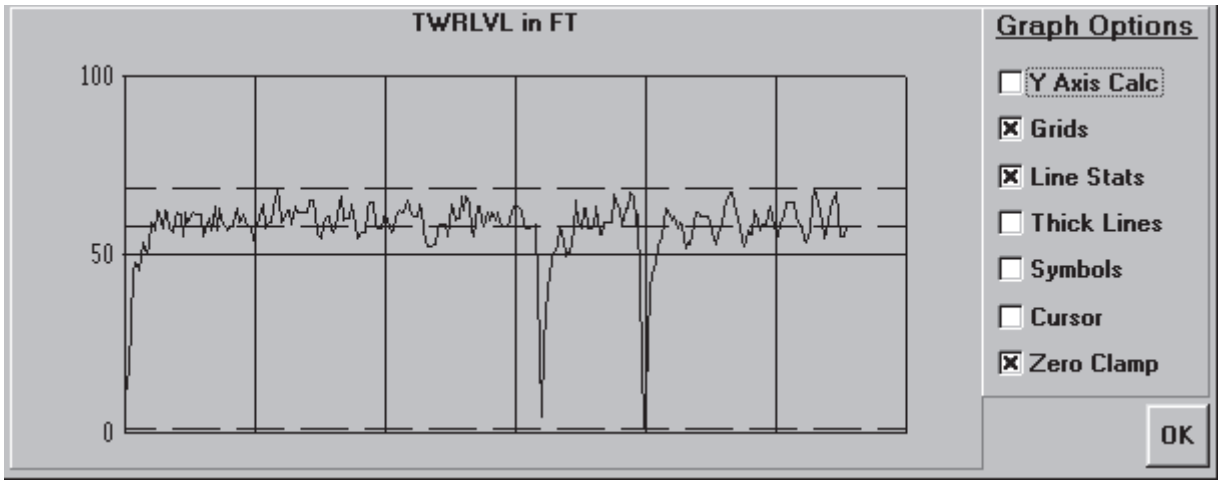
Graph Options are available to change the look of the analog graph. Click on the check box adjacent to the option you want to use to enable it. The graphing options are described below.

Y Axis Calc: The default Y axis range displayed by ProView is that which is configured for that input in the ProControl unit. By clicking on **Y Axis Calc**, ProView redraws the graph with a calculated Y axis range

based on the data in the sample. This will typically "tighten" the vertical axis on the graph to aid in showing smaller changes in the sampled data. Holding down the Shift, Control, or Alt key, respectively, while clicking **Y Axis Calc** will produce progressively tighter calculations of the vertical scale.

Grids: The grid option places some vertical and horizontal lines on the graph for reference.

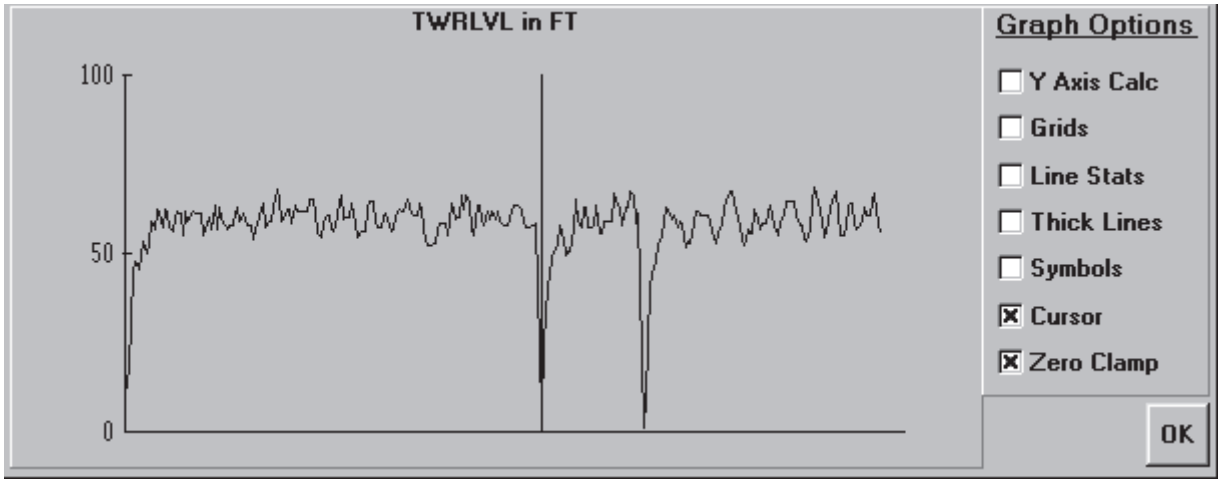
Line Stats: This option will draw dashed lines across the graph at the **Low**, **High** and **Mean** input levels. In the example below, the **Grids** and **Line Stats** options have been checked.



Thick Lines: This option increases the line weight of the graph.

Symbols: This option places a small "+" at each data point.

Cursor: This option places a vertical line on the graph at a data point selected in the **Analog Input Data** window. This option makes it easier to correlate the list data with the graph.



Zero Clamp: This option is selected by default, and forces the graph to display zero at all points where data was logged with a value less than zero. Negative values can be logged when an analog transmitter outputs less than 4 mA.

FYI

Be sure to disable the Zero Clamp option if you are viewing data for an analog input whose value can drop below zero under typical operating conditions.

After you are finished examining the datalogged information, you may want to save it for future reference within ProView or export it to a spreadsheet, database program or word processor.

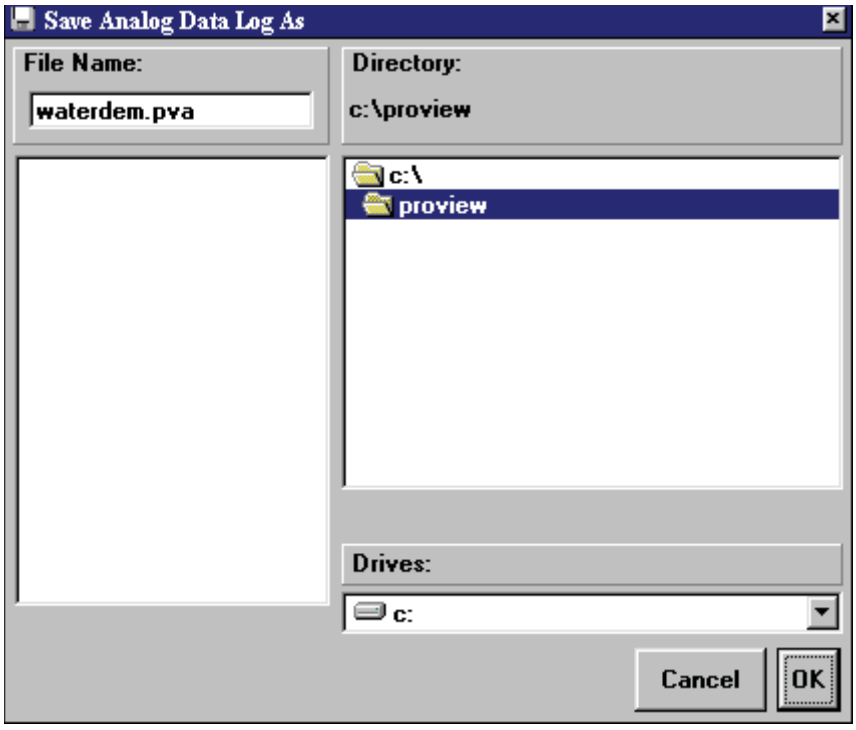
Saving Logged Data to File

To save a datalogging record to a ProView-readable file, do the following:

1. Click on the **Get Logged Data** tab. Select the type of file you wish to save by clicking on the appropriate button in the **Data Type** panel. *Remember that you must have already completed the separate step of extracting the data type you wish to save.*

2. Click on the **Save Log Data to File** button.

3. This opens the **Save *xxxxxx* Data Log As** dialog box, where ***xxxxxx*** is the type of data you wish to save. ProView selects a default file name for you, which is the name of the site configuration file with the .pvd, .pva or .pve file extension depending on the type of data file you intend to save (discrete, analog, or events, respectively). However, you may wish to change the file name to indicate a date representative of the log you are saving, for instance.



5. Click the **OK** button to save the file.

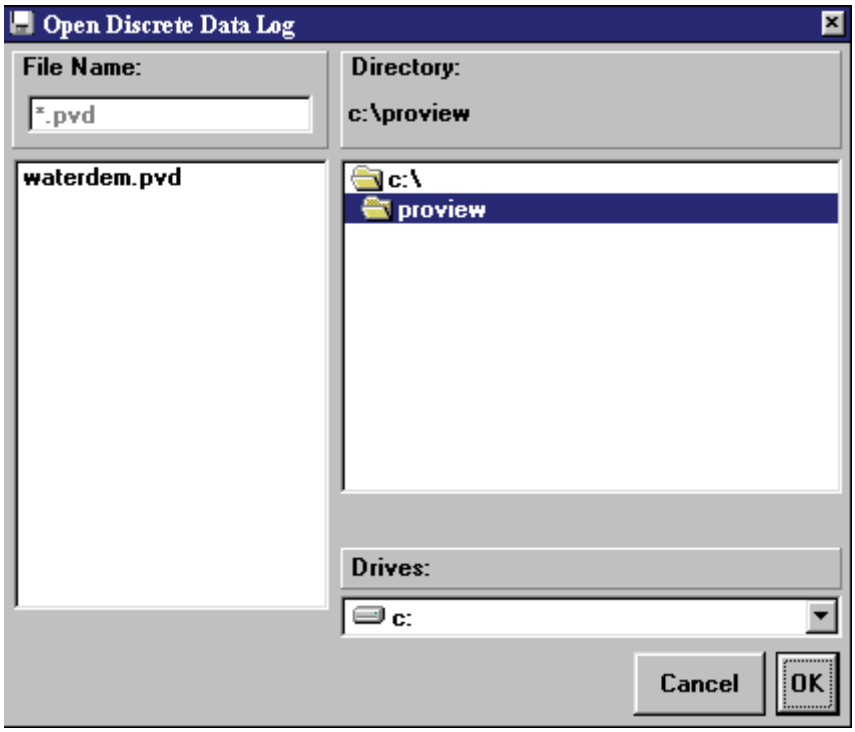
Opening a Datalog File

To view data that was previously saved in ProView-readable format, do the following:

1. In the **Get Logged Data** tab of the **Extract Datalogged Information** dialog box, select the type of data file you wish to open by clicking on the appropriate button in the **Data Type** panel.

2. Click on the **Open Datalog File** button.

3. This opens the **Open *xxxxxx* Data Log As** dialog box, where ***xxxxxx*** is the type of data you wish to view. ProView lists any files in the folder you have selected that contain the .pvd, .pva or .pve file extension (depending on the type of data file you intend to open). Click on the name of the file you wish to open, and it will appear in the **File Name:** text box. If the file you wish to open is stored elsewhere, select the location in the **Drives:** and **Directory:** list boxes.



4. Click on the **OK** button to open the file. View the data as you would any logged data that you have just extracted.

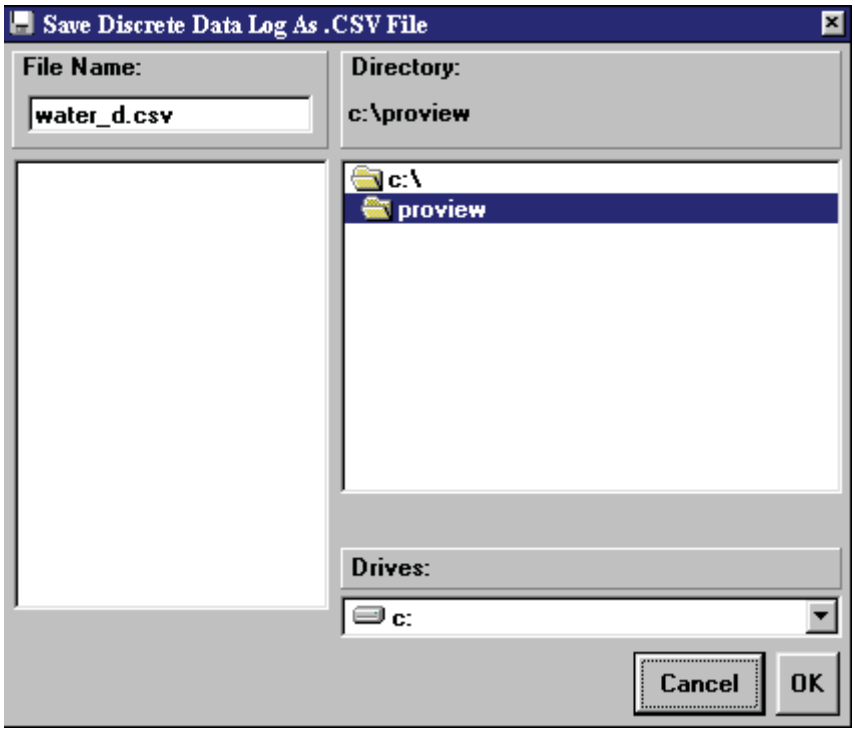
Exporting Logged Data for use in Other Applications

ProView provides users the ability to export data for use in other applications, so that you can take advantage of the data manipulation and graphing capabilities provided by widely-used software. ProView allows you to export analog, discrete or event data to a CSV (Comma-Separated Variable) file, which can then be opened by any spreadsheet or database program (e.g., Microsoft Excel™, Access™). You can also export discrete and event data to a text file for use in a word processor.

1. In the **Extract Datalogged Information** dialog box, click on the **Get Logged Data** tab. Select the type of file you wish to export by clicking on the appropriate button in the **Data Type** panel. Note that analog output data cannot be exported.

2. Click on the **Export to Text File** or **Export to CSV File** button.

3. This opens the **Save Analog Data Log As .CSV File,** the **Save Discrete Data Log As .TXT File** or other dialog box, depending on the type of file you wish to export. The default file name is the truncated name of the site configuration file with the .csv or .txt extension. However, you may wish to change the file name to indicate a date representative of the log you are saving, for instance.



5. Click the **OK** button to export the file.

6. You will be asked whether you would like to include header information in the file that is saved. The header provides two lines of basic site information and titles for the columns of data.

!

*The CSV file format is considered a **Text** format by most spreadsheet and database software. When you open the .csv file created by ProView, be sure to specify that you are opening a Text file. For instance, in Excel, in the **File….Open** dialog box, choose **Text Files** from the list in the **File of type** list box.*

FYI

*A word about the date format in the exported files: Discrete and event data are exported using a time stamp in which the date and the time are in separate columns or separated by a comma (for example, 9/15/2000,09:39:08). Analog data are exported using a combined date/time in standard Windows format (which is the decimal equivalent of the number of days and fractions of a day since January 1, 1900). When an analog data file is opened in a spreadsheet or database software package, you will probably want to reformat the date/time information in the leftmost column. For instance, in Excel, select the column, choose **Format….Cells**, and select a **Number** format that includes both the date and the time.*

CHAPTER 7: OTHER OPERATIONS

This chapter explains how to save the site setup, print current operating data to a file, view the process configuration, use the annunciator feature and exit the program.

Saving the Site Configuration to File

While you work in ProView, you may change certain system settings that are stored in your site configuration (or .pvs) file. Examples of some of the parameters stored with your site file include remote communication settings, passwords, and notes for your tagnames. You should save your .pvs file before closing ProView if you make any changes to these parameters.

FYI

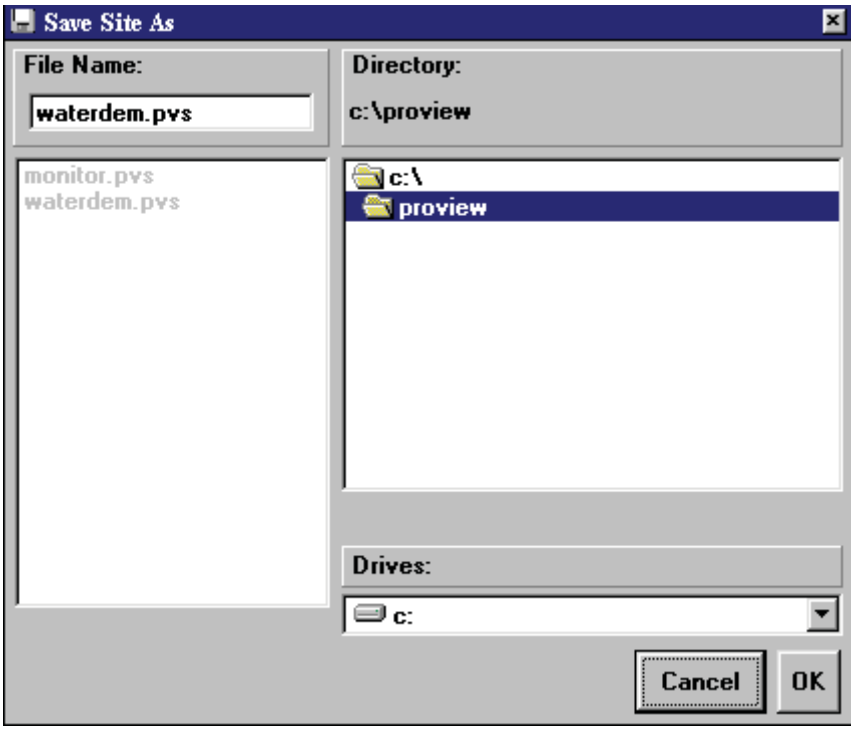
Remember that most operational settings, such as alarm levels, fax report numbers, datalogging setup, PID gains, etc. are stored in the ProControl unit, not in your site file. ProView "pulls up" this information stored in the ProControl unit when you connect to it. There is no need to save your site file if you only make changes to these operational settings.

To save your site configuration do the following:

1. Click on **Save Site** or **Save Site As…** in the **File** menu.

   Or

   Click on the **Save File** button on the toolbar.  The **Save Site As** dialog box appears. If you chose **File…Save Site**, ProView bypasses the dialog box.



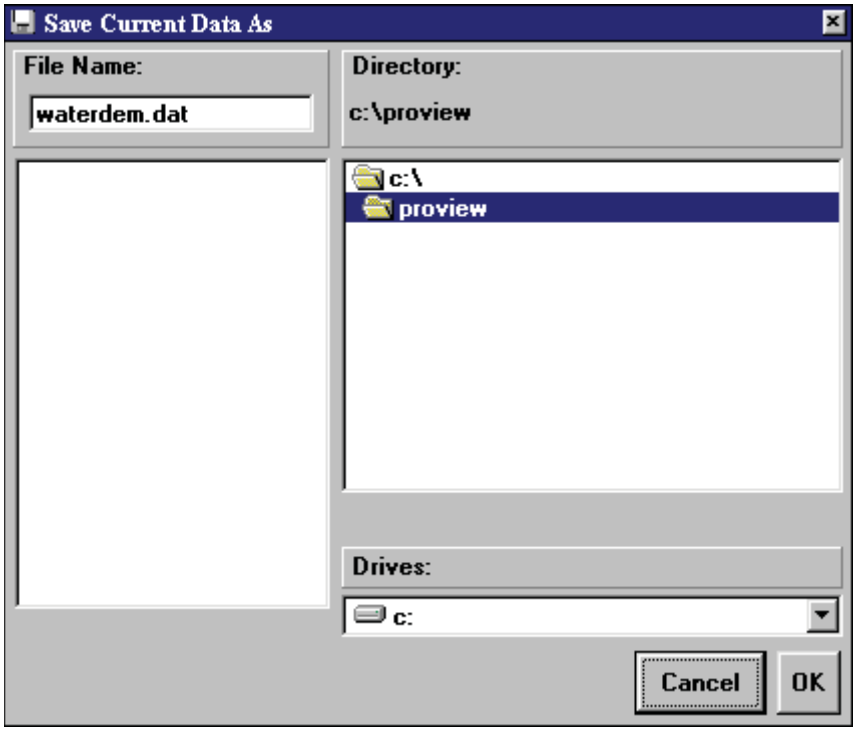
2. Select the **Drive**, **Directory** and **File Name** you would like and click on the **OK** button to save the file. You will be asked whether you wish to overwrite the existing file. Choose **Yes** to complete the file save.

Printing the Current Data to File

While you are connected to your ProControl via ProView, you can print the current operating data to a text file for future reference. This can prove useful for documentation and reporting purposes.

To save your current process data to a text file, do the following:

1. Click on **Print Current Data** in the **File** menu. You will see the **Save Current Data As** dialog box.



2. Select the **Drive**, **Directory** and **File Name** you would like. ProView selects a default file name for you, which is the name of the site configuration file with a .dat file extension. However, you may wish to change the file name to indicate a date representative of the information you are saving, for instance. Click the **OK** button to save the current data to the file.

You can examine the current data file with any text editor or word processor. An example of a file generated for our sample operation is shown on the following pages.

EOS RESEARCH LTD.
ProControl Series II+

ProView Current Operational Information

***** FAX Recipient:	BULLWINKLE MOOSE
***** Customer:	MAYBERRY WATER DEPT
***** Site Location:	MAYBERRY RFD
***** Setup:	1
***** Option:	B
***** Type:	102
***** Serial Number:	7429
***** Date:	04/23/2000
***** Time:	14:52:35
***** ProView:	Version 2.153

***** Communications State:	REMOTE CONNECT
***** System Mode:	Auto 14
***** Last Shutdown:	Last Shutdown 12:28:27 , 2/20/2000 , Remote
***** Alarms:	Alarms SET
***** FAX:	Report ON

THE CURRENT INPUT STATUS:

#	TAGNAME	CURRENT VALUE	LO ALARM	HI ALARM	TOTALIZER		HOURS ON		HOURS OFF	
1	WEL1LO	is OFF					000,000	23.6	002,704	52.8
2	WEL2LO	is OFF					000,000	02.7	002,705	13.8
3	TWR_HH	is OFF					000,000	01.0	002,705	15.5
4	TNK_HH	is OFF					000,000	01.5	002,705	14.9
8	RESET	is OFF					000,000	00.8	002,705	15.7
17	TWRLVL	41.0 FT	30.0	55.0			000,044	36.7	002,660	39.6
18	TNKLVL	10.07 FT	9.00	11.00			000,018	38.8	002,686	37.7
19	FINFLO	220.0 GPM	0.0	600.0	2,707,032	GAL	000,749	30.0	001,955	46.4
20	FLOW_2	178.1 GPM	0.0	400.0	11,535,456	GAL	000,758	50.8	001,946	25.6
21	FLOW_1	95.8 GPM	35.8	170.0	10,479,505	GAL	000,003	03.4	002,702	13.1
22	FIN_PH	8.39 PH	7.50	8.50			001,004	05.6	001,701	10.8
23	FIN_CL	0.99 PPM	0.80	1.15			000,499	10.1	002,206	06.3

THE CURRENT OUTPUT STATUS:

#	TAGNAME	CURRENT VALUE	HOURS ON		HOURS OFF	
1	WLPMP1	is ON	001,871	40.2	000,833	36.1
2	WLPMP2	is ON	001,871	26.7	000,833	48.8
3	FINPMP	is ON	001,871	27.5	000,833	48.5
4	CHLMET	is ON	001,655	51.6	001,049	24.9
5	NAOMET	is ON	001,099	11.9	001,606	04.6
8	PH_ALM	is OFF	000,991	03.1	001,714	13.3
9	CL_ALM	is OFF	000,485	39.2	002,219	37.3
10	TWRALM	is OFF	000,028	11.2	002,677	05.1
11	WL1ALM	is OFF	000,000	12.0	002,705	04.6
12	WL2ALM	is OFF	000,000	00.1	002,705	16.5
13	TNKALM	is OFF	000,003	42.3	002,701	34.3

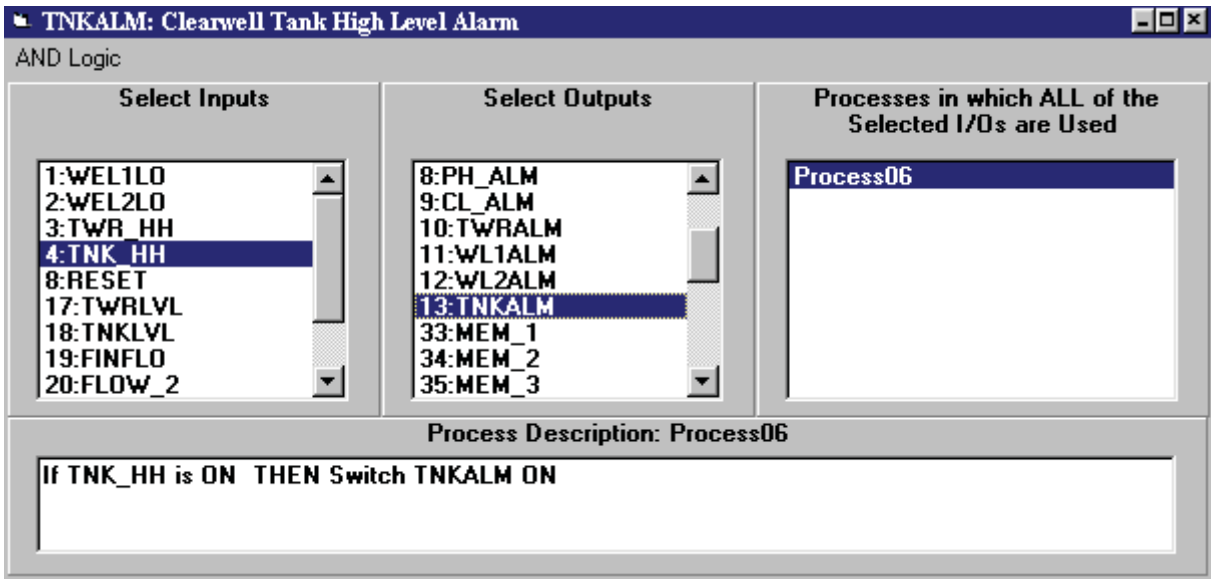
THE CURRENT ANALOG OUTPUT STATUS:

#	TAGNAME	VALUE	PID Mode	SETPOINT	P Gain	I Gain	D Gain	MAX CHG
1	VSPMP1	39.1 %	ALG	40.0	10.0	.010	0.1	5.0 %
2	VSPMP2	46.9 %	ALG	10.00	7.33	.010	0.5	5.0 %
3	NAOHFD	32.0 %	ALG	8.25	9.16	.010	0.1	5.0 %
4	CHLRFD	22.3 %	ALG		50			5.0 %

```
ANALOG OUTPUT NOTES
-------------------
VALUE   - The current output level expressed as a percentage 0%=4ma 100%=20ma.
MAN     - (Manual) The PID or PRO control loop algorithm has been turned off.
PID     - The (Proportional, Integral, Derivative) control loop is running.
PRO     - The open loop (Proportional) algorithm is running.
MAX CHG - The maximum amount the output can change in one control cycle.


THE CURRENT REPORTING SETUP:

     ********************************************************************************
     ***** Report Enable:          ON                                           *****
     ***** FAX Number 1:           1 (999) 555-1234                             *****
     ***** FAX Number 2:           555-4321                                     *****
     ***** Scheduled FAX:          Every Day at:       07:00                    *****
     ***** Next Scheduled FAX:     07:00                                        *****
     ***** Pager #1:               Enabled, Numeric                             *****
     ***** Pager #2:               Enabled, AlphaNumeric                        *****
     ***** Paging:                 Will occur at 2400 baud                      *****
     ***** Page Number 1:          1 (700) 555-6789                             *****
     ***** Pager ID    1:          9876543                                      *****
     ***** Page Number 2:          1 (700) 555-6789                             *****
     ***** Pager ID    2:          3456789                                      *****
     ********************************************************************************

THE CURRENT DATALOGGING SETUP:

     ********************************************************************************
     ***** Enabled Datalogging:    Digital ,Analog ,Event                       *****
     ***** Datalogging Interval:   00:01                                        *****
     ***** Next Datalog Time:      13:47                                        *****
     ********************************************************************************
```

Reviewing the Process Configuration

ProView includes a utility that can help you understand the control logic that is programmed into your ProControl unit (if your site file is not the most up-to-date version, note that the control logic shown may not match what is in your ProControl unit). Click on **Process Configuration** under the **File** menu, and the following screen will appear, showing the inputs and outputs that are configured for your system:



By selecting inputs and outputs from the left and center columns, respectively, you will see a listing of process tasks that include your selected I/O. For instance, if you choose an output from the center column, you will see a list of processes that turn that output ON or OFF in the window on the right. Clicking on a process will provide a description in the **Process Description** window. You can select both inputs and outputs to filter the list of processes. To de-select an I/O point, **<Ctrl> - left click** on it.

