JS Rochdale Cleaners

Interim Remedial Measures Work Plan

165-50 Baisley Boulevard, Jamaica
Block 12495, Lot 2 (portion)
BCP Site # C241165

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau B
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Prepared for:
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CERTIFICATIONS

I, Matthew M. Carroll, certify that I am a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Interim Remedial Measures Work Plan was prepared in accordance with all applicable statues and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

091629	08/17/2017	Matthew M. Carroll, P.E.
NYS Professional Engineer #	Date	Signature

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education Law.

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LIST OF ACRONYMS

AGV	NYSDOH Air Guidance Value
AOC	area of concern
AS	air sparging
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
ECL	Environmental Conservation Law
BTEX	benzene, toluene, ethylbenzene and xylenes
CAMP	Community Air Monitoring Program
C&D	construction and demolition
CDS	construction dewatering system
Class GA Standards	NYSDEC TOGS 1.1.1 Class GA Ambient Water Quality Standards and Guidance Values
CEQR	City Environmental Quality Review
CFR	Code of Federal Regulations
CPP	Citizen Participation Plan
COC	Certificate of Completion
DCE	dichloroethylene
DER-10	NYSDEC Division of Environmental Remediation (DER), DER-10 / Technical Guidance for Site Investigation and Remediation
DRO	diesel range organics
DOC	dissolved organic carbon
DUSR	Data Usability Summary Report
EC	engineering control
ESA	Environmental Site Assessment
EZ	exclusion zone
FB	field blanks
FER	Final Engineering Report
ft-bs	feet below building slab
ft-bg	feet below sidewalk grade
ft-msl	feet above mean sea level
HASP	Health and Safety Plan
HSA	Hollow Stem Auger
HSO	Health and Safety Officer
IC	institutional control
ISCO	in-situ chemical oxidation
IRM	Interim Remedial Measure
MW	monitoring well
NGVD	National Geodetic Vertical Datum
NIOSH	National Institute for Occupational Safety and Health
NYCDEP	New York City Department of Environmental Protection
NYCDOB	New York City Department of Buildings
NYCDOT	New York City Department of Transportation
NYCRR	New York Codes, Rules and Regulations

NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOH-ELAP	NYSDOH Environmental Laboratory Approval Program
OSHA	Occupational Safety and Health Association
PCB	polychlorinated biphenyl
PCE	perchloroethylene, aka tetrachloroethylene
PID	photoionization detector
PP Metals	Priority Pollutant Metals
PPE	personal protective equipment
QA/QC	quality assurance / quality control
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RAWP	Remedial Action Plan
RCNY	Rules of the City of New York
RMO	Remedial Measure Objective
RE	Remedial Engineer
RI	remedial investigation
RSCOs	Recommended Soil Cleanup Objectives
RCUSCOs	6 NYCRR 375-6.8(b) – Restricted-Commercial Use Soil Cleanup Objectives
RRUSCOs	6 NYCRR 375-6.8(b) – Restricted-Residential Use Soil Cleanup Objectives
SB	soil boring
SV	soil vapor
SMP	Site Management Plan
SMMP	Soil/Material Management Plan
SSDS	sub-slab depressurization system
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TAGM 4046	NYSDEC Technical and Administrative Guidance Memorandum #4046
TB	trip blanks
TCE	trichloroethylene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TCLP Limits	USEPA Maximum Concentrations of Contaminants for the Toxicity Characteristic
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	underground storage tank
UUSCOs	6 NYCRR 375-6.8(a) Track 1 Unrestricted Use Soil Cleanup Objectives
VOC	volatile organic compound

EXECUTIVE SUMMARY

SITE DESCRIPTION/PHYSICAL SETTING/SITE HISTORY

This Interim Remedial Measures (IRM) Work Plan was prepared by Tenen Environmental (Tenen) on behalf of Rochdale Village Inc. (the "Participant"). On February 05, 2015, the Participant entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) to investigate and remediate the property located at 165-50 Baisley Boulevard (Block 12495, portion of Lot 2) in the Queens Borough of New York (the "Site"). The Site was accepted into the New York State Brownfield Cleanup Program on February 5, 2015 and the Site Number is C241165. The Site location is shown in Figure 1.

The Participant is proposing to depressurize beneath the entire footprint of Rochdale Mall #1 (Mall #1) outside of the Site footprint by installing an active sub-slab depressurization system (SSDS) as an Interim Remedial Measure (IRM). The remedial action for the Site will be addressed in a separate work plan. A September 2, 2015 Remedial Investigation Work Plan (RIWP) was approved by NYSDEC on September 13, 2015 and the RIWP was implemented in November 2015. Based upon the RI findings, NYSDEC requested additional off-Site sampling and an SRIWP was submitted to NYSDEC in March 2016. The SRI was completed in December 2016.