Annunciators

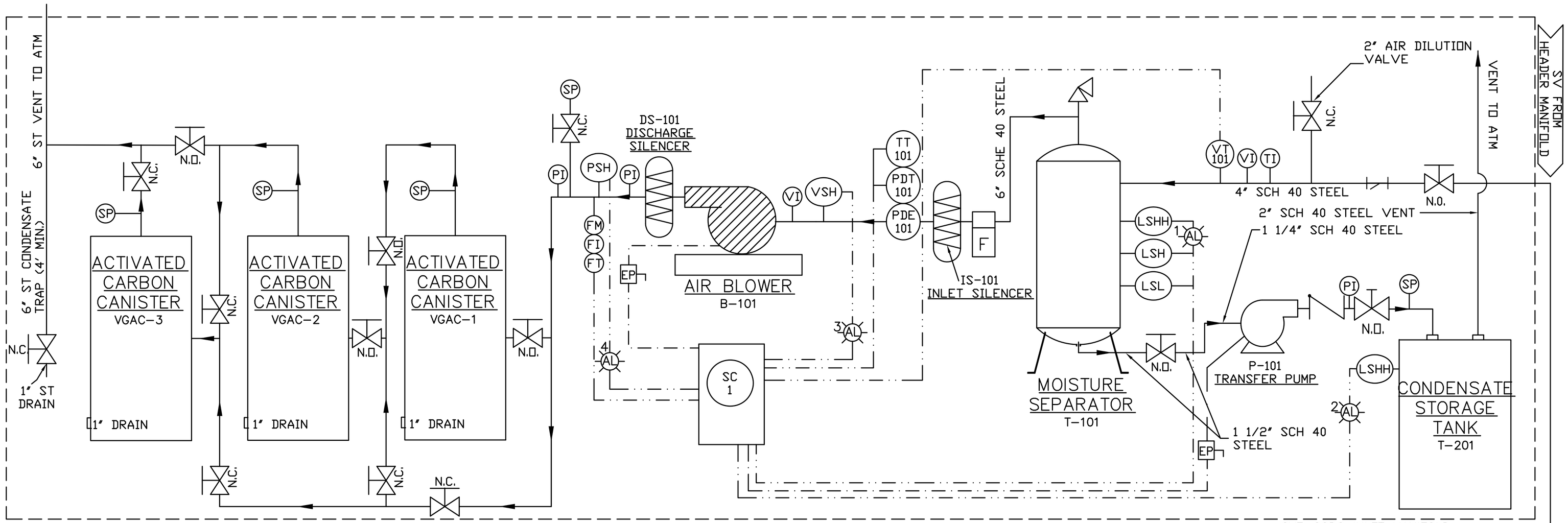
The Annunciator feature is useful for those ProControl users that remain connected to their systems for extended periods of time via ProView. The Annunciator is a visual alarm indicator for the ProView screen that is designed to draw attention to an alarm condition that *presently exists*, or *has occurred but has now cleared*. Clicking on **Annunciation** in the **File** menu toggles the Annunciation feature on and off. If any discrete or analog input that is configured as an alarm input becomes *active*, the input's tagname will turn red, and the System Status panel (the panel that indicates **Auto** or **Manual** mode) will begin to flash red. The annunciator continues to flash even if the input is no longer active, so that the operator does not miss an alarm condition. To acknowledge the alarm, click on **Clear Annunciators** in the **System** menu. If an alarm condition still exists, the annunciator will begin flashing again. *Note that only those alarm conditions that occur in the current ProView session will be annunciated.*

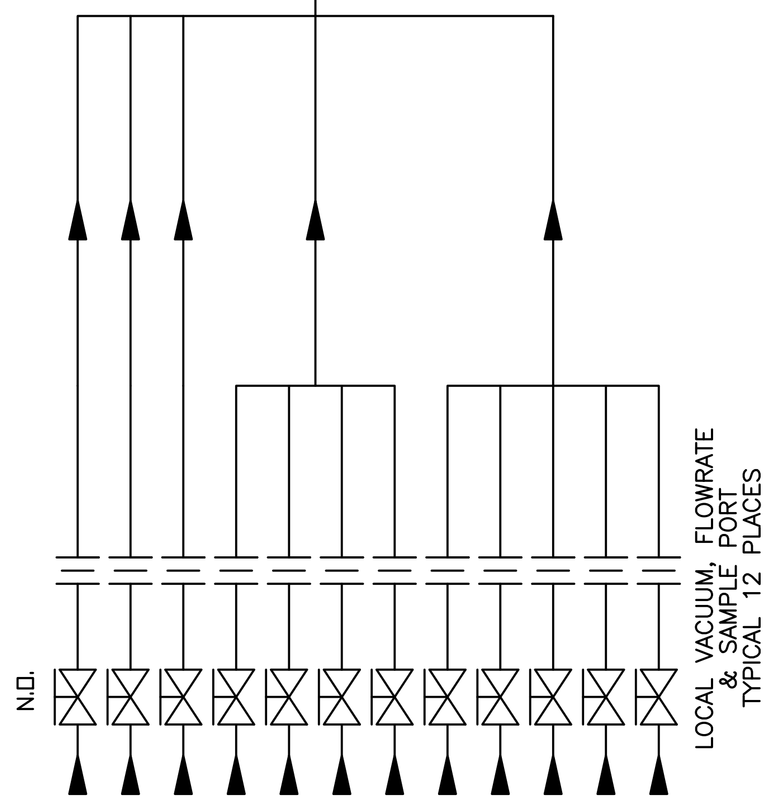
Exiting ProView

You can exit ProView by clicking on the  at the top of the main screen or by clicking **Exit** in the **File** menu. You will be asked whether you want to save your site file and any logged date that you have extracted.

SECTION - 9

System Drawings





INTERLOCK SCHEDULE

DESIGNATION	FUNCTION
LSHH T-101	B-101 OFF, AL-1 ON
LSH T-101	B-101 OFF, P-101 ON
LSL T-101	B-101 ON, P-101 OFF
LSHH T-201	P-101 OFF, AL-2 ON
VSH B-101	B-101 OFF, AL-3 ON
PSH B-101	B-101 OFF, AL-4 ON
VARIOUS TRANSMITTERS	TELEMETRY ONLY

EQUIPMENT SCHEDULE

I.D.	DESCRIPTION	CAPACITY	MOTOR	MANUFACTURER/MODEL
VGAC-1	VAPOR PHASE CARBON ADSORBER	1500 CFM @ 65" WC 3000 LBS CARBON	NA	TETRASOLV VFV-3000
VGAC-2	VAPOR PHASE CARBON ADSORBER	1500 CFM @ 65" WC 3000 LBS CARBON	NA	TETRASOLV VFV-3000
VGAC-3	VAPOR PHASE CARBON ADSORBER	1500 CFM @ 65" WC 3000 LBS CARBON	NA	TETRASOLV VFV-3000
P-101	CENTIFUGAL TRANSFER PUMP	10 GPM @ 75 FT TDH	1 HP EXP.	WEG 25 HP
B-101	BLOWER	1000 SCFM @ 108" WC VACUUM (8"Hg)	25 HP EXP 1,700 RPM	ROOTS 615 URAI
T-101	MOISTURE SEPARATOR	120 GALLON LIQUID HOLDING CAPACITY	NA	ACS DEMISTER
T-201	CONDENSATE STORAGE TANK	200 GALLON	NA	CHEM-TAINER TC4647
SC-1	SYSTEM CONTROL PANEL	230V/3/60	NA	EDS RESEARCH SERIES 2 PLUS TYPE A1 MASTER PLC
IS-101	INLET SILENCER	30-40dB @ 63-4K Hz	NA	STODDARD D13H-6
DS-101	DISCHARGE SILENCER	30-40DB @ 63-4K HZ	NA	STODDARD D33H-6

INSTRUMENT IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS	
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION & MODIFIER
A			ALARM	
C				CONTROL
D			DIFFERENTIAL	
E			SENSOR (PRIMARY ELEMENT)	
F	FLOW			
H	HAND			HIGH
I			INDICATOR	
K	TIME			
L	LEVEL			LOW
M		MONITOR		
P	PRESSURE			
Q		TOTALIZE		
R			RECORD	
S	SYSTEM		SWITCH	
T	TEMPERATURE			SENSOR/ TRANSMITTER
V	VACUUM			VALVE
Y	EVENT, STATE, OR PRESENCE			

NOTES:

1. INSTALL ALL SIGNAL AND POWER LINES IN RIGID STEEL CONDUIT TO MEET THE REQUIREMENTS OF CLASS 1, DIVISION 1 ATMOSPHERES.
2. BLOWER SHALL BE EQUIPPED WITH HAND-OFF-AUTO SWITCHES AND RUN-LIGHTS LOCATED IN THE SYSTEM CONTROL CABINET (SC-1).
3. CALCULATE THE VAPOR FLOW RATE BASED ON THE OUTPUT FROM PDT-101, TT-101, AND VT-101.

I, SHEILA RANSBOTTOM, CERTIFY THAT I AM CURRENTLY A NYS REGISTERED PROFESSIONAL ENGINEER AND THAT THESE INTERIM REMEDIAL MEASURE SOIL VAPOR EXTRACTION (SUB-SLAB DEPRESSURIZATION) DESIGN PLANS WERE PREPARED IN ACCORDANCE WITH ALL APPLICABLE STATUTES AND REGULATIONS AND IN SUBSTANTIAL CONFORMANCE WITH THE DER TECHNICAL GUIDANCE FOR SITE INVESTIGATION AND REMEDIATION (DER-10) AND THAT ALL ACTIVITIES WERE PERFORMED IN FULL ACCORDANCE WITH THE DER-APPROVED WORK PLAN AND ANY DER-APPROVED MODIFICATIONS.

CLIENT NAME

THE WILLS FAMILY GROUP LTD.
2116 43RD AVENUE
LONG ISLAND CITY, NY 11101

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
46-11 54TH AVENUE, MASPETH, N.Y. 11378, T: 718-762-0544, F: 718-762-0545
2312 WEHRLE DRIVE, BUFFALO, N.Y. 14221, T: 716-204-8054, F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY

DESCRIPTION:

SOIL VAPOR EXTRACTION SYSTEM (SUB-SLAB DEPRESSURIZATION)

DRAWING TITLE:

PROCESS & INSTRUMENTATION DESIGN

SEAL & SIGNATURE		
	DATE:	10/15/2014
	PROJECT No.:	–
	DRAWN BY:	BDB
	DESIGNED BY:	BDB
	CHECKED BY:	RPT
	APPROVED BY:	SAR
	DRAWING No.:	H-002.00
SCALE: NOT TO SCALE	SHEET No.: 4	OF: 6
	REVISED BY:	–

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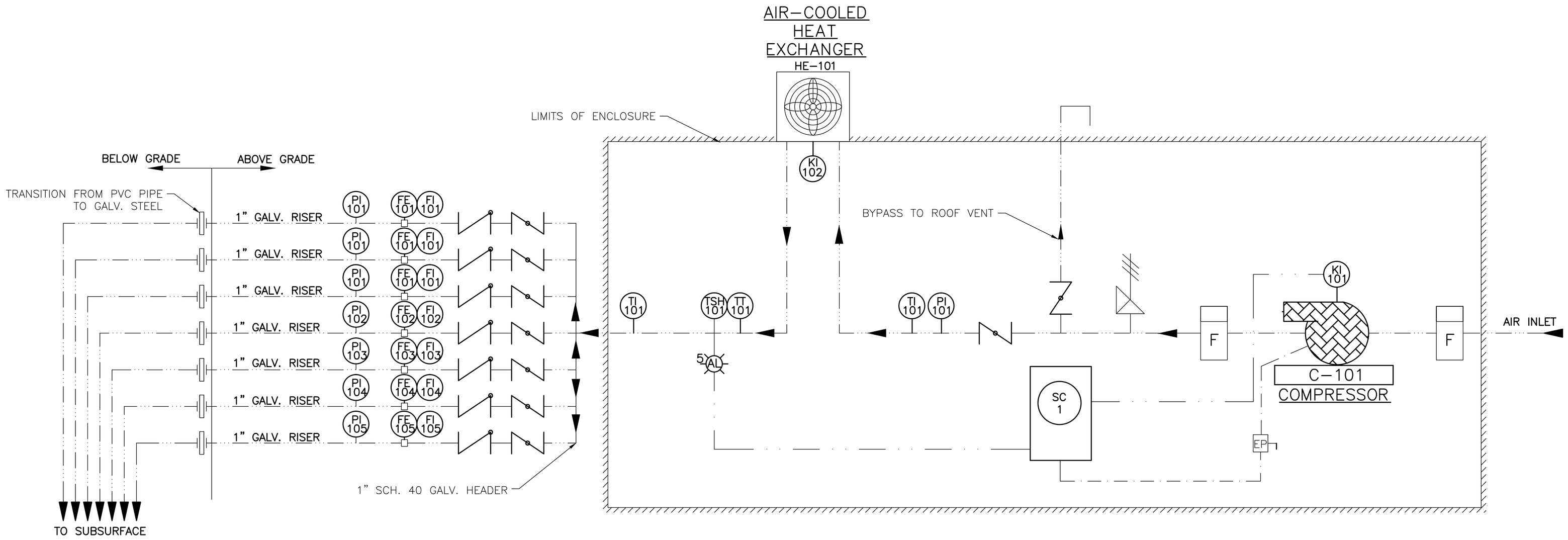

INTERLOCK SCHEDULE

DESIGNATION	FUNCTION
TSH HE-101	HE-101 ON, AL-5 ON
VARIOUS TRANSMITTERS	TELEMETRY ONLY

EQUIPMENT SCHEDULE

I.D.	DESCRIPTION	CAPACITY	MOTOR	MANUFACTURER/MODEL
C-101	ROTARY VANE COMPRESSOR	95 CFM FREE AIR @ MAX. PRESSURE	12 HP	BECKERS KDT 3.140
HE-101	HEAT EXCHANGER	MAX. AMBIENT TEMP 150 DEGREES F/140 CFM	81W/60Hz	FANTECH AEV1000
SC-1	SYSTEM CONTROL PANEL	230V/3/60	NA	EDS RESEARCH SERIES 2 PLUS TYPE A1 MASTER PLC

NOTES:

1. INSTALL ALL SIGNAL AND POWER LINES IN RIGID STEEL CONDUIT TO MEET THE REQUIREMENTS OF CLASS 1, DIVISION 1 ATMOSPHERES.
2. COMPRESSOR SHALL BE EQUIPPED WITH HAND-OFF-AUTO SWITCHES AND RUN-LIGHTS LOCATED IN THE SYSTEM CONTROL CABINET (SC-1).
3. STANDARD ROTARY VANE COMPRESSOR SPECIFIED INCLUDES INTEGRAL INLET AND DISCHARGE FILTERS, AND PRESSURE REGULATING VALVE.
4. AIR SPARGING SYSTEM SHALL BE SHUT DOWN IF EXTRACTION BLOWER IS OFF.

INSTRUMENT IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS	
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION & MODIFIER
A			ALARM	
C				CONTROL
D			DIFFERENTIAL	
E			SENSOR (PRIMARY ELEMENT)	
F	FLOW			
H	HAND			HIGH
I			INDICATOR	
K	TIME			
L	LEVEL			LOW
M		MONITOR		
P	PRESSURE			
Q		TOTALIZE		
R			RECORD	
S	SYSTEM		SWITCH	
T	TEMPERATURE			SENSOR/ TRANSMITTER
V	VACUUM			VALVE
Y	EVENT, STATE, OR PRESENCE			

I, SHEILA RANSBOTTOM, CERTIFY THAT I AM CURRENTLY A NYS REGISTERED PROFESSIONAL ENGINEER AND THAT THESE REMEDIAL WORK PLAN (AIR SPARGE SYSTEM) DESIGN PLANS WERE PREPARED IN ACCORDANCE WITH ALL APPLICABLE STATUTES AND REGULATIONS AND IN SUBSTANTIAL CONFORMANCE WITH THE DER TECHNICAL GUIDANCE FOR SITE INVESTIGATION AND REMEDIATION (DER-10) AND THAT ALL ACTIVITIES WERE PERFORMED IN FULL ACCORDANCE WITH THE NYSDEC-APPROVED WORK PLAN AND ANY NYSDEC-APPROVED MODIFICATIONS.

CLIENT NAME

SEAL & SIGNATURE

NO.	REVISIONS	DATE

CORE ENVIRONMENTAL CONSULTANTS
46-11 54TH AVENUE
MASPETH, N.Y. 11378
T: 718-762-0544
F: 718-762-0545
2312 WEHRLE DRIVE
BUFFALO, N.Y. 14221
T: 716-204-8054
F: 716-204-8557
www.COREenv.com

PROJECT TITLE:

THE WILLS BUILDING
43-01 21ST STREET
LONG ISLAND CITY, NY 11103

DESCRIPTION:

INSTALLATION OF AIR SPARGING SYSTEM AND SOIL VAPOR EXTRACTION SYSTEM UPGRADES
REMEDIAL WORK PLAN

DRAWING TITLE:

AIR SPARGE
PROCESS & INSTRUMENTATION DIAGRAM

SEAL & SIGNATURE		
	DATE:	04/01/2015
	BIN No.:	4009158
	DRAWN BY:	BDB
	DESIGNED BY:	BDB
	CHECKED BY:	SAR, P.E.
	APPROVED BY:	SAR, P.E.
	DRAWING No.:	H-006.00
SCALE:	SHEET No.: 8	OF: 10
95% DRAWING	REVISED BY:	-

J:\Wills Building - Rockrose\Remedial Work Plan_2015\Air Sparging - SVE\Full Scale\Wills AS-SVE.dwg

SECTION - 10

Warranty

WARRANTY OF CONSTRUCTION

PART 1 - GENERAL

1.01 SCOPE OF WORK:

This section covers the warranties of construction including requirements for equipment, materials, and workmanship.

1.02 GENERAL REQUIREMENTS:

In addition to any other warranties set out elsewhere in the Contract, the Contractor warrants that work performed under this Contract conforms to the Contract requirements and is free of any defect of equipment, material or design furnished, or workmanship by the Contractor or any of his Subcontractors or suppliers. The warranty shall run for a period of one year from the date of final acceptance of the work.

1.02.1 The Contractor shall remedy at his own expense any failure to conform or any such defect. In addition, the Contractor shall remedy at his own expense any damage to Owner controlled real or personal property, when that damage is the result of the Contractor's failure to conform to Contract requirements or any such defect of equipment, material, workmanship, or design.

1.02.2 The Contractor shall also restore any work damaged in fulfilling the terms and conditions of this Section. The Contractor's warranty with respect to work repaired or replaced hereunder will run for one year from the date of such repair or replacement.

1.03 NOTICE OF FAILURE:

The Owner will notify the Contractor in writing within a reasonable time after the discovery of any failure, defect, or damage.

1.04 CONTRACTOR'S LIABILITY:

Should the Contractor fail to remedy any failure, defect, or damage within a reasonable time after receipt of notice thereof, the Owner will have the right to replace, repair, or otherwise remedy such failure, defect, or damage at the Contractor's expense.

1.05 OTHER WARRANTIES:

In addition to the other rights and remedies provided by this section, all Subcontractors', manufacturers', and suppliers' warranties expressed or implied, respecting any work and materials shall, at the direction of the Owner, be enforced by the Contractor for the benefit of the Owner. In such case if the Contractor's warranty under Subsection: GENERAL REQUIREMENTS has expired, any suit directed by the Owner to enforce a Subcontractors', manufacturers', or suppliers' warranty will be at the expense of the Owner. The Contractor shall obtain any warranties which the Subcontractors, manufacturers, or suppliers would give in normal commercial practice.

1.06 ENDORSEMENT OF OTHER WARRANTIES:

If directed by the Owner, the Contractor shall require any such warranties to be executed in writing to the Owner.

1.07 CONTRACTOR'S LIABILITY EXCLUSIONS:

Notwithstanding any other provision of this Section, unless such a defect is caused by the negligence of the Contractor or his Subcontractors or suppliers at any time, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Owner or for the repair of any damage which results from any such defect in Owner-furnished material or design.

1.08 NEW YORK CITY ADDITIONAL RIGHTS:

The warranty specified herein shall not limit Owner rights under this Contract with respect to latent defects, gross mistake, or fraud.

1.09 BRAND NAME WARRANTIES:

Defects in design or manufacture of equipment specified by the Owner on a "Brand name and Model" basis, shall not be included in this warranty. The Contractor shall require any Subcontractors, manufacturers, or suppliers thereof to execute their warranties in writing directly to the Owner.

1.10 WARRANTY SERVICE CALLS:

The Contractor shall furnish to the Owner the names of local service representatives and/or Contractors that are available for warranty service calls and who will respond to a call within 4 hours for petroleum handling systems and critical electrical service systems. The names, addresses, and telephone numbers for day, night, weekend, and holiday service responses shall be furnished for one year to the Owner and also posted at conspicuous locations close to the units.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

APPENDIX G

Quality Assurance Project Plan

CORE ENVIRONMENTAL CONSULTANTS

QUALITY ASSURANCE PROJECT PLAN
Wills Building
43-01 21st Street
Long Island City, New York 11101
Site No. C241143

Prepared for:

Rockrose Development Corporation
15 East 26th Street, 7th Floor
New York, New York 10010

Prepared by:

46-11 54th Ave
Maspeth, New York 11378

July 7, 2015

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLES

FORMS

ATTACHMENT

1.0 INTRODUCTION

CORE has prepared this Quality Assurance Project Plan (QAPP) to accompany the Remedial Work Plan (RWP). This QAPP presents the policies, organization, objectives, functional activities, and specific quality assurance and quality control activities to ensure the validity of data generated during the remedial action at the Site. The purpose of this QAPP is to ensure that all technical data generated are accurate and representative. The objectives for meeting these requirements include:

- Identification of qualifications and responsibilities for key project staff;
- Proper sample management in field and laboratory environments; and
- Assurance that data are complete, accurate, and acceptable.

Quality assurance (QA) is a management system for ensuring that all information, data, and decisions resulting from investigation and environmental monitoring programs are technically sound and properly documented. Quality control (QC) is the functional mechanism through which quality assurance is achieved. Quality control programs, for example, define the frequency and methods of checks, audits, and reviews necessary to identify problems and dictate corrective actions to resolve these problems, ensuring high quality data. As such, a quality assurance and quality control (QA/QC) program pertains to all data collection, evaluation, and review activities that are part of the remedial program.

All QA/QC procedures will be in accordance with applicable professional technical standards, government regulations and guidelines, and specific project goals and requirements. This QAPP has been prepared in accordance with New York State Department of Environmental Conservation (NYSDEC) and United States Environmental Protection Agency (USEPA) Region II guidance documents.

Laboratory analysis of all project samples will be performed by an independent laboratory with the experience and certifications appropriate for the analyses performed. All analyses will be performed by laboratories accredited pursuant to the New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) for the category of parameters to be analyzed. The specific environmental laboratory or laboratories to be used will be determined as the project proceeds and monitoring activities are scheduled.

Duplicates, replicates, and matrix spike/matrix spike duplicate (MS/MSD) samples will be used to identify the quality of the analytical data. Field audits may be conducted to verify that proper sampling techniques and Chain-of Custody procedures are followed. Field data compilation, tabulation, and analysis will be checked for accuracy. Calculations and other post-field tasks will be reviewed by senior project personnel. Equipment used to take field measurements will be maintained and calibrated in accordance with established procedures. Records of calibration and maintenance will

be kept by assigned personnel. Field testing and data acquisition will be performed following strict guidelines as described herein.

Document control procedures will be used to coordinate the distribution, coding, storage, retrieval, and review of all data collected during each task.

A Data Usability Summary Report (DUSR) will be prepared for analytical results from each investigation activity. The DUSR will be prepared by an independent consultant in accordance with NYSDEC's "*Guidance for the Development of Data Usability Summary Reports*," revised 1997 and NYSDEC's DER-10 "*Technical Guidance for Site Investigation and Remediation*," May 2010 (DER-10).

2.0 PROJECT DESCRIPTION

This QAPP pertains to the completion of field activities and subsequent laboratory and data analysis associated with the Wills Building Site located at 43-01 21st Street, Long Island City, New York. A sub-slab depressurization system is currently in operation at the Site to address impacts to indoor air quality as a result of soil vapor migration.

The primary objectives of the remedial action are to:

- Degrade and treat the source area to reduce volatile organic compound (VOC) impacts to groundwater;
- Prevent off-Site migration of VOC impacts;
- Protect occupants of existing building from vapor intrusion into occupied areas of the on-site building; and
- Protect occupants of existing building and the public from direct contact with impacted soil and groundwater.

2.1 SITE DESCRIPTION

The Site is located at 43-01 21st Street in Long Island City, Queens, New York. The Wills Building is currently a mixed-use commercial and manufacturing space. The Site is located in an area zoned M1-4 by the New York City Department of City Planning, indicating that it can be used for manufacturing and commercial uses. The Site, presently owned by Rockrose Development Corporation (Rockrose), is bound by various commercial and industrial properties to the south, 21st Street to the west, 43rd Avenue to the north, and 22nd Street to the east. The East River is located approximately one-half mile northwest of the Site.

The Site is comprised of a large parcel occupying the entire block length between 21st and 22nd Streets. The parcel is approximately 261 feet along 43rd Avenue by 190 feet along the 21st Street frontage, and is identified as Block 441, Lot 16 by the New York City Department of Finance. The Site is currently occupied by one 124,000 square foot, three-story building originally constructed in approximately 1926. The property is relatively flat, with an approximate ground elevation 19 feet above mean sea level (msl). General topography in the area of the Site slopes slightly to the West.

2.2 REMEDIAL SCOPE

The scope of the project includes the installation and operation of an air sparge and soil vapor extraction system. This QAPP will provide guidance on field collection of samples, analysis procedures, and QA/QC tasks to be performed as part of the project.

2.3 REMEDIAL OBJECTIVES

The primary objectives of the remedial action are to:

- Degrade and treat the source area to reduce VOC impacts to groundwater;
- Prevent off-Site migration of VOC impacts;
- Operate a sub-slab depressurization system (SSDS) to protect building occupants from off-gasses;
- Installation and/or maintenance of a Site cover to protect the public from direct contact with impacted media; and
- Institutional controls (ICs), including:
    - Existing New York City statute that prevents the installation of a groundwater drinking well where potable water is supplied, and
    - A NYSDEC Environmental Easement to ensure that Site ICs and engineering controls (ECs) remain in place.

2.4 QUALITY ASSURANCE OBJECTIVES

The goals of the QAPP are to document the framework needed to ensure that:

- The measurements performed will adequately support the project objectives regarding data collection and hypothesis testing;
- Data collected are of the highest quality that can be reasonably expected;
- The quality of the data is known;
- The data and its quality are adequately documented; and
- The data are adequately preserved and rendered in available form.

2.5 DATA QUALITY OBJECTIVES

Data quality objective (DQO) criteria define the uncertainty in a data set and are expressed in terms of accuracy, comparability, completeness, precision, and representativeness.

- **Accuracy** - Accuracy is the degree of agreement of a measurement (or average of measurements) with an accepted reference or "true" value and is a measure of bias in the system.
- **Completeness** - Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under correct normal conditions.

- **Comparability** - Comparability expresses the confidence with which one data set can be compared to another
- **Precision** - Precision is the degree of mutual agreement among individual measurements of a given parameter.
- **Representativeness** - Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

3.0 DATA COLLECTION AND QUALITY ASSURANCE ROLES

This QAPP provides for designated qualified personnel to review products and provide guidance on QA matters. The document also outlines the approach that will be followed in order to ensure that data of sufficient quality are obtained. The various QA functions of the project positions are explained in the following subsections.

Senior Project Manager

The Senior Project Manager will have responsibility for ensuring that the project meets the objectives and quality standards as presented in the RWP and this QAPP. He/she will be responsible for implementing the project, and will have the authority to commit the resources necessary to meet project objectives and requirements. The project manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. He/she will act as the major point of contact and control for matters related to the project. In addition, he/she will be responsible for technical quality control and project oversight.

Team Leaders

The Senior Project Manager will be supported by team leaders who will be responsible for leading and coordinating the day-to-day activities of the various resources under their supervision. The team leaders will be highly experienced environmental professionals who will report directly to the Senior Project Manager.

Technical Staff

The technical staff (field support members) for this project will be drawn from CORE's workforce. The technical team staff will be used to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical team members will be experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

QA Officer

The Project QA Officer will be responsible for maintaining QA for the project.

4.0 QUALITY CONTROL ACTIVITIES

All measurements will be made to ensure that analytical results are representative of the media and conditions measured. Unless otherwise specified, all data will be calculated and reported in units consistent with other organizations who report similar data to maintain comparability.

4.1 GOALS

The QA/QC goal will focus on controlling measurement error within the limits established and will ultimately provide a database for estimating the actual uncertainty in the data collected.

Target values for detection limit, percent spike recovery and percent "true" value of known check standards, and relative percent difference (RPD) of duplicates/replicates are provided in the referenced analytical procedures. It should be noted that target values are not always attainable. Instances may arise where high sample concentrations, non-homogeneity of samples, or matrix interferences preclude achievement of target detection limits or other quality control criteria. In such instances, the laboratory will report reasons for deviations from these detection limits or noncompliance with quality control criteria.

4.2 FIELD QUALITY CONTROL SAMPLES

Field quality control samples will consist of trip blanks, field blanks, field duplicates, matrix spikes, and matrix spike duplicates, as shown in Table 1.

4.2.1 Field Duplicates

Field quality control samples will be collected to verify reproducibility of the sampling and analytical methods. Field duplicates will be obtained at a rate of 1 per 20 original field samples, as outlined in Table 1.

4.2.2 Trip Blanks

Trip blanks will be used to assess whether groundwater has been exposed to volatile constituents during sample storage and transport. Trip blanks will consist of a volatile organics analysis (VOA) vial pre-filled by the laboratory with analyte-free water. The trip blanks will remain unopened throughout the sampling event and will be analyzed for VOCs. Trip blanks will be collected as outlined in Table 1.

4.2.3 Matrix Spike/Matrix Spike Duplicates

MS/MSD samples will be obtained to determine if the matrix is interfering with sample analysis. MS/MSDs will be collected at a rate of 1 per 20 original field samples, or as required to meet DQOs, as outlined in Table 1.

4.2.4 Rinseate/Equipment Blanks

Rinseate blanks will be used to assess decontamination procedures for non-dedicated equipment. Rinse blanks will be collected as outlined in Table 1.

4.3 LABORATORY QUALITY CONTROL CHECKS

Internal laboratory quality control checks will be used to monitor data integrity. These checks include method (equipment) blanks, spike blanks, internal standards, surrogate samples, calibration standards, and reference standards.

5.0 CALIBRATION PROCEDURES AND FREQUENCY

All instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations as well as criteria set forth in the applicable analytical methodology references.

5.1 FIELD INSTRUMENTS

A calibration program will be implemented to ensure that routine calibration is performed on all field instruments. Field team members familiar with field calibration and operation of the equipment will maintain proficiency and perform the prescribed calibration procedures outlined in the Operation and Field Manuals accompanying the respective instruments. Calibration records for each field instrument used on the project will be maintained on-site during field activities and a copy will be kept in the project files.

5.1.1 Portable Total Organic Vapor Monitor

Any vapor monitor used will undergo routine maintenance and calibration prior to shipment to the project site. Daily calibration and instrument checks will be performed by a trained team member at the start of each day. Daily calibrations will be performed according to the manufacturer's specifications and are to include the following:

- Battery check: If the equipment fails the battery check, recharge the battery.
- Gas standard: The gauge should display an accurate reading when a standard gas is used.
- Cleaning: If proper calibration cannot be achieved, the instrument ports must be cleaned.

5.1.2 pH and Specific Conductance

The following steps should be observed by personnel engaged in groundwater sampling for pH and specific conductance:

- The operation of instrumentation should be checked prior to each day’s sampling and calibrated if necessary. Fresh standard buffer solution (pH 4, pH 7 and pH 10) will be used if it is determined that calibration is required.
- The specific conductance meter should be calibrated prior to each sampling event using a standard solution of known specific conductance.

More frequent calibrations may be performed as necessary to maintain analytical integrity. Calibration records for each field instrument used on the project should be maintained and a copy kept in project files.

6.0 SAMPLING PROCEDURES

The sampling of various environmental media will be completed as part of the remedial action. Sample type and data use are presented in Table 2.

6.1 SAMPLING PROTOCOL

Contained within this section are various guidelines related to the sample collection activities which may be performed at the site. These guidelines will be used by the field personnel to ensure the samples are collected and field activities are performed in a consistent manner. Each guideline will allow the field teams to customize the Work Plan to meet the specific sampling requirements of each site. Guidelines contained in this section are:

- Soil Sampling
- Boring Using a Geoprobe®
- Boring With a Standard Drilling Rig
- Groundwater Sampling

The sample containers that will be used are identified in Table 3. The sample containers will be labeled in accordance with Section 7.1.1. Sample handling, packaging, and shipping procedures are presented in Section 7.3.

6.1.1 Soil Sampling

This section provides the guidelines and requirements for soil sampling. The objective of the guideline is to ensure a representative soil sample is collected at each designated sampling location to accurately define the concentration and determine whether the site soils have been impacted by site activities.

Soil samples may be collected using a hand auger. Listed below is the process for collecting soil samples:

1. A new pair of clean disposable nitrile gloves will be donned at each sampling location.
2. Prepare the sampling location by removing all concrete, stone sub-base, asphalt, vegetation, roots, etc., from the sampling point.
3. Advance a decontaminated hand auger to the desired sampling depth below ground surface.
4. Remove the hand auger from the boring and use a decontaminated stainless steel spoon to remove the sample from the auger bucket.

5. Carefully place the soil samples for volatile organic analysis directly in to the sample bottles ensuring that no head space exists.
6. Place the remaining sample into a decontaminated bowl (stainless steel or Pyrex). The borehole may need to be further advanced to obtain enough samples to fill all the sample containers.
7. Once enough samples are collected, homogenize the sample using the quartering method (see below). When the sample has been completely mixed, fill the remaining sample containers.
8. After the sample bottle is filled, the cap will be placed on the bottle and the bottle will be packaged for shipment as specified in Section 7.3.
9. QA/QC samples will be collected as specified in Section 4.2.
10. Backfill the boring with the soil removed from the hole and return the Site to its natural state.

The following should be considered when collecting a soil sample using a hand auger:

- When a vertical sampling interval has been established, one auger-bucket is used to advance the auger hole to the first desired sampling depth.
- If discrete grab samples are to be collected to characterize each depth, a new bucket must be placed on the end of the auger extension immediately prior to collecting the next sample.
- The top few inches of soil should be removed from the bucket to minimize the chances of cross-contamination of the sample from fall-in of material from the upper portions of the hole.

The cut and quartering technique is as follows:

- The sample will be thoroughly mixed in a bowl, and divided into quarters.
- A portion of the soil will be gathered from two of the quartered sections. This process will be repeated until the amount of soil needed to completely fill the sample containers has been obtained.
- It is pertinent that soil samples be mixed as thoroughly as possible to ensure the sample is representative of the interval sampled.

Soil sampling records will be kept in the field log book. The information recorded will include the general requirements presented in Section. 7.2. The following records will also be reported:

1. Name and location (including sample interval) of the soil sample and boring.
2. Depth to top of sample and soil description when applicable.
3. Type of equipment used during the soil sampling/boring.
4. Sample location.

Field quality control samples will be collected to verify reproducibility of the sampling and analytical methods. Field duplicates will be obtained at a rate of 1 per 20 original field samples, as outlined in Table 1.

6.1.2 Geoprobe® Borings

This section provides the guidelines and requirements for advancing soil borings using a Geoprobe® for the purpose of collecting soil samples and extracting groundwater samples.

The following procedure will be used to advance borings with a Geoprobe® rig and Macrocore® sampler to collect subsurface soil samples.

1. Determine and clear (for utilities) the boring locations through site personnel and the local underground facilities locating service. Surface materials such as concrete, asphalt, or vegetation may be removed from boring locations.
2. Geoprobe® rods will be advanced in 4-foot intervals. Each new 4-foot interval will be sampled using a single-use acetate Macrocore® sleeve liner.
3. Once the desired sampling depth has been reached, rods will be retraced and the Macrocore® sample liner will be retrieved from the sampling rod sleeve.
4. The acetate liner will be cut open by the drill rig operator or his/her assistant.
5. Small portions of soil will be collected along the length of the acetate liner and placed in VOC sample bottles. Sample bottles will be filled in such a manner as to minimize head space and ensure that a representative sample from the designated sampling depth is collected.
6. After the VOC sample is collected, the remaining sample will be placed in a decontaminated stainless steel bowl, homogenized using the quartering method (see Soil Sampling Section 5.1.1), and used to fill remaining sample containers.
7. Once the samples have been collected they will be packaged as specified in Section 7.3.
8. QA/QC samples will be collected as specified in Section 4.2.

9. Backfill the boring with the soil removed from the hole and return the site to its natural state. If the hole is not completely backfilled to ground surface with the soil removed from the hole, bentonite chips will be used to backfill the remaining space.

The following guidelines are to be used when advancing Geoprobe® borings and extracting groundwater samples in areas immediately surrounding the locations where site activities may have impacted groundwater resources:

1. Sampling locations are determined prior to site activities; however minor adjustments in the field may be needed. Prior to advancing the Geoprobe®, underground utilities in the area will be identified.
2. The Geoprobe® borings will be advanced to just below the water table, a predetermined maximum depth, or to refusal.
3. The outer sleeve will be retracted exposing the inner stainless steel screen.
4. Sample will be obtained using a peristaltic pump, tubing and check ball system or a mini bailer.
5. In areas with low groundwater yield, a temporary piezometer constructed out of pre-cleaned schedule 40 PVC (1-inch diameter) will be placed in the Geoprobe® borehole after down-hole tools have been removed.
6. If the boring yields sufficient water to allow for sample collection completion within one hour, a peristaltic pump, tubing and check ball system, or a bailer will be used for sample collection per section 6.1.4.
7. Groundwater will be removed under very low-flow conditions to minimize turbidity when filling pre-cleaned, pre-preserved, pre-labeled sample bottles, starting with the collection of the samples for VOC analyses.
8. There should be no bubbles in VOC samples.
9. Continue to fill remaining bottles.
10. If samples for metals analysis contain excessive silt, the samples may be allowed to settle. The less turbid sample will be decanted and sent to the laboratory for analysis.
11. After the sample bottle is filled, the cap will be placed on the bottle and the bottle will be packaged for shipment as specified in Section 7.3.
12. QA/QC samples will be collected as specified in Section 4.2.
13. Conductivity, pH, and temperature will be measured after sample collection. The measurements will be recorded in the field log book.

14. Once the sample collection process has been completed, the temporary casing will be removed and the borehole will be backfilled with soil removed from the hole. If the hole is not completely backfilled to ground surface with the soil removed from the hole, bentonite chips will be used to backfill the remaining space.

Geoprobe® records will be recorded in the field log book. The information recorded will include the general requirements presented in Section. 7.2. The following records will also be reported:

1. Name and location of the Geoprobe® sample and boring.
2. Date and time that the Geoprobe® boring/sampling was advanced.
3. Depth range across with sample was collected.
4. Name of the persons overseeing and company conducting the Geoprobe® borings.
5. Type of equipment used during the Geoprobe® boring and during construction of the temporary piezometers. Soil descriptions should be included when applicable.
6. Type of equipment used during sampling, number and type of containers used for sampling purposes, and analyses to be conducted.
7. Sample location.

Field quality control samples will be collected to verify reproducibility of the sampling and analytical methods. Field duplicates will be obtained at a rate of 1 per 20 original field samples, as outlined in Table 1.

6.1.3 Hollow Stem Auger Rig Borings

This section provides the guidelines and requirements for advancing soil borings with a standard hollow-stem auger (HSA) drilling rig for the purpose of extracting soil samples and installing groundwater monitoring wells.

The following procedure will be used to advance borings with an HSA rig and split spoon sampler to collect subsurface soil samples. Listed below is the procedure for collecting subsurface soil samples:

1. Determine and clear (for utilities) the boring locations through site personnel and the local underground facilities locating service. Surface materials such as concrete, asphalt, or vegetation may be removed from boring locations.
2. A minimum 2 ½ -inch diameter hollow stem auger will be used to advance the borehole to the desired subsurface depth.
3. Once the desired sampling depth has been reached, a decontaminated split spoon sampler will be used to retrieve the subsurface soil sample.

4. The split spoon sampler will be brought to the surface and opened for sample collection and lithological description.
5. Small portions of soil will be collected along the length of the split spoon and placed in VOC sample bottles. Sample bottles will be filled in such a manner as to minimize head space and ensure that a representative sample from the designated sampling depth is collected.
6. After the VOC sample is collected, the remaining sample will be placed in a decontaminated stainless steel bowl, homogenized using the quartering method (see Soil Sampling Section 6.1.1), and used to fill remaining sample containers.
7. Once the samples have been collected they will be packaged as specified in Section 7.3.
8. QA/QC samples will be collected as specified in Section 4.2.
9. Backfill the boring with the soil removed from the hole and return the site to its natural state. If the hole is not completely backfilled to ground surface with the soil removed from the hole, bentonite chips will be used to backfill the remaining space.

Standard drilling rig records and soil sampling records will be kept in the field log book. The information recorded will include the general requirements presented in Section 7.2. The following records will also be reported:

1. Name and location of the boring.
2. Date and time that the boring was advanced and sampling occurred.
3. Depth range across which sample was collected.
4. Names of on-site personnel and company conducting the borings.
5. Lithological description of subsurface soils for each boring location.
6. Length of split spoon sampler and amount of recovered sample.
7. Sample location.

Field quality control samples will be collected to verify reproducibility of the sampling and analytical methods. Field duplicates will be obtained at a rate of 1 per 20 original field samples, as outlined in Table 1.

6.1.4 Groundwater Sampling

This section provides the guidelines and requirements for collecting groundwater samples from monitoring wells. The purpose of the guideline is to ensure that the groundwater samples are

collected in such a manner to ensure that a representative sample is collected at each designated sampling location.

Prior to collection of groundwater samples, monitoring wells and water supply wells will be purged to remove stagnant water that is not considered indicative of aquifer conditions. Purge water disposal will be addressed on a site-specific basis. A new pair of clean disposable gloves will be donned at each sample location.

Procedures for monitoring well purging:

1. Place plastic around well head.
2. Unlock protective casing and remove well cap.
3. Immediately (after well cap removal) take an organic vapor reading down the well casing using a photoionization detector (PID) and record reading in the field logbook.
4. Measure water level distance from top of casing and sound the total depth as detailed below. Record in logbook. Check tip of water level indicator for silt or product residue. If either is observed, note in logbook.
    a. Lower decontaminated water level indicator into monitoring well until indicator sounds and light is illuminated.
    b. Confirm that the water surface has been contacted by repeatedly raising and lowering the indicator at least three times to ensure a consistent sounding level has been reached.
    c. Measure and record depth (nearest 0.01 feet) to the water surface from the top of casing in field logbook.
    d. Lower the indicator to the well bottom and record the total depth.
    e. Retrieve and decontaminate water level indicator.
5. Calculate volume to remove for purging.
6. Lower decontaminated purging device into well.
7. Begin to purge water from the well near the bottom.
8. Observe and record: odor, color, clarity, siltiness, and general water condition in logbook. Also record changes in the physical condition of the monitoring wells that could affect well integrity.
9. Temperature, pH, and specific conductivity of groundwater will be measured and recorded periodically during well purging. The sample may be collected after the water

has cleared sufficiently and temperature, pH, and conductivity have stabilized. Stabilization is defined as follows:

- Temperature ±1°C
- pH ±0.1
- Redox potential ±3% for 10 mv
- Turbidity/dissolved oxygen ±10 %
- Conductivity ±10 µmhos/cm^2

10. A total of at least 3 to 5 volumes of well water should be removed for purging to be considered complete. Wells with little or no recharge will be purged to near dryness. If a pump is used for well purging, it will be brought to the water surface prior to completion of purging activities to ensure complete removal of stagnant water.

Water supply wells which need to be sampled for constituents of concern and are equipped with an operable pump will also be purged of stagnant water. To do so, the total depth and diameter of the well should be known or accurately estimated, and it must be determined whether or not a storage tank exits. If a storage tank is present and is located before the sample port location, it must also be purged of stagnant water.

Listed below are the guidelines used for water supply well purging:

1. Locate a sample port or discharge location.
2. Determine volume to be removed based on total depth and diameter of the well and the storage capacity of the storage tank if it exists.
3. Activate the submersible pump in the well.
4. Begin to remove water from the well, and continue until it has been determined that the stagnant water has been removed based on discharge rate and well construction.
5. Observe and record: odor, color, clarity, siltiness and general water condition in logbook. Also record observed construction of the water supply well.
6. Temperature, pH, and, specific conductivity of the groundwater will be measured and recorded periodically during water supply well purging. The sample may be collected after the water has cleared sufficiently and the temperature, pH, and conductivity have stabilized. Stabilization is defined as follows:
    - Temperature ±1°C
    - pH ±0.1

- Redox potential ±3% for 10 mv
- Turbidity/dissolved oxygen ±10 %
- Conductivity ±10 µmhos/cm^2

7. If well construction information is not available, then the recommended purge time is 15 minutes for a high volume pump.

Monitoring wells which contain excess silt and have a low yield will be purged using low flow methodology. This method of purging and well sampling will be used to minimize the volume of purge water removed from the well and to reduce turbidity in the groundwater samples collected. The pumping device selected should operate at variable speeds to reduce aquifer stress and agitation.

Listed below are the guidelines used for purging a well using the low flow method:

1. Place plastic around well head.
2. Unlock protective casing and remove well cap.
3. Immediately (after well cap removal) take an organic vapor reading down the well casing using a photoionization detector and record reading in the field logbook.
4. Measure water level distance from top of casing and sound the total depth as detailed below. Record in logbook. Check tip of water level indicator for silt or product residue (if either are observed note in logbook).
    a. Lower decontaminated water level indicator into monitoring well until indicator sounds and light is illuminated.
    b. Confirm that the water surface has been contacted by repeatedly raising and lowering the indicator at least three times to ensure a consistent sounding level has been reached.
    c. Measure and record depth (nearest 0.01 feet) to the water surface from the top of casing in field logbook.
    d. Lower the indicator to the well bottom and record the total depth.
    e. Retrieve and decontaminate water level indicator.
5. Calculate volume to remove for purging.
6. Lower decontaminated low flow purging device into well within the screened area of the well producing the highest flow rate.

7. Begin pumping and measure the groundwater elevation to ensure that the aquifer is not being stressed. If significant drawdown occurs, reduce the pumping rate. Flow rates should range between 100 mL/ min and 1,000 mL/min.
8. Observe and record: odor, color, clarity, siltiness, and general water condition in logbook. Also record changes in the physical condition of the monitoring wells that could affect well integrity.
9. Temperature, pH, turbidity, dissolved oxygen, redox potential, and specific conductivity of the groundwater will be measured and recorded periodically during well purging. The sample may be collected after the water has cleared sufficiently, water quality indicators have stabilized after 3 successive measurements, and at least one well volume has been removed. Stabilization is defined as follows:
    - Temperature ±1°C
    - pH ±0.1
    - Redox potential ±3% for 10 mv
    - Turbidity/dissolved oxygen ±10 %
    - Conductivity ±10 µmhos/cm2
10. After the monitoring well is purged, do not turn off the pump or remove it from the well.

Groundwater sample collection from a monitoring well:

1. Purge the monitoring well as described earlier in section.
2. Establish that the well has properly recharged (80% of static water level has recovered). No more than 16 hours should lapse between purge completion and sample collection.
3. Carefully lower a decontaminated bailer (with a fresh nylon line attached for each well) down the monitoring well. Disposable bailers may also be used.
4. Continue to lower the sample collection device to the desired sampling depth.
5. Raise the bailer and carefully fill pre-cleaned, pre-preserved, pre-labeled sample bottles, VOC analysis first.
6. Make sure there are no bubbles in VOC samples.
7. Continue to fill remaining bottles.
8. After the sample bottle is filled, the cap will be placed on the bottle and the bottle will be packaged for shipment as specified in Section 7.3.
9. QA/QC samples will be collected as specified in Section 4.2.

10. Conductivity, pH, and temperature, will be measured after sample collection. The measurements will be recorded in the field log book.

Groundwater sample collection using the low flow method:

1. Purge the monitoring well as described earlier in section.
2. Use the pumping device already in place to collect the samples where turbidity can influence the analytical results (such as metals).
3. If a peristaltic pump/ vacuum jug assembly or stainless steel and Teflon bladder pump were used for purging, continue to collect the remaining samples using these devices.
4. If neither of the devices listed above were used, carefully remove the pump from the well and use a Teflon bailer to collect the remaining groundwater samples.
5. After the sample bottle is filled, the cap will be placed on the bottle and the bottle will be packaged for shipment as specified in Section 7.3.
6. QA/QC samples will be collected as specified in Section 4.2.
7. Conductivity, pH, and temperature will be measured after sample collection. The measurements will be recorded in the field log book.

Records

Sample collection records will be kept on the appropriate forms, including the purge logs and sampling log forms. The information recorded is described on the forms. In addition, the following information will also be reported in the log book:

1. Observations of groundwater condition;
2. Field measurements;
3. Sample identification, date, and time; and
4. Sample analytical parameters

6.3 SAMPLE CONTAINERS

The volumes and containers required for the sampling activities are included in Table 3. Pre-washed sample containers will be provided by the laboratory. All bottles are to be prepared in accordance with USEPA bottle washing procedures.

6.4 DECONTAMINATION

Dedicated and/or disposable sampling equipment will be used to the extent possible to minimize decontamination requirements and the possibility of cross-contamination.

When the use of new/dedicated equipment at each sampling location is not feasible, such as the use of augers and a split spoon sampler, equipment will be decontaminated between sampling locations. The water level indicator will be decontaminated between locations by using the following decontamination procedures:

- Initial cleaning of any foreign matter with paper towels, if needed;
- Low phosphate detergent wash;
- De-ionized water rinse; and
- Air dry.

If a Geoprobe® is used to install monitoring wells, the Geoprobe®, Geoprobe® rods, and Macrocore® samplers utilized to install borings will be decontaminated with a bucket wash consisting of a low phosphate detergent wash followed by water rinse. The backhoe bucket, drill rig, augers, rods, split spoon samplers, and/or other related downhole equipment will be decontaminated using high pressure steam prior to initiating the excavation and well installation programs prior to the initiation of subsurface intrusive activities and between each boring location. Steam cleaning will be performed in a pre-designated on-site decontamination area. Throughout and after the cleaning processes, direct contact between the equipment and the ground surface will not be permitted. Decontamination waste water will be collected in 55-gallon drums. The drill rig and associated equipment will also be cleaned upon completion of the investigation and prior to departure from the Site using the following methods:

- Initial cleaning of all foreign matter; and
- Wash down with high pressure, high temperature sprays to remove and/or volatilize organic contamination.

6.5 LEVELS OF PROTECTION/SITE SAFETY

All sampling will be conducted under a documented Health and Safety Plan. On the basis of air monitoring, the level of protection may be downgraded or upgraded at the discretion of the Site Safety Officer. Crew members will stand upwind of open boreholes or wellheads during the collection of samples, when possible. All work will initially be conducted in Level D (refer to Site Health and Safety Plan). Air purifying respirators (APRs) will be available if monitoring indicates an upgrade to Level C is appropriate.

7.0 SAMPLE CUSTODY

This section describes standard operating procedures for sample identification and chain-of custody to be used for all field activities. These procedures are in place to ensure that the quality of the samples is maintained during collection, transportation, storage, and analysis. All Chain-of-Custody requirements comply with standard operating procedures indicated in USEPA and NYSDEC sample-handling protocol.

Sample identification documents must be carefully prepared so that sample identification and Chain-of-Custody can be maintained and sample disposition controlled. Sample identification documents include:

- Field records;
- Sample labels;
- Custody seals; and
- Chain-of-Custody records.

7.1 CHAIN-OF-CUSTODY

The primary objective of the Chain-of-Custody procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from collection to completion of all required analyses.

7.1.1 Sample Labels

Sample labels attached to, or affixed around, the sample container must be used to properly identify all samples collected in the field. To the extent possible, the sample labels are to be placed on the bottles so as not to obscure QA/QC lot numbers on bottles. Sample information must be printed in a legible manner using waterproof ink. Field identification must be sufficient to enable cross reference with the field sampling records or sample logbook. For Chain-of-Custody purposes, all QC samples are subject to the same custodial procedures and documentation as original samples.

7.1.2 Custody Seals

Custody seals are pre-printed adhesive-backed seals, often with security slots, designed to break if the seals are disturbed. Sample shipping containers (coolers, cardboard boxes, etc.) are sealed to ensure security. Seals must be signed and dated before use. Upon receipt at the laboratory, the custodian must check (and certify by completing logbook entries) that seals on shipping containers are intact. Strapping tape should be placed over the seals to ensure the Chain-of-Custody remains intact and seals are not inadvertently destroyed during sample shipment.

7.1.3 Chain-Of-Custody Record

The Chain-of-Custody record must be fully completed, on duplicate, at a minimum, by the field technician who has been designated responsible for sample shipment. In addition, if samples are known to require rapid analysis turnaround time because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations), the person completing the Chain-of-Custody record should note these constraints in the "Remarks" section of the Custody record.

7.1.4 Field Custody Procedures

- As few persons as possible should handle samples.
- Sample bottles will be obtained pre-cleaned by the laboratory and shipped to sampling personnel in charge of the field activities.
- Coolers or boxes containing cleaned bottles will be sealed with a custody tape seal during transport to the field or while in storage prior to use.
- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly under Chain-of-Custody procedures.
- The sample collector will record sample data in a controlled field notebook and/or on appropriate field sampling records.
- The Site team leader will determine whether proper custody procedures were followed during fieldwork, and decide if additional samples are required.

7.2 DOCUMENTATION

7.2.1 Sample Identification

All containers of samples collected from the project will be identified using the following format on a label or tag fixed to the sample container Each sample will be labeled, chemically preserved (where required), and sealed immediately following collection. To minimize handling of sample containers, labels will be filled out prior to sample collection to the extent possible. The sample label will be filled out using waterproof ink and will be firmly affixed to the appropriate sample container. The following information will be contained on the sample label:

- Name or initials of sampler;
- Date and time of collection;
- Sample identification;
- Intended analysis; and

- Preservation method (if any).

7.3 SAMPLE HANDLING, PACKAGING, AND SHIPPING

The transportation and handling of samples must be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to the potential hazardous nature of the samples. Regulations for packaging, marking, labeling, and shipping hazardous materials are promulgated by the United States Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171 through 177.

All Chain-of-Custody requirements must comply with standard operating procedures in the NYSDEC and USEPA sample handling protocols. Field personnel will make arrangements for samples to be transported to the laboratory. When custody is relinquished to a shipper, field personnel will ensure that the laboratory custodian or Project Manager is aware of the expected arrival time of the sample shipment and of any time constraints on sample analysis. All samples will be delivered to the laboratory in a timely manner to help ensure sample analysis holding times are met.

8.0 LABORATORY ANALYTICAL PROCEDURES

Specific analytical methods for constituents of interest in soil and groundwater are listed in Table 3. The laboratory will maintain, and have available for the appropriate operators, standard operating procedures relating to sample preparation and analysis according to the methods stipulated in Table 3.

9.0 DATA REDUCTION AND REPORTING

QA/QC requirements will be strictly adhered to during sampling and analytical work. All data generated will be reviewed by comparing and interpreting results from chromatograms (responses, stability of retention times), accuracy (mean percent recovery of spiked samples), and precision (reproducibility of results). Refer to Section 10 for a discussion of QA/QC protocol.

Data storage and documentation will be maintained using logbooks and data sheets that will be kept on file. Analytical QC will be documented and included in the analytical testing report. A central file will be maintained for the sampling and analytical effort after the final laboratory report is issued.

All calculations and data manipulations are included in the appropriate methodology references. Control charts and calibration curves will be used to review the data and identify outlying results. Prior to the submission of the report to the client, all data will be evaluated for precision, accuracy, and completeness.

Laboratory reports will be reviewed by the laboratory supervisor, the QA Officer, Laboratory Manager and/or Director, and the project manager. Analytical reports will contain a data tabulation including results and supporting QC information will be provided. Raw data will be available for later inspection, if required, and maintained in the project file.

All data will be reported to NYSDEC in electronic format in accordance with DER-10 and the NYSDEC's Environmental Data Submission requirements.

9.1 DATA USABILITY SUMMARY REPORTS

Upon completion of a project sampling effort, analytical and QC data will be included in a Data Usability Summary Report (DUSR) that summarizes the work and provides a data evaluation. A discussion of the usability of the results in the context of QA/QC procedures will be made, as well as a summation of the QA/QC activity. The DUSR will be performed in accordance with the DEC's "Guidance for the Development of Data Usability Summary Reports," revised 1997 and DER-10.

Serious analytical problems will be reported. Time and type of corrective action, if needed, will depend on the severity of the problem and relative overall project importance. Corrective actions may include altering procedures in the field, conducting an audit, or modifying laboratory protocol. All corrective action will be implemented after notification of the project representatives.

9.2 INTERNAL QUALITY CONTROL CHECKS

QC data are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of glassware and reagents. The procedures for internal quality control checks will be consistent with NYSDEC ASP protocols.

10.0 PERFORMANCE AND SYSTEM AUDITS

10.1 FIELD AUDITS

The Project QA Director may conduct episodic audits of the operations at the Site to ensure that work is being performed in accordance with the Work Plan and associated Standard Operating Practice (SOP). The audit will cover, but not necessarily be limited to, such areas as:

- Conformance to standard operating procedures;
- Completeness and accuracy of documentation;
- Chain-of-Custody procedures; and
- Construction specifications.

10.2 LABORATORY AUDITS

In addition to any audits required by the NYSDEC, the Project QA Director may choose to audit the laboratory. These additional audits may take the form of performance evaluation samples or on-site laboratory inspections. Performance evaluation samples may be either blind samples or samples of known origin to the laboratory. Reasonable notice will be provided if the audit is to include an on-site inspection.

11.0 PREVENTIVE MAINTENANCE

11.1 FIELD

Field personnel assigned to complete the work will be responsible for preventative maintenance of all field instruments. The field sampling personnel will protect the portable total organic vapor monitors, water quality meter, etc. by placing them in portable boxes and/or protective cases.

All field equipment will be subject to a routine maintenance program, prior to and after each use. The routine maintenance program for each piece of equipment will be in accordance with the manufacturer's operations and maintenance manual. All equipment will be cleaned and checked for integrity after each use. Necessary repairs will be performed immediately after any defects are observed, and before the equipment is used again. Equipment parts with a limited life (such as batteries, membranes, and some electronic components) will be periodically checked and replaced/recharged as necessary according to the manufacturer's specifications.

11.2 LABORATORY

The laboratory's preventative maintenance procedures can be provided as outlined in their Laboratory Quality Assurance Manual.

12.0 CORRECTIVE ACTIONS

Corrective actions can be initiated as a result of performance and system audits, laboratory and interfiled comparison studies, data validation, and/or a QA program audit. They may also be required as a result of a request from project representatives. All corrective action necessary to resolve analytical problems will be taken. Success or failure of corrective actions will be reported with an estimate of effect on data quality, if any.

Corrective actions may include altering procedures in the field, conducting subsequent audits, or modifying project protocol. Time and type of corrective action, if needed, will depend on the severity of the problem and relative overall project importance. The project manager is responsible for initiating corrective action and the team leader is responsible for its implementation in the correction of field non-conformance corrective actions.

13.0 REFERENCES

New York State Department of Environmental Conservation (NYSDEC), 2010. *DEC Program Policy. DER-10/Technical Guidance for Site Investigation and Remediation.*

NYSDEC, 2013. *Analytical Services Protocol.*

United States Environmental Protection Agency (USEPA), 2005. *Standard Methods for the Examination of Water and Wastewater.*

USEPA, 2008. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods/SW-846.*

TABLES

TABLE 2
SAMPLE SUMMARY

Media	Type	Matrix	Data Use
Soil	Pneumatic Soil Boring	Soil	Comparison to Part 375[2]
	HSA[1] Split Spoon		
	Pneumatic Soil Vapor Boring		
Vapor	VOCs[3]	Vapor	NYSDOH[4] Vapor Intrusion Guidelines
Groundwater	Monitoring Wells	Water	Comparison to Part 703.5[5]
	Pneumatic Boring Grab Sample		

Notes:

(1) Hollow-stem auger
(2) Title 6 of the New York Codes, Rules, and Regulations Part 375 (6 NYCRR 375) Soil Cleanup Objectives
(3) Volatile organic compounds
(4) New York State Department of Health
(5) 6 NYCRR 703.5 - *Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations, Water quality standards for taste-, color- and odor-producing, toxic and other deleterious substances*

CORE ENVIRONMENTAL CONSULTANTS

TABLE 3
SAMPLE CONTAINERS AND PRESERVATION

Parameter	Method	Matrix	Container	Preservation[1]
TCL[3] VOCs[4]	SW-846[2] 8260B	Groundwater	Glass, 2 x 40 mL	HCl to pH<2
		Soil	Glass, 4 x 40 mL (Terracore)	USEPA 5030/5035
	USEPA[5] TO-15	Vapor	SUMMA Canister (6 L)	None
TCL SVOCs[6]	SW-846 8270C	Groundwater	Amber Glass, 1 x 1000 mL	None
		Soil	Glass Soil Jar, 1 x 8 oz	None
TCL Pesticides	SW-846 8081B	Groundwater	Amber Glass, 1 x 1000 mL	None
		Soil[7]	Glass Soil Jar, 1 x 8 oz	None
TCL Aroclors	SW-846 8082A	Groundwater	Amber Glass, 1 x 1000 mL	None
		Soil[7]	Glass Soil Jar, 1 x 8 oz	None
TAL[8] Metals	SW-846 6010C	Groundwater	Plastic, 1 x 250 mL	HNO_3
		Soil[7]	Glass Soil Jar, 1 x 8 oz	None
Cyanide	SW-846 9012B	Groundwater	Plastic, 1 x 250 mL	NaOH
		Soil[7]	Glass Soil Jar, 1 x 8 oz	None

Notes:

(1) All soil and groundwater samples will be maintained at 4ºC following collection
(2) USEPA *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*
(3) Target Compound List
(4) Volatile organic compounds
(5) United States Environmental Protection Agency
(6) Semi-volatile organic compounds
(7) Sample can be analyzed from same jar containing soil for SVOC analysis
(8) Target Analyte List

CORE ENVIRONMENTAL CONSULTANTS

TABLE 1
SUMMARY OF QUALITY CONTROL CHECKS

Sample Type	Frequency	Justification
Field Duplicate	1 per 20 samples collected	Data shows precision of analytical scheme from sampling through analysis when compared with results of sample. This represents a blind QC sample to the laboratory. Collect an additional amount of sample.
Laboratory Duplicate	1 per 20 samples collected	Data shows precision of the analytical scheme within the laboratory. The difference between this precision and that of the field duplicate represents the precision of the analytical method.
LS/LSD[(1)]	1 per 20 samples collected	Data shows how well the analysis of interest can be performed, and recovered from the sample matrix. Such information is useful when reported value is near an action level, but the sample exhibits poor recovery.
MS/MSD[(2)]	1 per 20 samples collected	Data shows precision of analysis when compared with matrix spike duplicate and matrix effects from recovery of spiked analysis. Collect an additional amount for each analysis. Analyzed as a spike.
MS/MSD (inorganic)	1 per 20 samples collected	Data shows precision of laboratory analysis when compared with results of sample. Collect an additional amount of sample for each analysis. Analyzed as unspiked sample.
Field Blank/ Equipment Blank	As required by DQOs[(3)]	Data demonstrates that sampling equipment was clean prior to use. Pass a sample of reagent water through collection device. Submit for analysis of analytes of concern.
Trip Blank	One per cooler containing samples for VOC[(4)] analysis	Data demonstrates that sample was not contaminated with volatile organics by other samples in shipping container, laboratory or outside influences.
Background or Reference Sample	As required by DQOs	Data provides baseline information to evaluate environmental impact.
Split Samples	When required to meet DQOs	Compare the quality of laboratory procedures of the permittee with State contracted laboratory procedures. Collect an additional amount of sample for each analysis.

Notes:

(1) Laboratory Spike/Laboratory Spike Duplicate
(2) Matrix Spike/Matrix Spike Duplicate
(3) Data Quality Objectives
(4) Volatile Organic Compounds

CORE ENVIRONMENTAL CONSULTANTS

FORMS

Daily Observation Log

CORE ENVIRONMENTAL

Project Name:	**Date:**
Project Address:	**Weather:**
Field Activity:	

PERSONNEL: Name	COMPANY	TIME IN	TIME OUT

TIME	DESCRIPTION OF WORK PERFORMED

Daily Observation Log (continuted)

CORE ENVIRONMENTAL

Project Name:	Date:

TIME	DESCRIPTION OF WORK PERFORMED

CORE ENVIRONMENTAL CONSULTANTS

2312 Wehrle Drive
Williamsville, NY
14221
(716) 204-8054

TEST BORING LOG

BORING NO.

Project:
Client:
Contractor:

Project No.
GS Elev
WS Ref Elev
N-S Coord
E-W Coord
Start Date
Finish Date
Driller
Geologist

Groundwater Data (feet)				Equipment Data			
Date	Time	Depth	Elev		Casing	Sampler	Core
				Type	HSA	SS	HQ
				Diameter	4.25"	2.0"	3.5"
				Weight		140 #	
				Fall		30"	

Well Construction	Depth (feet)	Sample No.	Blows per 6"	N' Value	Recovery (%)	Graphic Log	Field Description	Remarks PID Reading (ppm) Direct Screen	Remarks PID Reading (ppm) Head Space
	5								
	10								
	15								
	20								
	25								
	30								

CORE ENVIRONMENTAL

WELL SAMPLING/DEVELOPMENT RECORD

Well ID: _____ **Initial Depth to Water:** _____

Sample ID: _____ **Duplicate ID:** _____ **Depth to Water After Sampling:** _____

Sample Depth: _____ **Total Depth to Well:** _____

Project Name: _____ **Well Diameter (in.)** _____

Project Address: _____ **1 Casing Volume (Gallons)** _____

Date: _____

Sampled By: _____ **Sample Time:** _____ **4 Casing Volumes (Gallons)** _____

Purge Method: _____

Sample Method: _____ **Total Casing Volumes Removed:** _____

Time	Rate (gal/min)	Cum. Vol. (gal)	Temp (°C)	pH (units)	Specific Electrical Conductivity (mS/cm)	Redox Potential mV	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Depth to Water (ft btoc)	Remarks (color and sediment)

pH CALIBRATION (choose two)			
Buffer Solution	pH 4.0	oH 7.0	pH 10.0
Field Temperature (°C)			
Instrument Reading			

SPECIFIC ELECTRICAL CONDUCTANCE - CALIBRATION			
KCL Solution (mS/cm)	4.49 at 25°C		
Field Temperature (°C)			
Instrument Reading			

REDOX CALIBRATION	DISSOLVED OXYGEN CALIBRATION
Standard Solution	Salinity %
Field Temperature (°C)	Altitude
Instrument Reading	Instrument Readin
Model or Unit No.	Model or Unit No.

Model or Unit No:

Model or Unit No:

Well Diameter	Volume (gal/ft)
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

Notes:

CORE ENVIRONMENTAL

WELL SAMPLING/DEVELOPMENT RECORD
(continued)

Well ID: ______________________ **Date:** ____________ **Project Name:** ________________________________ Page _____ of _____

Time	Rate (gal/min)	Cum. Vol. (gal)	Temp (°C)	pH (units)	Specific Electrical Conductivity (mS/cm)	Redox Potential mV	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Depth to Water (ft btoc)	Remarks (color and sediment)

SAMPLE CONTROL LOG

Project Name: _____ **Laboratory:** _____

Project Address: _____ **Page _____ of _____**

Sampling Date	Sampling Time	Sample ID	C.O.C. Number	Analyses Requested	Remarks (Duplicate, Blank info, etc.)	Date Sent to Lab
				See C.O.C.		

ATTACHMENT

ATTACHMENT A

Resumes

Alyssa Cruikshank
Environmental Scientist/ Geologist

Summary of Experience

Remedial Investigation/Feasibility Study Work Plan for the Former National Rubber Adhesives Site, Long Island City, NY – Hamil Stratten Properties, LLC:

Prepared a Remedial Investigation/ Feasibility Study (RIFS) Work Plan for the former National Rubber Adhesives Site in Long Island City, New York. Remedial Investigation activities are being performed to delineate the nature and extent of subsurface impacts potentially associated with historic site activities. In addition to determining the proper field and office activities necessary for the successful completion of the investigation, the Work Plan also included the preparation of Site-specific Quality Assurance Project Plan (QAPP), Health and Safety Plan (HASP), and Community Air Monitoring Plan (CAMP). Prepare Monthly Progress Reports for the Site to document progress of Remedial Investigation activities.

Brownfield Remedial Investigation and Remediation, Wills Building, Long Island City, NY – Wills Family Group Limited Partnership:

Environmental Scientist responsible for preparation of Scope of Work for Phase I Remedial Investigation, including the installation of soil boring and groundwater monitoring wells to delineate the nature and extent of known subsurface impacts. Prepared a Phase I Remedial Investigation Report (RIR) summarizing Site investigation activities, investigation results, and an analysis and interpretation of results. In addition, developed and prepared a Remedial Investigation Work Plan (RIWP) for additional Site investigation activities and an Interim Remedial Measure (IRM) Work Plan to address sub-slab vapor and indoor air quality issues in the on-Site building. Prepared a Citizen Participation Plan (CPP) in accordance with NYSDEC requirements. Assisted the client in completing application paperwork for admission to the New York State Brownfield Cleanup Program. Project involved consistent and continual contact with NYSDEC to achieve project goals.

Remedial Action Report and Quarterly Groundwater Monitoring Reports for Everest Scaffolding, Bronx, NY – Mendon Truck Leasing and Rental Corporation:

Prepared a Remedial Action Report (RAR) detailing field activities relating to the installation of injection wells and the injection of an oxidizing agent into the subsurface to address known petroleum-related impacts at the Site. Report detailed methods and results of the injection event. Prepare quarterly groundwater monitoring reports summarizing analytical data results and conclusions and recommendations for Site closure. The Site was granted spill closure by NYSDEC in July 2014.

Remedial Action Work Plan and Remedial Action Report for 26th Ward Water Pollution Control Plant, Brooklyn, NY – Franklin Company Contractors, New York City Department of Environmental Protection:

Environmental Scientist responsible for preparation of Remedial Action Work Plan (RAWP) for enhanced in situ aerobic bioremediation via injection of Oxygen Release Compound (ORC) to address petroleum impacts to soil and groundwater stemming from a No. 2 fuel oil tank overfill. Following completion of remedial actions, prepared a RAR for the Site which included

Experience

CORE: 1 Other: 9

Education

B.S., Environmental Science, Rensselaer Polytechnic Institute, 2004
M.S., Geology, Rensselaer Polytechnic Institute, 2005
M.A., Biological Sciences, State University of New York at Buffalo, 2012

Current Responsibilities

Ms. Cruikshank has over nine (9) years of experience in environmental consulting, including technical reporting, analytical data QA/QC and validation procedures, and extensive field experience in both soil and groundwater characterization. She is currently managing CORE's environmental fieldwork division that involves Phase I ESAs, Phase II ESIs, and Remedial Investigations.

detailed injection methods utilized during the injection event, a summary of analytical data obtained prior to and following the injection event, and conclusions and recommendations.

Phase II Limited Subsurface Investigation Work Plan for Gulf Service Station, Astoria, NY – Franklin Company Contractors:

At the request of NYSDEC, prepared a Phase II Limited Subsurface Investigation (LSI) Work Plan including soil boring installation and groundwater sample collection to delineate impacts related to a waste oil tank formerly located at the Site.

Phase II Limited Subsurface Investigation Report, for Professional Service Centers for the Handicapped – College Point, NY – Franklin Company Contractors:

Environmental Scientist responsible for preparation of Phase II Limited Subsurface Investigation (LSI) Report detailing field activities that included soil borings and groundwater sample collection. The report included a discussion of finding, analytical data summary tables, and conclusions. The Phase II was performed following a Phase I Environmental Site Assessment (ESA) for the property that indicated Recognized Environmental Conditions (RECs) related to the former uses of the Site and nearby properties.

Facility Reports and Plans, New York City, NY – Franklin Company Contractors, New York City Fire Department:

Environmental Scientist responsible for updating and finalizing Facility Spill Prevention, Control, and Countermeasures Plan (SPCC) for Petroleum Bulk Storage (PBS) and Spill Prevention Report (SPR) for Chemical Bulk Storage (CBS). The purpose of the SPR is to identify CBS deficiencies at the Site, if any, and to provide recommendations for corrective actions. The SPR and SPCC for this Facility were being issued as new documents for use by the New York City Fire Department (FDNY), the current Site owner/operator.

Facility Reports and Plans, New York City, NY - Franklin Company Contractors, New York City Department of Environmental Protection:

Responsible for updating Petroleum Bulk Storage Facility Reports and Spill Prevention, Control, and Countermeasures Plans at six New York City Department of Environmental Protection (NYCDEP) Water Pollution Control Plants under Contract 1198-PBS. The purpose of the PBS Facility Report is to identify PBS deficiencies at the Site, if any, and to provide recommendations for corrective actions. The program is part of DEP's on-going effort to inspect, test, maintain and determine the regulatory health of their PBS tanks, and ancillary equipment through testing, inspection, review, and modifications.

Lead Based Paint Inspection Services Contract, New York City, NY - NYC Housing Authority:

Report Manager responsible for the deliverables of the lead based paint inspections. Inspections are completed on housing units, common areas, and storage units in accordance with U.S. Housing and Urban Development protocols. Inspections included the use of X-Ray Fluorescence (XRF) analysis in each unit and often paint chip samples were collected and laboratory analyzed. The XRF analysis is conducted on site, using a portable LPA-1 Lead Paint Inspection System manufactured by Radiation Monitoring Devices, Inc. (RMD).

SENY Reporting for Poletti, 500MW, and Flynn Plants, Astoria, NY– New York Power Authority (NYPA):

CORE is providing State Pollution Discharge Elimination System (SPDES), Major Oil Storage Facility (MOSF), and Resource Conservation and Recovery Act (RCRA) Metals sampling services at the facilities as part of on-going environmental compliance programs. Technicians are completing sampling and laboratory analysis of groundwater, surface water and waste sampling services on a scheduled basis. Environmental Scientist responsible for preparing weekly reports of the NYPA Plant water inlet and outlet sample results.

Stormwater Pollution Prevention Plan (SWPPP) and Discharge Monitoring Reporting (DMR), Brooklyn, NY – Mendon Truck Leasing and Rental Corporation:

Environmental Scientist responsible for updating Site-specific SWPPP following a change to the State-dictated sampling frequency and schedule. Track and submit DMRs to the New York State Department of Environmental

Conservation's (NYSDEC) Bureau of Water Compliance to maintain compliance with Client's discharge permit.

Phase I Environmental Site Assessment, Williamsville, New York - SYMS Corporation:

Provided investigations and reporting for McKinley, Inc. for the SYMS building located in Williamsville, New York in Erie County. Executed historical records reviews including but not limited to environmental records, proprietary records, topographical maps, Sanborn maps, aerial photography, and City Directories to assess the current and past environmental conditions at the site. Completed FOIL/FOIA requests to all applicable government agencies.

Phase I Environmental Site Assessment, Buffalo, New York - Buffalo Metal Forming:

Provided investigations and reporting for Eberl Iron Works, Inc. for two properties owned by Buffalo Metal Forming located in Buffalo, New York in Erie County. Executed historical records reviews including but not limited to environmental records, proprietary records, topographical maps, Sanborn maps, aerial photography, and City Directories to assess the current and past environmental conditions at the site. Completed FOIL/FOIA requests to all applicable government agencies.

Phase I Environmental Site Assessment, Ellicottville, New York - Edelweiss Ski Lodge:

Provided investigations and reporting for the Edelweiss Ski Lodge properties located in Ellicottville, New York in Cattaraugus County. Executed historical records reviews including but not limited to environmental records, proprietary records, topographical maps, Sanborn maps, aerial photography, and City Directories to assess the current and past environmental conditions at the site. Completed FOIL/FOIA requests to all applicable government agencies.

Phase I Environmental Site Assessment, Queens, New York - Trattoria Neo:

Provided investigations and reporting for the Trattoria Neo restaurant located in Queens, New York in Queens County. Executed historical records reviews including but not limited to environmental records, proprietary records, topographical maps, Sanborn maps, aerial photography, and City Directories to assess the current and past environmental conditions at the site. Completed FOIL/FOIA requests to all applicable government agencies.

Phase I Environmental Site Assessment, Bronx, New York – Group Corporation:

Provided investigations and reporting for two adjacent properties on 179th Street and Bronx Park Avenue in Bronx, New York in Bronx County. Executed historical records reviews including but not limited to environmental records, proprietary records, topographical maps, Sanborn maps, aerial photography, and City Directories to assess the current and past environmental conditions at the site. Completed FOIL/FOIA requests to all applicable government agencies.

Phase I Environmental Site Assessments, 21 S. Ryan Street and 245 Dearborn Street, Buffalo, New York – Buffalo Urban Renewal Agency:

Provided ASTM and United States Environmental Protection Agency (USEPA) compliant Phase I Environmental Site Assessments (ESAs) for two properties in Buffalo, New York. Executed historical records reviews including but not limited to environmental records, proprietary records, topographical maps, Sanborn maps, aerial photography, and City Directories to assess the current and past environmental conditions at the site. Completed FOIL/FOIA requests to all applicable government agencies. The Phase I ESA for the property at 21 S. Ryan Street identified possible groundwater impacts and soil vapor intrusion issues from an upgradient dry cleaning facility that was a known point source of impacts to the subsurface. The Phase I ESA resulted in a Phase II Environmental Site Investigation (ESI) to evaluate the possibility that these impacts had migrated to the target property.

AMEC E&I – Amherst, NY and Newport Beach, CA:

Project Manager responsible for scheduling, budgeting, invoicing, and direct client interaction. Involved in technical report writing for Feasibility Studies, Quarterly Groundwater Monitoring Reports, Remedial Investigation Reports, and Work Plans.

Site Characterization at the Former Papermate Facility, Santa Monica, CA – The Gillette Company:
On-Site geologist responsible for oversight of drilling activities to determine vertical and horizontal extent of VOC and other impacts to the subsurface. Responsible for soil and groundwater sample collection. Performed construction oversight of installation and sampling of continuous multichannel tubing (CMT) and traditional groundwater wells. Interpreted and reported lithologic and hydrogeologic data collected during Site assessments, developed cross-sections, and compiled and performed QA/QC and data validation of laboratory analytical data.

MGP Remedial Investigation for the West Station Plant, Rochester, NY – Rochester Gas and Electric Corporation:
Field Investigator for the Manufactured Gas Plant Site, including soil and rock core collection and monitoring well installation. Assisted with preparation of associated Work Plans, Remedial Investigation Report, Supplemental Remedial Investigation Reports, and Feasibility Study.

Site Investigation for Property Redevelopment, New Philadelphia, OH – GE Water & Process Technology:
On-Site geologist responsible for overseeing and monitoring drilling activities to determine potential vertical and horizontal extent of impacts to the subsurface prior to property redevelopment. Responsible for lithologic logging of all soils and soil sample collection. Performed oversight of construction, installation, and sampling groundwater wells.

RCRA Corrective Action Activities for the FMC Middleport Facility, Middleport, NY – FMC Corporation:
Community Relations Liaison for an industrial client and associated environmental project, handling community complaints, preparing newsletters, updating various client-sponsored websites, coordinating stakeholder meetings, and relaying information between the client and the community.

Environmental Restoration Specialist – Edwards Air Force Base, CA – CH2MHill:
Performed quarterly groundwater sampling and prepared quarterly and annual groundwater monitoring reports for various long-term-monitoring Sites, including a CERCLA listed Site. Prepared reports in accordance with regulatory guidelines, including CERCLA, California EPA and applicable Regional Water Quality Control Boards.

Groundwater & Environmental Services, Inc. – Westford, MA:
Project Manager and field team leader responsible for field investigations, basic management of Site-related activities including arranging field schedules, preparing characterization reports, closure reports, and remedial action plans, as well as interfacing with clients and regulatory agencies. Performed additional project management duties such as technical report writing and budget/project management.

Site Investigations and Management at Multiple Locations, Massachusetts - ExxonMobil Corporation:
Field duties included Site characterization for petroleum impacts to soil, groundwater, and surface water by performing investigative drilling using hollow stem auger, direct push, cone penetrometer (CPT), and air-rotary hammer methods, lithologic logging of borings, soil and groundwater sample collection, and monitoring well installation.

Construction Oversight and Tank-Top Upgrade, Concord, MA - ExxonMobil Corporation:
Field Investigator responsible for construction oversight of contractors during operations to perform gasoline service station tank-top upgrades and underground storage tank (UST) removals.

ASTM Phase I Reporting at Multiple Locations, Rhode Island – Shell Oil Company:
Case manager responsible for performing several ASTM Phase I Site investigations for property divestment purposes, including historical records review.

Ronald Tramposch
Senior Project Manager

Summary of Experience

Fuel System Installation, Port Authority of NY-NJ:

Senior Project Manager responsible for oversight for the development of site plans and details for the installation of two (2) Petroleum Bulk Storage dispensing systems for Franklin Company Contractors at the Red Hook Container Terminal in the Bronx, NY in Nassau County. Designs included the placement of tanks, fuel dispensers, and related monitoring equipment as per the relevant New York City Codes & regulations (NEPA 30). Development of a Fire Suppression system was also included in the design.

Fuel System Upgrades, FDNY Engine Company 63, Brooklyn, NY – Galante Architecture:

Project Manager responsible for oversight during the development site plans and details for the relocation of Petroleum Bulk Storage service lines for Galante Architecture at the Engine Company 63 in Brooklyn, NY. Designs include the relocation of fill and suction lines, fuel dispenser, and utilities as per relevant New York City Codes & regulations (NEPA 30).

Health & Safety Plan, Syosset, NY – The LIRO Group:

Project Manager responsible for oversight during the development of a General Health & Safety Plan for The LIRO Group located in Syosset, NY. The plan provided guidelines for safety of LIRO employees and contractors and covered topics such as safety training, emergency action plans, job hazard analysis, means of egress, hazard communication, materials handling, and protective equipment. Also developed in the plan were examples of safety inspection checklists, noise & dust mitigation plans, a protection of traffic plan, a lockout/tagout program, and a confined space program.

Excavated Materials Disposal Plan Review, New York City – NYC School Construction Authority:

Project Manager responsible for oversight during the review of excavated materials disposal plans for accuracy to the design specifications for numerous NYC public schools. The project includes confirming analytical results, waste transporter permits, disposal facility permits, and contractor sampling plans for conformance to local NYC codes and regulations.

Asbestos, Lead and PCB Survey and Report, Buffalo Public Schools, PS 95, Buffalo, NY:

Project Manager in charge of planning, coordinating and managing the resources necessary to perform an asbestos and lead inspection of several areas within Buffalo Public School 95 for renovation work to replace several air handling units. The work included the collection and analysis of numerous bulk samples of suspected asbestos containing materials as well as the investigation of potential lead based paint surfaces. The asbestos and lead survey report prepared for this work included a summary of the materials sampled and analyzed as well as estimates of construction cost for the abatement of suspect materials.

Asbestos, Lead, and Comprehensive Environmental Consultant Services Contract, NY – NYCT MTA:

Program Manager responsible for two consecutive indefinite quantity contracts.

Experience

CORE: 10 Other: 20

Education

M.S., Environmental Science, University of New Haven, 1988
B.S., Geology, State University of New York at Buffalo, 1982

Certifications

USEPA Environmental Impact Assessment Training
OSHA Confined Space Safety Training
40 Hour OSHA Waste Site Worker Protection Training
8 Hour OSHA Supervisory Training
NYS DOL Asbestos Supervisor
NYS DOL Asbestos Inspector
NYCDEP Asbestos Investigator
NYCT Track Safety Certification

Current Responsibilities

Mr. Tramposch is a Senior Project Manager with 30 years of experience in remedial investigations, feasibility studies, underground storage tank management programs, and remedial system design. He specializes in management of large work-order based environmental investigation and remediation projects. He has managed hazardous materials projects involving lead, metals, PCBs, hazardous waste, and asbestos, with many of these assignments occurring simultaneously. He also has experience in environmental assessment, planning, supervision, and interpretation of hydrogeologic and geotechnical investigations, and report preparation for various sites including active and inactive hazardous waste sites. Mr. Tramposch is currently directing an indefinite delivery order contract for asbestos, lead, and comprehensive environmental services for New York City Transit.

Responsible for the overall management of the project ensuring all required resources were provided to meet project schedules and budgets. Additional responsibilities include the development and implementation of project quality control and assurance measures. Services included asbestos investigations and reports, development of abatement work plans, cost estimating, project coordination, and interfacing with site representatives, and project management with oversight of the abatement contractors. Project sites included operating substations, subway stations, office buildings, mechanical rooms, rail yards, bus depots, tunnels, bridges, and various other structures throughout many of NYCT's over 300 facilities throughout New York City.

Asbestos Services, Five Boroughs, NY - NYC School Construction Authority:

Project Manager responsible for oversight of the air sampling and project monitoring. He managed the surveys that included collection of bulk samples throughout the campus that included operating office buildings, mechanical rooms, and various other structures.

Asbestos Abatement Project Monitoring, Beebe Road Waterline, Wilson, NY:

Project Manager responsible for the removal and disposal of ACM waterline pipe in association with the reconstruction of Beebe Road in Wilson, NY. Mr. Tramposch was responsible for overseeing project monitors during project monitoring and air sampling in accordance with New York State Department of Transportation Standard Specification Section 210 – Removal and Disposal of Asbestos Containing Material. Mr. Tramposch oversaw the completion of a Closure Report, which included copies of daily project records, sample analytical results and waste manifests.

Asbestos Abatement Monitoring and Testing, Emery Park, Erie County Department of Public Works:

As Program Manager for our Hazardous Materials Term Agreement with Erie County for Asbestos Abatement Monitoring and Testing, Mr. Tramposch directed the collection of samples of suspect materials at Emery Park in the Richardson Lodge and Shelter, and the Stohres Lodge. Suspect materials were analyzed for asbestos using a New York State Department of Health ELAP certified laboratory and a report of Asbestos Abatement monitoring and testing was prepared.

Remedial Investigation/Feasibility Study Work Plan for the Former National Rubber Adhesives Site, Long Island City, NY – Hamil Stratten Properties, LLC:

Project Manager responsible for oversight of a Remedial Investigation/ Feasibility Study (RIFS) Work Plan for the former National Rubber Adhesives Site in Long Island City, New York. Remedial Investigation activities are being performed to delineate the nature and extent of subsurface impacts potentially associated with historic site activities. In addition to determining the proper field and office activities necessary for the successful completion of the investigation, the Work Plan also included the preparation of Site-specific Quality Assurance Project Plan (QAPP), Health and Safety Plan (HASP), and Community Air Monitoring Plan (CAMP).

Phase I Remedial Investigation Report, Remedial Investigation Work Plan, and Interim Remedial Measure Work Plan for the Wills Building, Long Island City, NY – Wills Family Group Limited Partnership:

Project Manager responsible for oversight of a Scope of Work for Phase I Remedial Investigation including the installation of soil boring and groundwater monitoring wells to delineate the nature and extent of known subsurface impacts. Oversaw the preparation of a Remedial Investigation Report (RIR) that detailed a description of Site investigation activities, investigation results, and an analysis and interpretation of results. In addition, oversaw the development of a Remedial Investigation Work Plan for additional Site investigation activities and an Interim Remedial Measure Work Plan to address sub-slab vapor and indoor air quality issues in the on-Site building.

Phase I Environmental Site Assessment, Eberl Iron Works, Buffalo, NY:

Oversaw the completion of a Phase I ESA for Eberl Iron Works for a building located on Sycamore Street in Buffalo, NY. The Phase I ESA included historical records reviews including but not limited to environmental records, proprietary records, topographical maps, Sanborn maps, aerial photography, and City Directories to assess the current and past environmental conditions at the site.

SEQR Determination and Documentation Services, NOCO Energy Corp, Tonawanda, NY:
Senior Project Manager responsible for the completion of the State Environmental Quality Review (SEQR) component for NOCO for a proposed Emergency Power System at their Terminal located in Tonawanda, New York. The property was classified as a major oil storage facility (MOSF) with a capacity of over 400,000 gallons. Mr. Tramposch was responsible for preparing the SEQR evaluation, determination, documentation and municipal permitting, as well as the materials included as part of grant evaluations for NY State Dormitory Authority and Federal Emergency Management Agency (FEMA) funds.

SUNY Buffalo, Asbestos Survey & Design Services, O'Brian Hall:
Senior Project Manager responsible for the completion of an inspection for suspect asbestos-containing materials at O'Brian Hall, located on SUNY Buffalo's North Campus. The inspection included all accessible interior spaces, building envelopes, and roof areas. Collected bulk samples for laboratory analysis at suspect locations. Completed an asbestos survey report along with asbestos abatement design specifications for the removal.

SUNY Buffalo, Asbestos Project & Air Monitoring Services, Cary Hall:
Project Manager responsible for oversight during the project monitoring services at Cary Hall, located on SUNY Buffalo's North Campus. Supervised CORE's project monitors completing oversight during asbestos abatement that included floor tile and mastic, cove base, sinks, and a fume hood containing transite panels. Oversaw the completion of an Asbestos Final Project report that detailed the asbestos abatement.

Phase II Environmental Site Investigation (ESI) for 91 Sawyer Avenue, Niagara Blower Company, Tonawanda, NY:
Project Manager responsible for completion of Phase II Environmental Site Investigation (ESI) to investigate Recognized Environmental Conditions (REC's) identified in Draft Phase I Environmental Assessment (ESA). A Phase II Environmental Site Investigation was conducted and consisted of the advancement of fourteen soil borings, collection of soil samples from each boring for laboratory analysis, and the sampling and laboratory analysis of groundwater samples collected from monitoring wells at four locations (both permanent and temporary wells).

Lead Based Paint Inspection Services Contract, New York City, NY - NYC Housing Authority:
Project Manager responsible for project oversight of all lead based paint inspections. Inspections were completed on housing units, common areas, and storage units in accordance with U.S. Housing and Urban Development protocols. Inspections included the use of X-Ray Fluorescence (XRF) analysis in each unit and often paint chip samples were collected and laboratory analyzed. The XRF analysis is conducted on site, using a portable LPA-1 Lead Paint Inspection System manufactured by Radiation Monitoring Devices, Inc. (RMD).

Mother Clara Hale Bus Depot Replacement, New York City, NY Franklin Company Contractors / NYCT MTA:
Project Manager responsible for overseeing an experienced scientist to initially direct the contractor in segregating excavated soils according to total organic vapor (TOV) content with a photo-ionization detector. The work was completed in 20' x 20' cells. The soil was stabilized by open pit mixing with a fly ash and grout mix that was previously pilot tested. The stabilization was verified by wet sampling from specific intervals. Responsible for the review of all project deliverables.

Petroleum Monitoring Reporting Services Contract, New York City, NY NYC Housing Authority:
Project Manager responsible for project oversight of the Quarterly Petroleum Remediation Monitoring Reports at 27 Housing Development Sites that have groundwater contamination resulting from petroleum releases from fuel oil tanks. The purpose of the report is to summarize petroleum remediation activities performed on site, describe the current status, and provide an analysis of current remediation system effectiveness with further recommendation.

Site Investigation and Remediation, Lewiston, NY - NYPA:

Completed the project management for a site remediation and investigation project at a vacant site impacted with No. 2 fuel oil. The site had formerly contained a building and operated as a construction staging area for the Niagara Power Project. Included In house completion of manual product recovery from monitoring wells, a geophysical survey with anomalies located utilizing a Global Positioning System (GPS), a drilling investigation that included rock coring and monitoring well installation and soil and groundwater screening and sampling. All waste streams were characterized for treatment and/or disposal and a comprehensive report was completed.

UST Management Program, NY – NY City Transit (NYCT) Metropolitan Transportation Agency:

Project Manager responsible for this program involving site assessments, remedial investigation, feasibility studies, remedial design, and remedial action oversight services for the New York City Transit Underground Storage Tank (UST) Management Program. Activities include tank tightness testing, remedial investigations and remediation recommendations, design overview and technical inspection for tank replacement and installation. The USTs were located in all five boroughs of New York City, encompassing 350 tanks at 27 facilities. They ranged in size from 200 gallons to 35,000 gallons, were generally single walled, and were up to 52 years in age. The tanks contained petroleum products such as gasoline, diesel fuel, lube oil, fuel oil, and waste oil. A comprehensive database and GIS system was developed for UST management.

Remediation System Services, New York City, NY - Franklin Co.:

Project Manager for providing remediation system operation and maintenance, monitoring and reporting services at 14 sites in the five boroughs of New York City. Developed and implemented site specific investigations to evaluate the extent and migration of contamination in soil and groundwater. In-depth evaluations of soil and groundwater contamination along with pilot study data and recommendations for remediation were completed. Core personnel prepared the design drawings and specifications for the selected remedial approach. Manager for providing construction monitoring and inspection services during system installation, startup and initial troubleshooting.

Facility Reports, Plans and Drawings, New York City, NY - Franklin Company Contractors, NYC Department of Environmental Protection:

Project Manager responsible for overseeing the preparation of Petroleum Bulk Storage (PBS) Facility Reports, As-Built Drawings of tanks and Spill Prevention, Control, and Countermeasures Plans (SPCC) at 24 New York City Department of Environmental Protection (DEP) Water Pollution Control Plants and Pumping Stations under Contract 1198-PBS. The purpose of the PBS Facility Report is to identify PBS deficiencies at the site, if any, and provide recommendations for corrective actions. The program is part of DEP's on-going effort to inspect, test, maintain and determine the regulatory health of their PBS tanks, and ancillary equipment through testing, inspection, review, and modifications. As-built drawings were produced from record drawings and field inspections in order to satisfy the requirements of New York State PBS regulations. The drawings and plans were reviewed and approved by the Project Manager prior to submission to the client the NYC DEP.

Waste Auditor:

Performed the compliance auditing of eight (8) hazardous waste management facilities and Waste Accumulation Areas (WAAs) for compliance with EPA and NYSDEC policies. Waste included: hazardous, radioactive (high and low level), and mixed.

JFK IA Terminal 5 Redevelopment, Queens, NY - Turner Construction Corp.:

Project Manager for completing the field monitoring and oversight of the JFK International Airport Terminal 5 Redevelopment Project. The project area, approximately 67 acres, required work area air monitoring throughout the excavation program. As the project air monitoring consultant, Core was responsible for conducting NYSDOL and OSHA compliance monitoring. Core performed continuous air monitoring during excavation of the hydrant fueling lines. A photo-ionization detector (PID) and an explosimeter were used to document site conditions for worker Health and Safety monitoring. Air monitoring equipment was calibrated daily and all data including meteorological data (e.g., temperature range, wind speed, wind direction, etc.) was recorded. He supervised the

Asbestos Project Air monitoring consultant during abatement and completed the QA/QC of daily reports.

Warehouse Demolition/ Remediation, JFK IA, Queens, NY - JetBlue Airways:

Principal in Charge for the site investigation and design for the demolition of four large warehouse and maintenance facilities at JFK International Airport. He provided field support and prepared site investigation reports for the remediation of hazardous materials and asbestos. He supervised the preparation of drawings and specifications for the removal of asbestos, USTs, drummed wastes (PCBs and CFCs).

JetBlue Airways, JFK IA, Queens, NY:

Project Manager for completing a Spill Prevention Controls and Countermeasures Plan at John J. Kennedy International Airport Building 74 Ground Service Equipment (GSE) Maintenance Building. For JetBlue, he managed the preparation of a SPCC Plan, in writing, and in accordance with 40 CFR Part 112.7, and any other applicable section of Part 112 – Oil Pollution Prevention (40 CFR Part 112.8). Petroleum Bulk Storage at Building 74 GSE the facility is in one (1) aboveground storage tank (AST) and numerous 55-gallon capacity drums.

Logan International Airport, Boston, MA - JetBlue Airways:

Project Manager for completing the SWPPP at the Logan Station after Massachusetts switched to a multi sector general permit. Completed the project Quality Assurance and Quality Control (QA/QC) review for site specific SWPPPs for an expanding airline at international airports. Tasks included confirmation of site drainage, outfalls, permits and airport Best Management Practices (BMPs) as well as the overall review of all report submittals, which included reports, inspection forms, drawings, figures, BMPs, flow charts, and spill report procedures.

Habitat Restoration Project at Calvert Vaux Park (formerly Dreier-Offerman Park), Brooklyn, NY:

This project included the construction of aquatic and coastal upland habitats, wetland restoration, and trail construction. The project also involved the removal of 3.2 acres of contaminated soil. Mr. Tramposch was the Program Manager responsible for air monitoring services in relation to the removal of contaminated soil. Core monitored upwind and downwind areas of excavation work to ensure that dust concentrations did not exceed New York State Department of Environmental Conservation (NYSDEC) regulations [TAGM 4031]. Mr. Tramposch also completed the Site Specific Health and Safety Plan for environmental monitoring and weekly SPDES inspections. All Qualified Inspectors have received four (4) hours of training endorsed by the NYSDEC from a Soil and Water Conservation District and on-the-job training to follow the appropriate New York State standards, specifications, permits and manuals as part of the job.

Phase II ESAs, Queens, NY, Countrywide Commercial Real Estate:

Project Manager responsible for Phase II (ESAs) for the properties to investigate the concerns determined during the Phase I activities. Core completed soil borings and temporary monitoring well installations to evaluate site soils and groundwater samples from the sites. ESA reports were prepared presenting the approach, methods, results, and interpretations of the data as well as recommendations, conclusions and an opinion on further action.

Incinerator/Garage Demolition, NY - NYCDOS:

Project Director which included a detailed site investigation for asbestos / hazardous materials. and a structural evaluation in preparation of demolition design documents and specifications. Responsible for coordinating field work and for preparing drawing and specifications for asbestos, lead paint, mercury containing equipment, PCB-bearing equipment, residual ash, USTs, contaminated soil/groundwater and metals contaminated building components.

Varick Avenue Redevelopment, NY - NYCDOS:

Principal in Charge for the subsurface environmental investigation for large property being redeveloped for use by NYCDOS. Investigation included over 80 soil borings for delineation of contamination. His investigation work saved the owner from extensive costs and his RI/Site Remediation Plan was cited for excellence by the Chief of NYSDEC's Regional Hazardous Waste Program.

UST Program, NY – Dormitory Authority of the State of NY (DASNY):
Project Manager for the Authority's Program to upgrade, replace, add/or close 28 underground storage tanks at various City of New York Campuses in order to comply with Federal, State, and Local regulations regarding storage of petroleum products. The project included heating oil and emergency generator underground storage tanks ranging in size from 280 to 48,000 gallons.

New York Bus Service, NY:
Project Manager responsible for the design of a 1,000 cfm multi phase extraction system for the removal and treatment of free product, soil vapor and groundwater contamination. Negotiated a Stipulation Agreement with NYSDEC to allow discharge of treated groundwater to the Hutchinson River.

UST Program, NJ - NJ Department of Treasury:
Project Manager responsible for the statewide underground storage tank program consisting of 281 facilities with approximately 1,369 tanks. Project included pre-design investigations, site assessments, tank tightness testing, and soil borings. Responsible for preparation of conceptual design documents and construction staging plans for the upgrade, replacement, and closure at each facility. Project included a motor fuel consolidation study consisting of 229 sites and 458 fuel tanks.

UST Program, NY – NYC Department of Design and Construction (DDC):
Project Manager for this program, which included the design, construction inspection, and environmental investigation of 225 facilities for the Department of Design and Construction. He was responsible for preparing construction plans and specifications for the installation of 250 tanks.

Stormwater Pollution Prevention Plans, Multiple Cites, U.S. and U.S. Territories - JetBlue Airways:
Project Manager for completing SWPPPs at 48 Locations in the U.S. and U.S. Territories. Completed the project Quality Assurance and Quality Control (QA/QC) review for site specific SWPPPs for an expanding airline at international airports. Tasks included confirmation of site drainage, outfalls, permits and airport BMPs as well as the overall review of all report submittals, which included reports, inspection forms, drawings, figures, BMPs, flow charts, and spill report procedures.

Asbestos and Lead Paint Consulting Services - PA of NY&NJ:
Principal for asbestos air and project monitoring services at various PA facilities. Project included surveying, bulk sampling, reporting, tracking of materials/ quantities, compliance monitoring, daily record-keeping of all contractor activities, and reporting.

Mendon Truck Leasing, NY:
Project Manager responsible for the investigation of a petroleum spill and the pilot testing of a 600 cfm multi phase extraction system for the removal and treatment of free product, soil vapor and groundwater contamination. The system designed utilizes a medium vacuum liquid ring pump manifolded to 14 recovery wells to recover the free product, groundwater, and soil vapor. Additional duties included system operation, maintenance, and compliance monitoring/reporting.

Stuyvesant Cove Park, NY:
Principal-in-Charge for the investigation, remediation, and redevelopment of a 20-acre brownfields site in Manhattan. This former industrial site was contaminated with petroleum products, PCBs, and metals. He provided an accelerated site investigation and remedial design within six months of the work assignment. His leadership provided design-build services and remedial system construction, operation, and maintenance.

Asbestos and Lead Monitoring and Design Services Contract, New York City, NY – NYCT MTA:
Senior Project Manager responsible for the indefinite quantity contract (CM-1320). Responsible for the general day to day management of the project ensuring resources are available to meet project demands, schedules and budgets. Responsibilities include the implementation of project quality control and assurance measures including

corrective actions. Services provided include lead inspections, lead based paint removal project oversight, waste determination and manifest tracking. Asbestos services include surveys, abatement designs and work plans, cost estimating, project coordination, project and air monitoring, project reporting and oversight of the abatement contractors.

U.S. Air Force - Loring Air Force Base, ME:

Design Task Manager for $1.4 million study for free product recovery at the base fire training area. Design elements include 300 gal/min groundwater treatment facility, blast fractured trench for product recovery, PLC remote monitoring and groundwater and plume modeling.

Asbestos Consulting Services, Bronx, Brooklyn, Queens and Staten Island, NY - Restored Homes HDFC:

Project Manager responsible for assigning personnel, quality assurance and project deliverables. Core reviewed third-party lead-based paint (LBP) inspection reports, dust wipe analysis and determined the existence and presence of ACMs through surveys specific to areas scheduled for renovation. Also identified ACM, LBP and lead dust to determine what actions are necessary to treat, remediate, abate, enclose, encapsulate, remove or otherwise control such contaminants. Core also provided all design services necessary for the treatment, removal or abatement of ACMs and LBP.

Lead and Asbestos Services, Five Boroughs, NY - Mendon Truck Leasing:

Project Manager responsible for the completion of the project to ensure scope of work is executed and the contract documents are adhered to and all appropriate standards are followed. Project included inspection services for lead and asbestos at buildings throughout New York City in support of facility design and future abatement, encapsulation and construction activities. Complete lead and asbestos investigative surveys, inspections, sampling and abatement design. Project reporting with chain of custodies, laboratory analysis and photographs was completed. Core also completed data management with a project information database. Project involves inspection services for lead and asbestos at buildings throughout New York City in support of facility design and future abatement, encapsulation and construction activities of 26 buildings and properties.

Kirkman Boulevard Site, NJ:

Task Manager for the investigation of the ACIA hazardous waste site in Atlantic City, New Jersey. The property had a long history of manufactured gas plant (MGP) use and the investigations were conducted in support of redevelopment of the property into a rail terminal and convention center. Responsible for monitoring well construction, soil drilling, data interpretation, and report preparation. The report included plans for managing contaminated soil and groundwater as well plans for long-term monitoring at the site.

Karlsberger Architecture, P.C. - Various Sites:

Principal-in-Charge for site investigations and property evaluations for building design and construction specifications at various development sites in New York City. The investigations included reviews of site historical information from Sanborn maps and state/federal database searches as well as subsurface investigations to characterize soil and groundwater quality. Mr. Tramposch identified one of the properties as the former Brooklyn Union Gas Flatbush Works manufactured gas plant (MGP) and MGP contaminants were identified.

GM Plant Decommissioning, Clark, NJ:

Task Manager for a site previously used as an automobile assembly plant in Clark, New Jersey. Responsible for delineation of contamination and interpretation of hydrogeologic, geologic, and geotechnical data; and supervision of shallow and deep monitoring well construction. Evaluated 25 underground storage tanks for compliance with NJDEP/USEPA requirements. The project also included determination of soil remediation or reuse options and the development of remedial plans in accordance with NJDEP requirements.

GM Plant Decommissioning Study, Trenton, NJ:

Project Manager for a NJDEP ISRA plant closure investigation which included a complete facility assessment with environmental sampling to identify potential environmental concerns. Project scope involved the

investigation of PCB transformers, wastewater treatment equipment, RCRA storage areas, waste treatment tanks, USTs, ASTs, process equipment and potential asbestos-containing materials throughout the plant. Soil and groundwater contaminant levels were compared to NJDEP standards to determine cleanup requirements for site soil and groundwater.

Federal Deposit Insurance Corporation (FDIC), MA:

Project Engineer responsible for performing environmental assessments of several properties to identify environmental concerns relating to property transfer. Assessments involved site walkover inspections and file reviews for the identification of asbestos containing materials as well as lead based paint.

USAF Plattsburgh AFB, NY:

Task Leader responsible for oversight of field work including groundwater, soil, and sediments sampling; developing geologic interpretations; and assisting in report preparation for several assignments of this Indefinite Delivery Type Contract for the U.S. Air Force.

Sheila Ransbottom, PE
Vice President of Engineering Services

Summary of Experience

Lead and Asbestos Monitoring and Design Services Contract, NY – NYC Transit Authority MTA (March 2014 to Present):

Professional Engineer responsible for overall management of the survey and design drawings and reports. Services include QA/QC and review of all design documents. Ms. Ransbottom is the engineer on staff responsible for stamping all drawings. Project sites include operating substations, subway stations, office buildings, mechanical rooms, rail yards, bus depots, tunnels, bridges, manholes and other structures.

New York Power Authority, City of Buffalo Energy Master Plan (Wendel Energy Services), Buffalo, NY (Jan. 2014 – June 2014):

CORE acted as subconsultant to Wendel Energy Services to provide information regarding an Energy Master Plan for the City of Buffalo. The Master Plan will plan and coordinate strategies to improve energy efficiency that will support economic growth, create jobs, and serve the residents of New York State. Ms. Ransbottom was Project Manager responsible for the oversight of data collection, analysis, and development of recommendations for improved coordination and planning efforts between governmental departments, non-governmental agencies, and utility companies. She reviewed energy purchasing processes and strategies, analysis of future energy requirements, and recommendations for energy procurement strategies.

Various Asbestos Design Certifications, Various Firms, Buffalo, NY (Jan. 2014 to Present):

Professional Engineer responsible for oversight and approval of asbestos investigations and reports, and development of abatement work plans for various Dormitory Authority of the State of NY (DASNY), State University Construction Fund (SUCF) and NY State Office of General Services (OGS) building projects. CORE is typically a subconsultant to an architect or engineering firm for this work. Ms. Ransbottom has completed certifications for various local firms including Sienna Environmental Technologies, Trautman Associates, Mach Architecture, and Architectural Resources. Examples of projects include design certifications for various SUNY school buildings (including Albany, Buffalo, Fredonia, Oswego, Plattsburgh, and Purchase) and for various local primary and secondary schools. Ms. Ransbottom has also completed design certification for the NYS Office for People with Developmental Disabilities (OPWDD) Fire Safety Improvements & Associated Asbestos & Hazardous Materials Abatement Program.

Phase I Environmental Site Assessment, Wills Building, Long Island City, NY, Rockrose Development Corp. (October 2014):

Project Manager responsible for completion of Phase I Environmental Site Assessment (ESA) at the Wills Building in New York City. Phase I ESA was performed to identify recognized environmental conditions (RECs), historical recognized environmental conditions (HRECs), controlled recognized environmental conditions (CRECs), and/or potential environmental concerns (PECs). The Phase I ESA identified RECs and a PEC in connection with the target property, and multiple RECs, CRECs, and PECs in connection with adjacent/nearby properties.

Experience

CORE: 1 Other: 19

Education

B.S. Civil Engineering, University of Pittsburgh, 1993

Professional Registration

New York State Licensed Professional Engineer

Certifications

NYSDOL Asbestos Project Designer

Current Responsibilities

Ms. Ransbottom has 20 years professional experience in Civil / Site / Transportation engineering. Ms. Ransbottom has extensive experience working with various state agencies (NYSDOT, NYS Thruway, NYSDEC, NYPA) and several local counties and municipalities. She is experienced in managing and coordinating the planning, design, and construction phases of a variety of project types including transportation and roadway projects, civil/site projects and various studies (corridor, traffic, feasibility, environmental).

Brownfield Remedial Investigation and Remediation, Wills Building, Long Island City, NY, Wills Family Group Limited Partnership (June 2014 to Present):

Professional Engineer responsible for review and approval of Phase I Remedial Investigation (including installation of soil boring and groundwater monitoring wells), Remedial Investigation Work Plan (RIWP) for additional Site investigation activities and an Interim Remedial Measure (IRM) Work Plan to address sub-slab vapor and indoor air quality issues in the on-Site building. Responsible for review of application paperwork for admission to the New York State Brownfield Cleanup Program. Also responsible for review of design plans for installation of a sub-slab depressurization system.

Stormwater Pollution Prevention Programs, Zaepfel Development Corp., Williamsville, NY (Jan. 2014 to April 2014):

Professional Engineer responsible for the oversight and QA/QC for SWPPP inspections of the Remmington Woods Apartments and the PHH Office Building construction projects in Williamsville, NY, Erie County. Monthly inspections, inspection reports, and monthly, quarterly, and yearly summaries of inspections for both properties were required.

Fuel System Installation, Port Authority of NY-NJ, Red Hook Container Terminal, Bronx, NY (Jan. 2014 to Present):

Project Manager responsible for the development of site plans and details for the installation of a Petroleum Bulk Storage dispensing system at the Red Hook Container Terminal in Bronx, NY. Designs include the placement of tanks, fuel dispensers, and related monitoring equipment as per the relevant New York City Codes & regulations (NEPA 30). Development of a Fire Suppression system is also included in the design.

Fuel System Installation, 362 Kingsland Ave, Brooklyn, NY, Mendon Trucking and Leasing (May 2014 to Present):

Professional Engineer responsible for review and approval of site plans and details for the installation of a Petroleum Bulk Storage dispensing system at Mendon Trucking & Leasing in Brooklyn, NY. Designs include the placement of tanks, fuel dispensers, employee kiosk, a light pole, and associated monitoring equipment as per relevant New York City Codes & regulations (NEPA 30).

Oil/Water Separation Engineering Report, 360 Kingsland Ave, Brooklyn, NY, ESF Transport Inc. (April 2014 to May 2014):

Professional Engineer responsible for completion of Engineering report for ESF Transport located in Brooklyn, NY. The report detailed and provided cost estimates for three (3) alternatives to remediate oil/water contamination leaving the facility through the municipal storm water system. Engineering analysis of local hydrology and unique conditions of the site were performed and used to develop alternatives that gave flexibility to the client while conforming to the SPDES permit.

Health & Safety Plan, The LIRO Group, Syosset, NY (Jan. 2014):

Project Manager responsible for the development of a General Health & Safety Plan for The LIRO Group located in Syosset, NY. The plan provides guidelines for safety of LIRO employees and contractors and covers topics such as safety training, emergency action plans, job hazard analysis, means of egress, hazard communication, materials handling, and protective equipment. The plan includes examples of safety inspection checklists, noise & dust mitigation plans, maintenance and protection of traffic plan, lockout/tagout program, and confined space program.

Phase I Environmental Site Assessments, 21 S. Ryan Street and 245 Dearborn Street, Buffalo, NY – Buffalo Urban Renewal Agency (September 2014):

Project Manager responsible for completion of Phase I Environmental Site Assessments (ESAs) for two properties in Buffalo, NY. Phase I ESA for the property at 21 S. Ryan Street identified possible groundwater impacts and soil vapor intrusion issues from an upgradient dry cleaning facility that was a known point source of impacts to the subsurface. The Phase I ESA resulted in a Phase II Environmental Site Investigation (ESI) to

evaluate the possibility that these impacts had migrated to the target property.

NYC School Construction Authority (SCA) Environmental Consulting Survey, Design, Project/Air Monitoring, and Sample Analysis Services to Industrial and Environmental Hygiene Division (Contract No. C000012710) (September 2014 to Present):
Professional Engineer responsible for review and approval of asbestos surveys, design, abatement monitoring, and final reports. Surveys include collection of bulk samples throughout campuses including operating office buildings, mechanical rooms, and various other structures.

NYC School Construction Authority (SCA) Industrial & Environmental Hygiene Consulting Services in Connection with Hazardous Materials (Contract No. C000013006) (March 2014 to Present):
Professional Engineer responsible for oversight and QA/QC regarding reviews of Excavated Material Disposal Plans (EMDP) submitted by contractors for various NYC Schools projects. The EMDP's are reviewed against Earthwork specifications and templates. Reviews include the EMDP, as well as Site plans, Sample Characterization plans, Health and Safety Plans, and sample analytics.

Diesel Exhaust Fluid Dispensing System, Ryder Truck Rental Inc. (Feb. 2014):
Professional Engineer responsible for reviewing and approving site plans & details for the installation of a 1000 gallon enclosed aboveground diesel exhaust fluid (DEF) dispensing system for Ryder Truck Rental Inc. at the Farmingdale, NY facility in Suffolk County. Ms. Ransbottom oversaw engineering and administrative support to Ryder to expedite the tank registration process with the Town of Babylon and Suffolk County.

Asbestos, Lead and PCB Abatement Design, Buffalo Public Schools, PS 95, Buffalo, NY (Jan. 2014 to October 2014):
Professional Engineer responsible for completing Hazardous Materials Abatement design drawings and specifications to document locations and methods of removals for abatement contractor bidding purposes. Design followed inspection and survey of several areas within Buffalo Public School 95 for renovation work to replace several air handling units.

Construction Inspection, Westmont Ridge Development project, Ellicottville, NY (2013):
Ms. Ransbottom performed construction inspection for the $22 million, multi-phase Westmont Ridge Development project at Holimont Ski Resort. The project included construction of several roadways and utilities to ultimately serve a total build out of 94 ski in/ski out residential properties and 72 condominiums. Ms. Ransbottom coordinated directly with the contractors (Northrup Construction and Coldsprings Construction) on a daily basis to ensure the project was built to the design plans and specifications. In addition to new roadway construction, the project included new water and sewer lines, storm drainage and large culverts, and retention ponds.

NYS Department of Transportation (DOT), Reconstruction of Main Street, Village of East Aurora, NY (2004 to 2007):
Project Manager for this project to reconstruct approximately 2 km of US 20A/NY16/NY78, Main Street, between the Traffic circle and the East Village Line. The project included Right of Way mapping, grading and drainage design, utility coordination, traffic signage/markings, street lighting, landscaping, pavement design, and maintenance of traffic. Also included design of a roundabout to replace the existing traffic circle and evaluate design options for additional roundabouts in the project area. A coordinated traffic signal system was designed in order to improve traffic flow through the corridor. Context Sensitive Design principles were used to develop a design to meet transportation needs as well as the needs of the community. Project also included a video survey of the existing drainage system and obtaining of oblique aerial photographs from a helicopter. This project included considerable public involvement and Public Meetings. Ms. Ransbottom developed and maintained both a project newsletter and project website to provide information regarding this high profile project. She was the lynchpin between the numerous stakeholders, including the Village Reconstruction Task Force, the driving force behind the project. She met with the Village Task Force every two weeks for the four-year duration of the design. Ms.

Ransbottom's commitment to communication and organization between the task force and all other stakeholders, such as SHPO, NYSDOT, and NYSDEC, kept the project on schedule and moving smoothly.

City of Buffalo Department of Public Works, Reconstruction of Main Street, Buffalo, NY (2000 to 2002):
Project Manager/Senior Transportation Engineer for this locally administered, federally aided project to reconstruct Main Street from Bailey Avenue (US62) to the Scajaquada Expressway (NY198). Ms. Ransbottom was involved in the project from preliminary design to beginning of construction. Preliminary design included preparation of Design Report, highway capacity analyses, accident investigations, subsurface testing, bridge inspections, development projections, utility research, historical investigations, and bike route analyses. Final design included pavement replacement, widening and intersection re-alignment, drainage improvements, utility relocations, new traffic signals, bridge rehabilitation, maintenance of traffic plan, street signage/markings, and street lighting. The project required coordination with numerous federal, state, local, and private agencies, groups, and utilities. This project required numerous public meetings to keep the public informed of project progress. As project manager, Ms. Ransbottom went door to door to meet and coordinate with business owners. Since their businesses would be affected the most by the reconstruction of Main Street, she made sure the design included accommodations for temporary parking and maintaining pedestrian traffic during construction.

City of Buffalo Department of Public Works, Reconstruction of Elmwood Avenue in Buffalo NY:
Project Manager for this project to reconstruct nearly 1 mile of roadway along Elmwood and Forest Avenues. Project included preparation of Design Report, many design alternatives (including roundabouts), separating storm sewer from combined storm/sanitary system, accident analyses, capacity analyses, soil and pavement evaluation, utility coordination, traffic signage, street lighting, landscaping, and maintenance and protection of traffic. The design utilized Context sensitive design solutions and included a coordinated traffic signal system and City gateway features. The project area included Buffalo State College, Buffalo Psychiatric Center, Albright Knox Art Gallery, Buffalo Olmsted Parks and the Elmwood commercial strip. Ms. Ransbottom was responsible for coordinating with and obtaining agreement between several groups including the State Historic Preservation Office (SHPO), the City of Buffalo, NYSDOT, and a very active community task force. Her innovative design options were the key to getting consensus on the design of the project. She provided design alternatives that included safe and efficient operation for vehicles, bicycles, and pedestrians in this unique City neighborhood.

Greater Buffalo Niagara Regional Transportation Council (GBNTRC), Traffic Signal Optimization Project (2011 to 2012):
Project Manager for this $400k project to develop and implement cost effective traffic signal timing and coordination plans for 6 major corridors in the Buffalo area (142 signals) to reduce travel times and emissions. The project provided significant traffic flow improvements to the corridors with yearly benefits of over $1M in reduced travel time, stops, and gas consumption. City of Buffalo corridors included Clinton St. and Elmwood Ave. Traffic volume counts and geometric data were inventoried to develop coordination timings for each of the systems using the latest Synchro software. The resulting Synchro traffic models were used to manage and maintain the Owner's traffic network and provide a database for volumes, lane geometry, signal timing and phasing, and system coordination and offsets. Ms. Ransbottom also coordinated with the City of Buffalo Signal Dept. to assist with implementing new timings and phasings manually in the signal controllers.

City of Buffalo Department of Public Works, Curb and Sidewalk Project, Buffalo, NY:
Project Manager responsible for this $400,000 Locally Administered Federally Funded stimulus project for the City of Buffalo. Because it was a stimulus (ARA) project, it had a fast-paced design schedule (only 9 weeks). Project included curb and sidewalk replacement and curb ramp reconstruction to ADA standards on eight City streets. The project was closely coordinated with a separate project to mill/overlay the same eight City streets. Ms. Ransbottom's ability to provide a meticulous paperwork trail from design through construction assisted the City through two successful FHWA stimulus audits.

City of Buffalo Department of Public Works, Seneca Street Streetscape, Buffalo, NY:

Project Manager responsible for this $1 million Locally Administered Federal Funded project in the City of Buffalo. This was a streetscape project on Seneca Street from Hayden Street to Indian Church Road (approx. 1 mile), and included mill and overlay of the pavement, curb and sidewalk replacement, ADA compliant curb ramps, and traffic signal improvements at two intersections. This project also incorporated performing a traffic signal coordination / optimization study for the entire length of Seneca St. from Michigan Avenue to the City Line.

Greater Buffalo Niagara Regional Transportation Council (GBNTRC), Feasibility Study for Accommodating Motor Vehicles within the Pedestrian Mall on Main Street, Buffalo, NY:

Project Engineer responsible for compiling this study in conjunction with the City of Buffalo, NFTA, GBNRTC and Buffalo Place. Ms. Ransbottom attended numerous meetings with the project team in an effort to develop the feasibility study, which ultimately moved this important project in the City forward. The study included a matrix of numerous feasible options, photo simulations, and costs associated with all options.

Erie County Department of Environment and Planning, Black Rock Canal Park Feasibility Study, Buffalo, NY (2010):

Project Manager for this project as subconsultant to a Landscape Architect. Responsibilities included topographic and boundary surveys of a series of connected Erie County-owned waterfront parks. The study was to determine possible future development in the parks. Project included inspection of the Black Rock Canal park interlocked steel sheet-pile cantilevered retaining wall approximately 2200' in length. The inspection was conducted above water using a boat and walking along the top. Also prepared sketches and preliminary costs for a cantilevered walkway for a new pedestrian bridge over Cornelius Creek.

Erie County Department of Public Works, Maple Road Reconstruction Project (Flint Road to Niagara Falls Blvd), Amherst, NY:

Project Manager for this project as subconsultant to Prime consultant. Project included widening of shoulders along Maple Road, adding turning lanes to assist capacity issues, improved drainage systems, and replacement of guide rails. Project also included reconstruction of North Bailey Avenue between Maple and Romney Road including left turning lanes to alleviate traffic conditions and replacement of existing drainage system. Responsibilities included traffic analyses and capacity analyses in coordination with replacement of all traffic signals along Maple and North Bailey, a new signal at the intersection of Bowmart and North Bailey, and new sidewalks with handicap ramps and pedestrian signals.

Cattaraugus County Department of Public Works, St. Bonaventure University Access Improvements Project, Allegany, NY (2008 to 2010):

Project Manager for this $2M project that included several improvements at St. Bonaventure University (a private campus). Improvements included the design of a new multi-use trail, reconstruction, and realignment of several campus roadways; construction of a new campus access road; redesign of an existing 5-way intersection; stormwater treatment (bioretention), amenities and signage; and a new public safety/restroom building. Project included topographic survey/mapping, ROW mapping, Environmental Assessment, civil/site and structural design of the new building, and construction support/inspection. Ms. Ransbottom effectively coordinated and resolved environmental issues associated with wetland impacts, contaminated soils, floodplain encroachment, utility relocations, and impacts to historically sensitive areas.

Cattaraugus Country Department of Public Works, Replacement of Little Valley Bridge #15 - North Ninth Street over Little Valley Creek:

This project replaced a deficient 30 ft. span highway bridge and an adjacent trail bridge over the Little Valley Creek. Both structures were replaced with a two-cell reinforced precast concrete box structure. The channel is on a curved and skewed alignment that required a structure design, which was curved through the site. Wingwalls were also precast, and the trail was extended over the upstream side of the bridge. As Project Engineer, Ms. Ransbottom was responsible for highway design, MPT, and design report preparation.

Village of East Aurora, NY, Landscaping and Scenic Beautification Project, East Aurora, NY:

Project Manager for this $1M Transportation Enhancement Program (TEP) project in the Village. The project was locally administrated and federally funded. Project included new directional signage within the Central Business District, new Village boundary signs, and improvements to alleyways in downtown area with new signage, landscaping, and lighting. Project also included extensive restoration of pedestrian pathways and parking areas on the National Historic Landmark Roycroft campus. This project was designed in close coordination with another of Ms. Ransbottom's projects to install drainage on the Roycroft campus, which previously had no storm drainage system. The National Historic Landmark status necessitated extensive coordination with the State Historic Preservation Office (SHPO). Ms. Ransbottom coordinated the Environmental Assessment for both projects on the campus, which included a month-long Phase III Archaeological Data Recovery phase.

Roycroft Campus Corporation (RCC), Roycroft Campus Drainage Project:

Project Manager for drainage improvements on the Roycroft Campus, a recognized National Historic Landmark, which lacked storm water collection and flooded frequently. Mrs. Ransbottom also guided the Campus through extensive reviews by the State Historic Preservation Office.

City of Tonawanda NY, Delaware Street Rehabilitation:

Transportation Engineer responsible for writing Draft Expanded Project Proposal (EPP) for the select reconstruction and general rehabilitation of Route 384, Delaware Street, a locally administered, federally aided project. Provided pavement evaluation, horizontal and vertical alignment analysis, drainage analysis, replacement of sidewalks, driveway aprons and curbs, intersection improvements, right-of-way analysis, traffic volumes, non-standard features, safety considerations and alternative lane configurations. Analyzed traffic counts, signal phasing and existing conditions at all signalized intersections and used Highway Capacity Manual methodology and Highway Capacity Software to determine a LOS at these intersections and examine the need for improvements. Coordinated presentations to and feedback from the client.

New York State Department of Transportation (NYSDOT), Hamburg, NY:

Project Engineer responsible for the Route 75 reconstruction and widening included pavement widening design, pavement full-depth reconstruction design, intersection design, closed drainage system design, curb design, sidewalk design, waterline design and tabulation, performed vertical geometric design calculations, and horizontal geometry calculations to determine proposed curb locations.

NYSDOT, Towns of Clarence and Newstead, NY:

Project Engineer responsible for the reconstruction of Route 5 (Main Street). The project included writing pre-draft and Draft Design Report/Environmental Assessment for project involving rehabilitation, widening, intersection design, closed-drainage system design, traffic operations analysis, reconstruction through an historic business district, installation of new traffic control devices (signs and signals), left and center turn lane analyses, curb and sidewalk design, and replacement of two box culverts. Performed horizontal and vertical geometric design, driveway analysis, preliminary Right-of-way analysis, and coordination with utility owners.

NYSDOT, Town of Newfane, NY:

Project Engineer responsible for minor widening, intersection improvements, open and closed drainage system analyses, and traffic analysis of signalized intersections for the Route 78 rehabilitation and reconstruction, Lockport-Olcott Road. Wrote Design Reports that included descriptions of existing speeds and delay, traffic volumes, Level of Service (LOS), non-standard features and safety considerations. Performed horizontal and vertical geometric design, super elevation design, intersection design, left turn lane analysis, driveway design, curb and sidewalk design, preliminary Right-of-way analysis, tree analysis, pavement reconstruction and widening design and design of drainage systems. Prepared public hearing materials, including script, slides, and brochure; coordinated preparation of take-line meeting materials such as colored plans and cross sections; prepared and reviewed individual take maps. Assisted in development of Right-of-Way plan. Wrote Final Design Report that included responses to comments generated at public hearing. Prepared 40% and ADP submittals, including

estimates.

NYSDOT, Route 240 Reconstruction, Harlem Road, Amherst, NY:
Project Engineer responsible for writing Draft and Final Design Report. The report included descriptions of existing speeds, traffic volumes, and level of service and safety considerations, preparing responses to general and individual comments generated at the public hearing. Also included was a left turn lane analysis, assistance with pavement full-depth reconstruction design, center turn lane evaluation, intersection design, curb and sidewalk design, horizontal and vertical geometric design, assistance with design of right-of-way plan, and preparation of individual ROW acquisition maps.

NY State Thruway Authority, New E-ZPass Only Toll Lanes at Five Buffalo area Locations (2004 to 2005):
Project Manager for this project involving new E-ZPass Only toll lanes at five Buffalo area interchanges - Pembroke (#48A), Depew (#49), Silver Creek (#58), Dunkirk (#59) and North Grand Island Bridge (#89). The project included data collection and research, topographic survey and mapping, Environmental Assessment, preliminary and detailed design, geotechnical work, electrical design, structural design, and construction administration. This project was part of a Thruway term agreement that included four other projects in the Buffalo area coordinated and managed by Ms. Ransbottom.

Town of Wheatfield, NY, Drainage Study:
Civil Engineer responsible for analyzing existing drainage systems when problems arose and proposing alternative solutions, using HEC-2 computer software to analyze impact of existing and proposed cross culverts and bridges on Sawyer Creek, and reviewing subdivision site plans including drainage design, contour design, detention ponds and roadway horizontal and vertical geometry.

Chautauqua County Industrial Development Agency (CCIDA), Dunkirk and Fredonia NY:
Project Engineer responsible for researching and evaluating financial and operational information regarding sewer operations, assisted in preparation of a report regarding development of a master sewer district for Northern Chautauqua County, and met with City and Village officials and County agencies.

Town of Hamburg, NY, Master Plan Update:
Civil Engineer responsible for updating information regarding transportation, infrastructure, land characteristics and environmental restrictions within the Town, using information to write Town Master Plan, and meeting with various Town committees and officials and state and county transportation agencies.

New York Air National Guard, Niagara Falls, NY:
Project Engineer responsibilities for this term contract/Kirsch Drive reconstruction included the redesign of roadway on Air National Guard base that included horizontal and vertical geometric design, pavement full-depth reconstruction design, and coordinating design with existing utilities. Performed NYANG Type "A" services including design evaluation of several alternative roadway designs and preparation of report, and performed NYANG Type "B" services including design and evaluation of proposed project, technical specifications, horizontal alignment data, maintenance, and protection of traffic, cross-section design, and cost estimates.

Little Ausable River Trail, Peru, NY:
Project Manager for this $800,000 Rails-to-Trails conversion project in Town of Peru. The project included design of a picturesque trail along the Little Ausable River between two of the Town's most popular historic parks. Ms. Ransbottom worked closely with the Town to ensure proper procedures for the Transportation Enhancement Program (TEP) were followed and assisted in dealing with the NYSDOT regarding the trail crossing a state highway. The project included design of a 180 ft. long steel and timber pedestrian bridge and extensive coordination with the NY State Historic Preservation Office including completion of a Phase IA and IB Cultural Resource investigation.

Benjamin Barrey
Environmental Engineer

Summary of Experience

Remedial System Design for the Wills Building, Long Island City, NY – Wills Family Group Limited Partnership:

Environmental Engineer responsible for design of an active sub-slab depressurization system (SSDS) as an Interim Remedial Measure (IRM) to address and mitigate known impacted indoor air quality (IAQ) as a result of vapor intrusion. Used data acquired during execution of a pilot test to determine construction parameters for the SSDS. Assisted in preparation of a Design Analysis Report submitted to New York State Department of Environmental Conservation (NYSDEC) for approval. Performed all required CADD drawings and specifications for the SSDS, and assisted with obtaining the required building permits from NYC.

Lead and Asbestos Monitoring and Design Services Contract, NY – NYCT MTA:

CADD Manager responsible for completing all survey and design drawings for the Indefinite Quantity Asbestos and Lead Monitoring and Design Services for miscellaneous construction projects contract. Mr. Barrey is responsible for the completion of ACM sample location drawings, ACM quantity drawings, and abatement drawings. Project sites include operating substations, subway stations, office buildings, mechanical rooms, rail yards, bus depots, tunnels, bridges, manholes, and other structures.

Asbestos Services, Five Boroughs, New York City, NY – New York City School Construction Authority:

CADD Manager responsible for the completion of all design drawings for asbestos, lead and PCB projects for the Asbestos, Lead, Mold, and PCB Environmental Services Contract. Mr. Barrey prepares ACM and PCB drawings based on information given from the field inspections.

Phase I Environmental Site Assessment, SYMS Corp:

Project Engineer responsible for investigating and reporting for McKinley, Inc. for the SYMS building located in Williamsville, NY in Erie County. Executed historical records reviews including but not limited to environmental records, proprietary records, topographical maps, Sanborn maps, aerial photography, and City Directories to assess the current and past environmental conditions at the site. In addition, interviews with the owner & occupants were performed as well.

Phase I Environmental Site Assessment, Eberl Ironworks:

Project Engineer responsible for investigating and reporting for Eberl Ironworks for the Buffalo Metal Fabrication building located in Buffalo, NY in Erie County. Executed historical records reviews including but not limited to environmental records, proprietary records, topographical maps, Sanborn maps, aerial photography, and City Directories to assess the current and past environmental conditions at the site. In addition, interviews with the owner & occupants were performed as well.

New York Power Authority City of Buffalo Master Plan, Wendel Energy Services, Buffalo, NY:

Project Engineer responsible for the Energy Planning & Coordination

Experience

CORE: 1 Other: 4

Education

B.S., Environmental Engineering, State University of New York at Buffalo, 2013

Certifications

NYSDEC Erosion and Sediment Control Certificate

Current Responsibilities

Mr. Barrey has five (5) years of experience in Environmental Engineering included remediation design, tank design and permitting. He is experienced with CADD and has produced drawings for various projects including asbestos/lead abatement design, above and underground storage tank design, and various civil engineering designs. Mr. Barrey has experience with hazardous waste remediation, environmental assessments, groundwater modeling, and wastewater treatment.

Section of the Master Plan. Tasks included collecting Citywide and third party stakeholder data regarding energy procurement practices in Buffalo, NY in Erie County. Mr. Barrey also performed an analysis of current market rates along with forecasted rates out to 2030 which when compared to City of Buffalo data pinpointed areas of improvement. This information was used to provide recommendations to the City of Buffalo on how the procurement of energy could be made more cost effective and made attempts to leverage the large group of stakeholders to improve markets rates.

Habitat Restoration Project at Calvert Vaux Park (formerly Dreier-Offerman Park), Brooklyn, NY:

This project included the construction of aquatic and coastal upland habitats, wetland restoration, and trail construction. The project also involved the removal of 3.2 acres of contaminated soil. NYSDEC Erosion and Sediment Control Inspector responsible for coordination of and reporting on weekly Stormwater Pollution Prevention Plan (SWPPP) inspections for monitoring, recording and reporting on the condition of soil erosion and sedimentation practices that were employed to comply with the NYSDEC SPDES General Permit for Storm Water Discharges from Construction Activities (GP-0-10-001).

Fuel System Installation, Port Authority of NY-NJ:

Project Engineer responsible for developing site plans & details for the installation of two (2) Petroleum Bulk Storage dispensing systems for Franklin Company Contractors at the Red Hook Container Terminal in the Bronx, NY in Nassau County. Designs included the placement of tanks, fuel dispensers, and related monitoring equipment as per the relevant New York City Codes & regulations (NEPA 30). Development of a Fire Suppression system was also included in the design.

Fuel System Installation, 362 Kingsland Ave, Brooklyn, NY, Mendon Trucking and Leasing:

Project engineer responsible for developing site plans & details for the installation of a Petroleum Bulk Storage dispensing system at Mendon Trucking & Leasing in Brooklyn, NY. Designs include the placement of tanks, fuel dispensers, employee kiosk, a light pole, and associated monitoring equipment as per relevant New York City Codes & regulations (NEPA 30).

Fuel System Upgrades, EC 63:

Project engineer responsible for developing site plans & details for the relocation of Petroleum Bulk Storage service lines for Galante Architecture at the Engine Company 63 in Brooklyn, NY. Designs include the relocation of fill and suction lines, fuel dispenser, and utilities as per relevant New York City Codes & regulations (NEPA 30).

Oil/Water Separation Engineering Report, 360 Kingsland Ave, Brooklyn, NY, ESF Transport Inc.:

Project Engineer responsible for developing an Engineering report for ESF Transport located in Brooklyn, NY. The report provided insights into the costs associated with three (3) different alternatives to remediating oil/water contamination leaving the facility through the municipal storm water system. Engineering analysis of local hydrology and unique conditions of the site were performed and used to develop alternatives that gave flexibility to the client while conforming to the SPDES permit.

Health & Safety Plan, The LIRO Group:

Project Engineer responsible for developing a General Health & Safety Plan for The LIRO Group located in Syosset, NY. The plan provided guidelines for safety of LIRO employees and contractors and covered topics such as safety training, emergency action plans, job hazard analysis, means of egress, hazard communication, materials handling, and protective equipment. Also developed in the plan were examples of safety inspection checklists, noise & dust mitigation plans, a protection of traffic plan, a lockout/tagout program, and a confined space program.

Excavated Materials Disposal Plan Review, NYCSCA:

Junior Engineer responsible for reviewing excavated materials disposal plans for accuracy to the design specifications for numerous NYC public schools. The project includes confirming analytical results, waste

transporter permits, disposal facility permits, and contractor sampling plans for conformance to local NYC codes and regulations.

Diesel Exhaust Fluid Dispensing System, Ryder Truck Rental Inc.:

Project Engineer responsible for developing site plans & details for the installation of a 1000 gallon enclosed aboveground diesel exhaust fluid (DEF) dispensing system for Ryder Truck Rental Inc. at the Farmingdale, NY facility in Suffolk County. Mr. Barrey provided engineering and administrative support to Ryder to expedite the tank registration process with the Town of Babylon and Suffolk County.

Backflow Prevention Device Design, Zaepfel Development Corp.:

Provided engineering services for the design and installation of a Backflow Prevention Device for Zaepfel Development Corporation's Remmington Woods Apartments in Williamsville, NY in Erie County. The project included analyzing historical hydrologic data, municipal water distribution data, current hydrant flow data collection, and drafting designs in AutoCAD.

Stormwater Pollution Prevention Programs, Zaepfel Development Corp.:

NYSDEC Erosion and Sediment Control Inspector responsible for the routine inspection of the Remmington Woods Apartments and the PHH Office Building in Williamsville, NY in Erie County. Preformed weekly inspections, developed inspection reports, and provided monthly, quarterly, and yearly summaries of inspections for both properties.

Computer Aided Drafting & Design, Franklin Company Contractors:

Computer aided drafter & designer responsible for performing all CADD work for the Franklin Company contractors. Mr. Barrey has completed a wide range of designs for the company including but not limited to As-Builts, petroleum tank installations, excavation plans, site maps, maintenance of traffic plans, and equipment details.

Phase II Environmental Site Assessment, Wills Building:

Computer aided drafter & designer responsible for performing all CADD work for the Phase II remedial investigation at the National Rubber site located in Brooklyn, NY. The work included the creation of site maps for existing wells, proposed exploratory wells, and a sub-slab depressurization system.

Remedial Investigation, Buffalo Color Corporation, Buffalo, NY:

Remedial Project Manager (University of Buffalo) for the Remedial Investigation/Feasibility Study (RI/FS) at the Buffalo Color Corporation in the City of Buffalo, along the Buffalo River. Mr. Barrey managed a team effort to create a remedial design to re-develop the land for commercial and light industrial zoning uses. Responsibilities included reviewing the Phase I and Phase II assessments that had been performed for the site.

Wastewater Plant Design, Buffalo:

Project Engineer responsible for developing all stages in the design of a wastewater treatment plant. Utilized the knowledge of chemical and treatment processes to meet remedial goals of the wastewater.

Drinking Water Distribution System Design, Buffalo:

Project Engineer responsible for developing a drinking water distribution network to supply clean water to a community in northern California. Mr. Barrey incorporated the use of network design software (EPANET) to aid in the sizing and placement of the new distribution system in order to project future supply needs of the growing community.

Environmental Impact Statement Review, Buffalo:

Project Engineer responsible for the review of a final impact statement for a proposed redevelopment of a federal military ammunitions testing facility. Responsible for reviewing the state and federal guidelines for air, noise, soil and water pollution along with key factors such as public acceptance, ecological footprint, economic impacts and effects on endangered species.

Life Cycle Analysis, Buffalo:

Engineer responsible for an in depth look at energy, materials and costs required to create and install a rooftop solar array located in Buffalo and to compare it to the energy generated by the current system. Mr. Barrey was responsible for developing detailed cost analyses, and transportation and energy matrices to determine a benefit to cost ratio for different rooftop photovoltaic systems.

Volunteer at Buffalo Niagara Riverkeeper:

Mr. Barrey was involved in an Outreach program in which the community is engaged at tabling events and speaking engagements to develop awareness of the Riverkeeper mission. He was also involved in a River Stewardship program in which water quality testing, research and cleanups are performed.

Town of Amherst, NY Parks Department:

Mr. Barrey was a manager in the Town Park's Department where he supervised several seasonal employees and maintained public grounds by pesticide application, watering, excavation, berm installation, tree/shrub planting, debris removal, and several drainage installations.

Teresa Tramposch
Vice President

Summary of Experience

Habitat Restoration Work at Calvert Vaux Park (formerly Dreier-Offerman Park), Brooklyn, NY:

Principal responsible for providing air monitoring services to monitor upwind and downwind areas of excavation work to ensure that dust concentrations in air did not exceed New York State Department of Environmental Conservation (NYSDEC) regulations [TAGM 4031]. CORE provided professional/civil engineering services to perform site inspections required to conform to the requirements in the NYSDEC Pollution Discharge for Construction Activities, General Permit GP-0-08-001.

Phase I Environmental Site Assessments (ESA) - Queens, NY:

Completed the project Quality Assurance and Quality Control (QA/QC) review for ESAs completed for two (2) self storage facilities. The ESAs were prepared in accordance with ASTM E 1527-05 and EPA All Appropriate Inquiry standards. The confirmation of the recognized environmental conditions (RECs) and overall review of all reports submittals was completed. A scope of work for Phase II ESI activities was provided as part of the ESAs.

Garrison Avenue Soil Remediation System, Brooklyn, NY:

Project Principal for the remediation system installation and operation of a 350 scfm soil vapor extraction system for the Mendon Truck Leasing Garrison Avenue facility. Coordinated numerous sub-contractors for the installation of 350 feet of buried piping and as well as nine (9) vapor extraction wells. Close monitoring of project costs and contractors invoice were required.

Franklin Company Contractors, NYCT MTA Mother Clara Hale Bus Depot Replacement, New York City, NY:

Principal in Charge of the project oversight of Core's scientist to initially direct the contractor in segregating excavated soils according to total organic vapor (TOV) content with a photo-ionization detector. The work was completed in 20' x 20' cells. The soil was stabilized by open pit mixing with a fly ash and grout mix that was previously pilot tested. The stabilization was verified by wet sampling from specific intervals. Responsible for the review of all project deliverables.

Health and Safety Plan, Lewiston, NY:

Completed the program Quality Assurance and Quality Control (QA/QC) review for a site specific Health and Safety Plan (HASP) for a site remediation and investigation project at a vacant site impacted with No. 2 fuel oil. The site had formerly contained a building and operated as a construction staging area for the Niagara Power Project. The site is adjoined by a contaminated landfill site that has the potential to impact the target site. Project required confirmation of site specific contaminants of concern, exposure levels, personnel protection equipment (PPE), air monitoring, site controls, decontamination and emergency procedures.

Franklin Company Contractors, NYC Department of Environmental Protection, Facility Reports, Plans and Drawings, New York City, NY:

Principal in Charge of the project oversight for the preparation of Petroleum Bulk Storage (PBS) Facility Reports, As-Built Drawings of tanks and Spill

Experience

CORE: 10 Other: 20

Education

B.S., Biochemistry and Nutrition, Cornell University, 1982
M.S., Biochemistry and Nutrition, Texas Woman's University, 1983

Certifications

Certified Environmental Inspector (CEI)
NYSDOL Asbestos Project Designer
EPA, IAQ Mold Remediation in Schools and Commercial Buildings

Current Responsibilities

Ms. Tramposch has over 30 years of professional management experience. In 2004, Ms. Tramposch formed CORE Environmental Consultants, a consulting company specializing in environmental services including site assessments, site inspections and site remediation. Ms. Tramposch's distinguished career includes teaching at the college level and numerous managerial positions prior to her current involvement in the environmental industry. Past and present responsibilities have prepared her for a role as President and Financial Officer of a growing corporation.

Prevention, Control, and Countermeasures Plans (SPCC) at 24 New York City Department of Environmental Protection (DEP) Water Pollution Control Plants and Pumping Stations under Contract 1198-PBS. The purpose of the PBS Facility Report is to identify PBS deficiencies at the site, if any, and provide recommendations for corrective actions.

NYCT Asbestos and Lead Monitoring and Design Services Contract, New York City, NY:

Project Principal responsible for the indefinite quantity contract (CM-1320) and for the assurance that the contract documents adhered to all appropriate standards. Project involves inspection services for lead and asbestos throughout New York City in support of facility design and future abatement, encapsulation and construction activities. Services include lead and asbestos investigations and reports, development of abatement work plans, cost estimating, project coordination and interfacing with site representatives, and project management with oversight of the abatement contractors. Project sites included operating substations, subway stations, office buildings, mechanical rooms, rail yards, bus depots, tunnels, bridges, and various other structures throughout many of NYC Transits 300 facilities located throughout the five boroughs of New York City.

NYC School Construction Authority, Asbestos Services, Five Boroughs, NY:

Principal in Charge of the project oversight of the air sampling and project monitoring at New York City Schools. The project included surveys, to include the collection of bulk samples as well as project monitoring during asbestos abatement.

Remediation System Operation and Reporting, Five Boroughs of NY:

Project Principal responsible for office support to Franklin Company Contractors providing remediation system monitoring and reporting related to fourteen soil and groundwater remediation systems in the City of New York. Responsibilities include daily remote monitoring of remediation systems utilizing SCADA software, weekly report preparation, and preparation of monthly system status reports.

NYC Housing Authority, Lead Based Paint Inspection Services Contract, New York City, NY:

Principal in Charge of the project oversight of all lead based paint inspections. Inspections are completed on housing units, common areas, and storage units in accordance with U.S. Housing and Urban Development protocols. Inspections included the use of X-Ray Fluorescence (XRF) analysis in each unit and often paint chip samples were collected and laboratory analyzed. The XRF analysis is conducted on site, using a portable LPA-1 Lead Paint Inspection System manufactured by Radiation Monitoring Devices, Inc. (RMD).

Mendon Truck Leasing Lead and Asbestos Services, Five Boroughs, NY:

Project Principal responsible for the preparation of the contract documents and assurance that the contract documents adhered to all appropriate standards. Project involves inspection services for lead and asbestos at buildings throughout New York City in support of facility design and future abatement, encapsulation and construction activities.

Restored Homes HDFC Asbestos Consulting Services, Bronx, Brooklyn, Queens and Staten Island, NY:

Project Principal for the contract to complete comprehensive asbestos containing material (ACM) surveys and assessments at 280 1-3 family vacant homes being rehabilitated. Responsibilities include the development and supervision of project quality control and assurance measures for efforts to provide comprehensive asbestos inspections and assessments, abatement or removal design.

Manuel Duran
Project Manager

Summary of Experience

Tank Sampling, Terminal 5, JFK Airport, Jamaica, NY – JetBlue Airways:
Field Technician responsible for completing soil sampling for propylene glycol from numerous tanks at Terminal 5 located in the JFK Airport.

Phase I Remedial Investigation Report, Remedial Investigation Work Plan, and Interim Remedial Measure Work Plan for the Wills Building, Long Island City, NY – Wills Family Group Limited Partnership:
Field Technician responsible for water sampling for this apartment complex located in Long Island City during the Phase I Remedial Investigation to delineate the nature and extent of known subsurface impacts in the soil. Mr. Duran was responsible for collecting sample from monitoring wells along with checking the water levels for each well.

Lead and Asbestos Monitoring and Design Services Contract, NY – NYCT MTA:
Project Manager responsible for the management of personnel and the completion of air sampling and monitoring completed during the execution of the indefinite quantity contracts (CM-1320 & CM-1515). Responsibilities include the development and implementation air monitoring programs at all types of work areas and environments. Responsibilities include lead and asbestos investigations and reports, development of abatement work plans, cost estimation, project coordination, meetings with site representatives, and project management with oversight of the abatement contractors. Additional responsibilities includes project monitoring for lead abatement activities including contractor oversight. Project sites include operating substations, subway stations, office buildings, mechanical rooms, rail yards, bus depots, tunnels, bridges, manholes and other structures.

OHSA Air Monitoring, Noise Monitoring, and Soil Sampling, High Line Park Bridge, Manhattan, NY – Ahern Painting Contractors:
Project Manager responsible for the lead based paint abatement ongoing at High Line Park in Manhattan, NY. Responsible for the completion of OSHA Compliance Letters that detail the containment area air monitoring performed by CORE personnel. Also responsible for completing air monitoring during abatement in compliance with the noise mitigation efforts to reduce noise induced from abatement activities.

OSHA Worker Compliance Services, NYCT MTA Canal Street Station, 7th Avenue Line, Manhattan, NY – Belt Painting Contractors:
OSHA Air Monitor responsible for the completion of a lead air monitoring negative exposure assessment for employees completing lead disturbance activities at the Canal Street Station in Manhattan, NY. Responsible for collecting samples from the employees to determine if they had exceeded the OSHA Permissible Exposure Limit set forth by OSHA 29 CFR 1926.62.

OHSA Air Monitoring and Soil Sampling, Bayonne Bridge, NJ & NJ – Ahern Painting Contractors:
Project Manager responsible for the lead based paint abatement ongoing at Bayonne Bridge in Staten Island, NY and Bayonne, NJ. Responsible for the completion of OSHA Compliance Letters that detail the air monitoring

Experience

CORE: 5 Other: 5

Education

A.A.S., Accounting, Nassau Community College, 2000

Certifications

NYSDOL Asbestos Inspector
USEPA Lead Inspector and Risk Assessor
SSPC C-5 Supervisor/Competent Person
MTA NYCT Track Safety Certification
OSHA 10 hour Construction Safety & Health Certificate
OHSA 40 hour HAZWOPER
NYC DOB 4-HR Supported Scaffold User Certificate
NYSDEC Erosion and Sediment Control Certified

Current Responsibilities

Mr. Duran has ten (10) years of experience managing people and projects. He has a large background in lead and asbestos investigations, air monitoring, and construction management. He is experienced with all types of abatement work areas and has performed the oversight of hundreds of work areas throughout the New York metropolitan area as well as New Jersey. Additionally, Mr. Duran has performed Phase I and Phase II Investigations, well logging, sampling, geologic mapping, stratigraphic and structural analysis. Mr. Duran is currently managing our New York City Transit Authority Asbestos and Lead Contract.

exposure assessments and containment area air monitoring performed by CORE personnel. Also responsible for completing soil and paint chip samples to determine if the lead based paint abatement has contaminated the soil surrounding the bridge.

OHSA Air Monitoring, Throngs Neck Bridge, Bronx, NY – Ahern Painting Contractors:

Project Manager responsible for the lead based paint abatement ongoing at Throngs Neck Bridge in Bronx, NY. Responsible for oversight on air monitoring exposure assessment and ambient area air monitoring during the paint removal. Mr. Duran is also responsible for completing reports complying with various agencies after CORE personnel performs on-site monitoring or assessments.

Line Structure Overcoat Painting, Flushing Line, from 103rd Street to the Main Street, Queens, NY – NYCT MTA:

Project involves the removal of lead paint from the elevated steel structured of the Flushing Line (A Division, IRT), 103rd Street to the Main Street Portal including the Corona Yard Leads. Work procedures include manual wet scraping, needle scaling, and power tool cleaning. All work areas are contained in SSPC 3P containment. Responsible for ensuring the contractor complies with all NYCT lead removal specifications, OSHA worker protection procedures are carried out by the contractor, storage and tracking of lead waste perform air monitoring, tracking of lead wastes, and maintain ensure contractor follows OHSA requirements for lead removal work.

OSHA Lead Worker Monitoring, Seven MTA Stations, New York City, NY:

Completed the OSHA Lead Worker Monitoring as part of the lead abatement at seven (7) New York City Transit Authority Stations. The contract (R-50554) is for the lead paint removal and painting of subway stations in all areas of public and non-public use at the following seven (7) stations in the Boroughs of Manhattan, Brooklyn and the Bronx. The purpose of OSHA monitoring to ensure that all project personnel in each job category are properly protected with the appropriate PPE by monitoring the direct exposure that they receive to the airborne lead. Personal pumps are fitted on each employee for an entire shift.

Line Structure Overcoat Painting, White Plains Road Line, Bronx Park East to 241st, Bronx, NY – NYCT MTA:

Project involves the removal of lead paint from over 4,000,000 square feet of the elevated subway line. Specific removal methods include manual wet scraping and power tools with HEPA-vacuum attachments, rivet busting and hot work. All work is being performed utilizing a SSPC Class 3P containment system consisting of tarpaulins hanging from the work area both horizontally and vertically. Responsible for on-site field inspection during lead disturbance activities ensuring the contractor maintained proper containment around each work area, proper worker protection procedures under OSHA are carried out by the contractor, preparing weekly field inspection reports, and ensuring lead wastes are properly stored in compliance with NYSDEC and USEPA regulations.

Asbestos Services, Five Boroughs, New York City, NY – New York City School Construction Authority:

Asbestos Inspector and Lead Risk Assessor responsible for surveying and collecting samples at various public schools in the New York City Area. Responsibilities include the completion of inspections, forms, assessments, air sampling, logs, chain of custodies, and project data summaries. Utilizes an x-ray fluorescence (XRF) gun during lead inspections to survey schools for lead based paint. Other responsibilities include completing Final Design Reports after asbestos or lead surveys that detail the removal activities necessary.

Public School 91, Brooklyn, NY – New York City School Construction Authority:

Project Monitor responsible for on-site management during the removal of VAT and Associated Mastic in various rooms in the school. Mr. Duran was responsible for conducting walkthroughs, surveys, inspections, gathering samples and quantifying materials in various rooms.

Lead Based Paint Inspection Services Contract, New York City, NY - New York City Housing Authority:

Project Manager responsible for the inspections completed on housing units, common areas, and storage units

in accordance with U.S. Housing and Urban Development protocols. The inspections included the use of X-Ray Fluorescence (XRF) gun in each unit and the collection of paint chip samples. Responsibilities included scheduling a certified lead inspector along with report completion detailing the results of the lead based paint inspection.

Calvert Vaux Park, Brooklyn, Construction of Aquatic & Coastal Upland Habitat, Brooklyn, NY – Galvin Brothers:

Project Manager responsible for oversight of the project that included the performance of weekly SWPPP inspections to monitor, record and report on the condition of the soil erosion and sedimentation practices. The SWPPP inspections were to guarantee that the site was complying with the NYSDEC SPDES General Permit for Storm Water Discharges from Construction Activities (GP-0-10-001). Project involves removal of 3.2 acres of contaminated soil.

SENY Samplings and Analysis for Poletti/500mw/Flynn/SCPP Plants, Astoria, NY– New York Power Authority (NYPA):

SPDES Sampling Manager responsible for on-site collection, analysis and management of periodic storm water discharge samples, monitoring well samples, and waste fuel samples required by various NYSDEC SPDES permit requirements.

Phase II Environmental Site Investigation (ESI), Queens, NY - Olympic Flame:

Assisted with Phase II ESI activities at the gas station where a truck accident caused a gasoline release from a fuel dispenser. Responsible for the completion of the work plan, soil screening and sampling, well development and sampling. Applied the site health and safety plan and completed the oversight of the field crews.

Foster Avenue, Phase II Environmental Site Investigation (ESI), Bronx, NY - Mendon Realty:

Assisted with the Phase II ESI at the commercial property were a spill occurred. Responsibilities included preparing subcontracts and performing oversight for monitoring well drilling, geoprobe activities, and excavation services other field activities and compilation of field data for reporting.

Garrison Avenue, Phase II Environmental Site Investigation (ESI), Brooklyn, NY - Mendon Realty:

Assisted with soil borings and temporary monitoring well installations to evaluate site soils and groundwater samples from the sites. A report was prepared presenting the approach, methods, results, and interpretations of the data as well as recommendations, conclusions and an opinion on further action.

775 Tiffany Street, Bronx, Phase II Environmental Site Investigation (ESI), Brooklyn, NY - Kimcomatt Realty Corp.:

Assisted with soil borings and temporary monitoring well installations to evaluate site soils and groundwater samples from the sites. Responsibilities included performing oversight for monitoring well drilling, geoprobe activities, and soil and groundwater sampling services as well as other field activities.

Dennis Sanchez
Project Manager

CORE ENVIRONMENTAL CONSULTANTS

Summary of Experience

Lead and Asbestos Monitoring and Design Services Contract (CM-1320 and CM-1515), NY – NYCT MTA:

Report Manager responsible for assisting in the completion of survey and design reports for various subway stations as part of the Indefinite Quantity Asbestos and Lead Monitoring and Design Services contract. Mr. Sanchez is responsible for completing the ES/EN-tables included in the design drawings, detailing the work areas and any asbestos or lead that has been located.

Asbestos and Lead Services – NYCT Pelham Subway, Bronx, NY:

Lead Inspector and Asbestos Project Monitor responsible for monitoring in compliance with NYCT environmental rules for lead and asbestos (12N, 12L) during abatement. Ensured compliance with NYCT Safety rules (1s) including but not limited to respiratory protection, fall protection, confined space entry, safe use of power tools and overall maintenance of a safe work environment. Provided oversight and ensure regulatory compliance during super structure lead abatement projects. Other responsibilities included monitoring the upkeep of Hazardous Waste Storage Areas for EPA/NYCT-12L compliance and monitoring Contractors and workers during abatement activities. Performed daily air samples, monitored the quality of air in the work and public areas, conducted final visual inspections prior to clearance/re-occupancy of wok areas, and submitted daily reports noting all safety related occurrences, exposure levels and Contractor corrective actions.

Asbestos Services – NYU Langone Medical Center, Long Island City, NY:

Asbestos Project Monitor on site responsible for monitoring contracts and workers during the asbestos abatement project. Performed daily air samples, monitored the quality of air in the work and public areas, conducted final visual inspections prior to clearance/re-occupancy of wok areas, and submitted daily reports noting all safety related occurrences, exposure levels and Contractor corrective actions.

SENY Samplings and Analysis at South East Power Plants, NY– New York Power Authority (NYPA):

Field Technician responsible for collecting weekly, monthly, and quarterly water inlet and outlet sampling at the NYPA Charles Poletti/ 500 MW Richard M. Flynn Power plant and the Small Clean Power Plants sites (SCPP), located in Astoria, Long Island City, Bronx, Brooklyn, Staten Island, Holtsville and West Brentwood, NY. Responsibilities include: Performing groundwater and stormwater sampling, RCRA/metals sampling, preparing sampling logs and chain-of-custody documents, and the review of data and project reporting.

Experience

CORE: 1 Other: 8

Education

Diploma, General Studies, Mount Saint Michael Academy, 2003

Certifications

NYSDOL Asbestos Project Monitor and Air Technician
NYSDOL Asbestos Inspector
SSPC C-3 Supervisor/Competent Person
OSHA 10 Hours
NYC DOB 4-HR Supported Scaffold User Certificate
NYCT Track Safety Certification
OSHA Confined Space Entry Training

Current Responsibilities

Mr. Sanchez has over eight (8) years of experience performing multiple asbestos and lead inspections and has had significant experience overseeing abatement on NYCT projects. Mr. Sanchez is very familiar with all city, state and regulatory requirements for asbestos and lead projects.

Steven Granati
Field Technician

CORE ENVIRONMENTAL CONSULTANTS

Summary of Experience

Public School 48, Brooklyn, NY- NYC School Construction Authority:
Project Monitor responsible for on-site management during the roof replacement project. Mr. Granati was responsible for air monitoring as well ensuring compliance by the asbestos abatement contractor during all phases of the ACM roof removal, including project setup, foam removal method, proper bag out procedures, and final breakdown.

Public School 174, Brooklyn, NY- NYC School Construction Authority:
Project Monitor responsible for on-site management during the removal of VAT and Associated Mastic within the school. Mr. Granati was responsible for air monitoring as well ensuring compliance by the asbestos abatement contractor during all phases of the VAT and Associated Mastic removal, including project setup, the removal method, proper bag out procedures, and final breakdown.

Intermediate School 259, Brooklyn, NY- NYC School Construction Authority:
Project Monitor responsible for on-site management during the removal of VAT and Associated Mastic within the school. Mr. Granati was responsible for air monitoring as well ensuring compliance by the asbestos abatement contractor during all phases of the VAT and Associated Mastic removal, including project setup, the removal method, proper bag out procedures, and final breakdown.

Public School 32, Brooklyn, NY- NYC School Construction Authority:
Project Monitor responsible for on-site management during the core drilling of various flooring materials using NYCDEP tent procedures. Mr. Granati was responsible for air monitoring as well ensuring compliance by the asbestos abatement contractor during all phases of the drilling, including project setup, wet method drilling, proper bag out procedures, and final breakdown.

Public School 150, Brooklyn, NY- NYC School Construction Authority:
Project Monitor responsible for on-site management during the emergency repair of wall/ceiling plaster. Mr. Granati was responsible for air monitoring as well as ensuring compliance by the asbestos abatement contractor during all phases of the ACM plaster removal, including project setup, wet removal method, proper bag out procedures, and final breakdown.

Dyckman Street Station, Manhattan, NY- MTA NYCT:
Project Monitor responsible for on-site management during the removal of various asbestos containing materials at the station. Mr. Granati was responsible for air sampling as well as ensuring proper safety compliance by the asbestos abatement contractor during all phases of the ACM removal including project setup, wet removal method, proper cleaning procedures, and proper waste storage and identification.

Asbestos Monitoring, Maspeth Warehouse, Queens, NY- MTA NYCT:
Project Monitor for the NYCT property Maspeth Warehouse conducting air samples and inspections at the lower roof asbestos removal. Responsibilities include checking the NYSDOL licenses of the abatement contractor,

Experience

CORE: 3 Other: 1

Education

Diploma, General Studies, FDR High School, 1998

Certifications

NYSDOL Asbestos Project Monitor
NYSDOL Air Sampling Technician
RMD LPA-1 Certified Lead Paint Inspector
SSPC C-3 Lead Training
MTA Track Safety Training
OSHA 10 hour Construction Safety and Health
OSHA 40 hour HAZWOPER

Current Responsibilities

Mr. Granati is a Project Monitor with field experience in asbestos, lead monitoring and environmental services. As a field representative, he has proven his ability to perform on-site project management services during environmental remediation projects involving asbestos and lead, as well as all required environmental sampling.

conducting safety meetings, running air samples and checking the work areas to ensure protocol is being followed.

Asbestos Monitoring, 149th Street Grand Concourse, Bronx, NY:

Project Monitor for the NYCT property 149th Street Grand Concourse conducting air samples and inspections during the entire platform upgrade. Responsibilities include checking the NYSDOL licenses of the abatement contractor, conducting safety meetings, running air samples and checking the work areas to ensure protocol is being followed.

Asbestos Monitoring, 370 Jay Street, Brooklyn, NY:

Project Monitor for the NYCT property 370 Jay Street conducting air samples and inspections during the upgrades at the thirteen story building with two sub-level basements. Responsibilities include checking the NYSDOL licenses of the abatement contractor, conducting safety meetings, running air samples and checking the work areas to ensure protocol is being followed.

Poletti Power Plant, Astoria, NY–Franklin Contracting:

Lead Inspector responsible for on-site OSHA air monitoring during the demolition of oil tank structures containing lead-based paint. Mr. Granati was given the task of performing both personal and ambient air sampling during all phases of the demolition project.

SENY Samplings and Analysis for Poletti/500mw/Flynn/SCPP Plants, Astoria, NY– New York Power Authority (NYPA):

Lead Sampling Technician responsible for on-site collection, analysis and management of periodic storm water discharge samples, monitoring well samples, and waste fuel samples required by various NYSDEC SPDES permit requirements.

Calvert Vaux Park, Brooklyn, Construction of Aquatic & Coastal Upland Habitat, Brooklyn, NY – Galvin Brothers:

Project involves removal of 3.2 Acres of contaminated soil. Project Manager responsible for oversight of the project including the performance of weekly SWPPP inspections to monitor, record and report on the condition of the soil erosion and sedimentation practices being employed to comply with the NYSDEC SPDES General Permit for Storm Water Discharges from Construction Activities (GP-0-10-001).

APPENDIX H

Site Management Forms

CORE ENVIRONMENTAL CONSULTANTS

DAILY OBSERVATION LOG

Project Name:	**Wills Building**	**Date:**	
Project Address:	**43-01 21st Street, Long Island City**	**Weather:**	
Field Activity:			

PERSONNEL: Name	COMPANY	TIME IN	TIME OUT

TIME	DESCRIPTION OF WORK PERFORMED

DAILY OBSERVATION LOG
(continued)

CORE ENVIRONMENTAL CONSULTANTS

Project Name:	Wills Building	Date:

TIME	DESCRIPTION OF WORK PERFORMED

Water Level Monitoring Record

Project Name:	**Wills Building**	**Measured By:**	
Project Address:	**43-01 21st Street, Long Island City**	**Instrument Used:**	

Well No.	Time	MP Elevation (ft msl)	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Well Total Depth (ft bmp)	Remarks (well condition, etc.)
MW-1S		20.67				
MW-2S		20.82				
MW-101S		19.38				
C-MW-3						
MW-218		19.97				
MW-219		18.86				
MW-6BA		19.58				
MW-214D		19.88				
MW-215D		18.62				

Notes:
ft msl = feet above mean sea level
mp = measuring point
ft bmp = feet below measuring point

CORE ENVIRONMENTAL CONSULTANTS

Sub-Slab Depressurization and Soil Vapor Extraction System Monthly Monitoring Report

Site Name:	Wills Building	**Site Code:**	C241143		
Address:	43-01 21st Street	**City:**	Long Island City		
State:	New York	**Zip Code:**	11101	**County:**	Queens

Contact Information	
Technician:	Phone No.
Technician's Affiliation:	

Date:		**Hours of Operation:**	
Time:		**Total Flow (ft^3):**	

Parameter	Sample Location	Units	Value
Flowrate	Blower Input (B-101)	fpm	
	Differntial Pressure	Inches of H_2O	
Vacuum	Extraction well 1 (EW-1)	Inches of H_2O	
	Extraction well 2 (EW-2)	Inches of H_2O	
	Extraction well 3 (EW-3)	Inches of H_2O	
	Extraction well 4 (EW-4)	Inches of H_2O	
	Extraction well 5 (EW-5)	Inches of H_2O	
	Extraction well 6 (EW-6)	Inches of H_2O	
	Extraction well 7 (EW-7)	Inches of H_2O	
	Extraction well 8 (EW-8)	Inches of H_2O	
	Extraction well 9 (EW-9)	Inches of H_2O	
	Extraction well 10 (EW-10)	Inches of H_2O	
	Extraction well 11 (EW-11)	Inches of H_2O	
	Extraction well 12 (EW-12)	Inches of H_2O	
	Extraction well 15 (EW-15)	Inches of H_2O	
	Extraction well 16 (EW-16)	Inches of H_2O	
	Extraction well 17 (EW-17)	Inches of H_2O	
	Extraction well 18 (EW-18)	Inches of H_2O	
	Extraction well 19 (EW-19)	Inches of H_2O	
	Extraction well 20 (EW-20)	Inches of H_2O	
	Vapor Pin 1 (VP-1)	Inches of H_2O	
	Vapor Pin 2 (VP-2)	Inches of H_2O	
	Vapor Pin 3 (VP-3)	Inches of H_2O	
	Vapor Pin 4 (VP-4)	Inches of H_2O	
	Vapor Pin 5 (VP-5)	Inches of H_2O	
	Vapor Pin 6 (VP-6)	Inches of H_2O	

Sub-Slab Depressurization and
Soil Vapor Extraction System Monthly Monitoring Report

Site Name:	Wills Building	**Site Code:**	C241143		
Address:	43-01 21st Street	**City:**	Long Island City		
State:	New York	**Zip Code:**	11101	**County:**	Queens

Parameter	Sample Location	Units	Value
Vacuum (cont'd)	Vapor Pin 7 (VP-7)	Inches of H_2O	
	Vapor Pin 8 (VP-8)	Inches of H_2O	
	Vapor Pin 9 (VP-9)	Inches of H_2O	
	Vapor Pin 10 (VP-10)	Inches of H_2O	
	Vapor Pin 11 (VP-11)	Inches of H_2O	
	Vapor Pin 12 (VP-12)	Inches of H_2O	
	Vapor Pin 13 (VP-13)	Inches of H_2O	
	Vapor Pin 14 (VP-14)	Inches of H_2O	
	Before Blower Inlet Filter	Inches of H_2O	
	After Blower Inlet Filter	Inches of H_2O	
Pressure	Blower Output (B-101)	Inches of H_2O	
	Influent Vapor Phase Activated Carbon 1 (VGAC-1)	Inches of H_2O	
	Effluent Vapor Phase Activated Carbon 1 (VGAC-1)	Inches of H_2O	
	Effluent Vapor Phase Activated Carbon 2 (VGAC-2)	Inches of H_2O	
Temperature	Blower Outlet (B-101)	^oF	
Level	Condensate Storage Tank (T-201)	inches	

Air Sparge System Monthly Monitoring Report

Site Name:	Wills Building	**Site Code:**	C241143		
Address:	43-01 21st Street	**City:**	Long Island City		
State:	New York	**Zip Code:**	11101	**County:**	Queens

Contact Information	
Technician:	Phone No.
Technician's Affiliation:	

Date:	**Hours of Operation:**
Time:	**Total Flow (ft^3):**

Parameter	Sample Location	Units	Value
Flowrate	Compressor Input (C-101)	fpm	
	Differntial Pressure	Inches of H_2O	
Pressure	Air Sparge Well 1 (AS-1)	Inches of H_2O	
	Air Sparge Well 2 (AS-2)	Inches of H_2O	
	Air Sparge Well 3 (AS-3)	Inches of H_2O	
	Air Sparge Well 4 (AS-4)	Inches of H_2O	
	Air Sparge Well 5 (AS-5)	Inches of H_2O	
	Air Sparge Well 6 (AS-6)	Inches of H_2O	
	Air Sparge Well 7 (AS-7)	Inches of H_2O	
	Compressor Output (C-101)	Inches of H_2O	
Dissolved Oxygen	Air Sparge Well 1 (AS-1)	µg/L	
	Air Sparge Well 2 (AS-2)	µg/L	
	Air Sparge Well 3 (AS-3)	µg/L	
	Air Sparge Well 4 (AS-4)	µg/L	
	Air Sparge Well 5 (AS-5)	µg/L	
	Air Sparge Well 6 (AS-6)	µg/L	
	Air Sparge Well 7 (AS-7)	µg/L	
	C-MW-3	µg/L	
Temperature	Compressor Outlet (C-101)	°F	

SUMMARY OF GREEN REMEDIATION METRICS FOR SITE MANAGEMENT

Site Name:	Wills Building	**Site Code:**	C241143		
Address:	43-01 21st Street	**City:**	Long Island City		
State:	New York	**Zip Code:**	11101	**County:**	Queens

Initial Report Period (Start Date of period covered by the Initial Report submittal)	
Start Date:	
Current Reporting Period	
From:	To:
Contact Information	
Preparer's Name	Phone No.
Preparer's Affiliation	

I. Energy Usage - Quantify the amount of energy used directly on Site and the portion of that derived from renewable energy sources.

	Current Reporting Period	Total to Date
Fuel Type 1 (e.g. natural gas [cf])		
Fuel Type 2 (e.g. fuel oil, propane [gals])		
Electricity (kWh)		
Of that Electric usage, provide quantity		
Derived from renewable sources (e.g. solar, wind)		
Other energy sources (e.g. geothermal, solar thermal [BTU])		

Provide a description of all energy usage reduction programs for the Site in the space provided on Page 3.

II. Solid Waste Generation - Quantify the management of solid waste generated on Site.

	Current Reporting Period	Total to Date
Total waste generated on Site (tons)		
OM&M generated waste		
Of that total amount, provide quantity (tons)		
Transported off Site to landfills		
Transported off Site to other disposal facilities		
Transported off Site for recycling/reuse		
Reused on Site		

Provide a description of any implemented waste reduction programs for the Site in the space provided on Page 3.

III. Transportation/Shipping - Quantify the distances traveled for delivery of supplies, shipping of laboratory samples, and the removal of waste.

	Current Reporting Period	Total to Date
Total distance traveled (miles)		
Standby Engineer/Contractor		
Laboratory Courier/Delivery Service		
Waste Removal/Hauling		

Provide a description of all mileage reduction programs for the Site in the space provided on Page 3. Include specifically any local vendor/services utilized that are within 50 miles of the Site.

IV. Water Usage - Quantify the volume of water used on Site from various sources.

	Current Reporting Period	Total to Date
Total quantity of water used on Site (gallons)		
Of that total amount, provide quantity (gallons)		
Public potable water supply usage		
Surface water usage		
On-Site groundwater usage		
Collected or diverted storm water usage		

Provide a description of any implemented water consumption reduction programs for the Site in the space provided on Page 3.

V. Land Use and Ecosystems - Quantify the amount of land and/or ecosystems disturbed and the area of land and/or ecosystems restored to a pre-development condition (i.e. Green Infrastructure).

	Current Reporting Period	Total to Date
Land disturbed (acres)		
Land restored (acres)		

Provide a description of any implemented land restoration/green infrastructure programs for the Site in the space provided on Page 3.

Description of green remediation programs reported above (Attach additional sheets if needed)
Energy Usage:
Waste Generation:
Transportation/Shipping:
Water usage:
Land Use and Ecosystems:
Other:

CERTIFICATION BY CONTRACTOR	
I, _____ (**Name**) do hereby certify that I am _____ (**Title**) of the Company/Corporation herein referenced and contractor for the work described in the foregoing application for payment. According to my knowledge and belief, all items and amounts shown on the face of this application for payment are correct, all work has been performed and/or materials supplied, the foregoing is a true and correct statement of the contract account up to and including that last day of the period covered by this application.	
Date:	**Contractor:**

APPENDIX I

Remedial System Optimization Table of Contents

CORE ENVIRONMENTAL CONSULTANTS

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