The objectives of the IRM Work Plan are to provide the means and methods to maintain a negative pressure under the Mall #1 building footprint (outside of the Site footprint); to be protective of human health and the environment; and, mitigate the potential further migration of contaminants in soil, groundwater, and soil vapor.

SUMMARY OF THE REMEDIAL INVESTIGATIONS

The findings of past environmental investigations indicate the presence of chlorinated solvents in soil, groundwater and indoor air above regulatory levels and at elevated levels in soil vapor. The concentrations of PCE in soil vapor and indoor air should be mitigated at the Site based on the NYSDOH Matrix 2. The concentrations of TCE in the indoor ambient air should be mitigated at the Site based on the NYSDOH Matrix 1.

The May 2010 Phase I ESA findings identified dry cleaning operations at the Site, including JS Cleaners, from 1996 to 2010 (the date of the Phase I ESA). Additionally an UST was identified at the Site with no associated closure documentation. Records indicate a fuel oil release during oil delivery in 1995; Spill Number 9510922 was assigned in November 1995. Reportedly, only one gallon of product was spilled and the NY Spills listing was closed the same day. The Phase II investigation conducted in September 2010 confirmed the presence of PCE in soil and groundwater. The soil vapor investigation conducted in December 2013 identified elevated levels of chlorinated solvents (PCE and TCE) in the indoor ambient air, and elevated levels of PCE in the soil vapor. Based on comparison with the NYSDOH matrices, the levels at JS Rochdale

Cleaners (165-60 Baisley Boulevard) require mitigation.

Based on the results of the 2015 RI and the 2016 SRI, the contaminants of concern at the Site include chlorinated solvents, specifically PCE; petroleum-related compounds; historic fill-related metals; and PCBs.

Chlorinated solvents and their breakdown products were detected at elevated levels in sub-slab and exterior soil vapor samples, indoor air and groundwater during the RI and SRI, with one compound (PCE) detected in soil above the Unrestricted Use SCO. Sampling identified PCE at elevated (above ambient level) soil vapor concentrations on- and off-Site below the sub-slab of Mall #1 and at lower concentrations at exterior off-Site locations. PCE was also detected in on- and off-Site groundwater wells, with a concentration above the Class GA standard at one well adjacent to the dry cleaning equipment. Several petroleum-related compounds, including xylenes, ethanol and trimethylbenzenes, were detected in soil vapor at concentrations above the ambient concentrations. One PCB isomer was detected above applicable regulatory levels in one soil sample. Two naturally occurring metals, iron and manganese, were identified in groundwater at total and dissolved concentrations above the Class GA Standard. Total lead and one PCB isomer were each detected slightly above the Unrestricted Use SCO in one sample.

QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

The results of the sampling completed to-date provided sufficient data to complete a preliminary Qualitative Human Health Exposure Assessment (QHHEA), which identified complete exposure pathways (inhalation of vapors and dermal contact with soil) with respect to Mall #1, outside of the Site footprint.

The potential exposure pathways associated with the IRM are temporary and of limited duration. Construction worker exposure to impacted soil vapor and particulates will be addressed by adherence to health and safety protocols. Potential exposure of neighborhood residents, Mall visitors and other off-site populations will be addressed through compliance with the Community Air Monitoring Plan (CAMP). A summary of the CAMP is included in Section 4.0 of the Health and Safety Plan (HASP) presented in Appendix A of this IRM.

SUMMARY OF THE INTERIM REMEDIAL MEASURES

The proposed interim remedial measures consist of the following:

- Installation of an active SSDS to depressurize below the entire footprint of Mall #1, outside of the Site footprint; and,
- Preparation of an IRM Construction Completion Report (IRMCCR) to document the implemented interim remedial measures.

Remedial activities will be performed at the Site in accordance with this NYSDEC-approved IRM Work Plan. Any deviations from the IRM Work Plan will be promptly reported to NYSDEC.

INTERIM REMEDIAL MEASURES WORK PLAN

1.0 INTRODUCTION

Rochdale Village Inc. (the "Participant") entered into the Brownfield Cleanup Program (BCP No. C241165) with the New York State Department of Environmental Conservation (NYSDEC) as a "Participant", to investigate and, where necessary, remediate contaminated soil, groundwater and soil vapor associated with the Site. The Site is located at 165-50 Baisley Boulevard, in the Jamaica neighborhood of Queens, NY. The Site is an active dry cleaners (JS Rochdale Cleaners), located within the Rochdale Village Mall (Mall #1), which is part of a larger community development and housing complex known as Rochdale Village. The Site is generally identified as a portion of Block 12495, Lot 2. This IRM Work Plan is applicable for the entirety of Mall #1; remedial measures for JS Cleaners will be discussed under separate cover.

The Participant entered into a Brownfield Cleanup Agreement (BCA) with NYSDEC on February 5, 2015. A Remedial Investigation (RI) was performed on the Site in accordance with the September 2, 2015 Remedial Investigation Work Plan (RIWP) approved by the NYSDEC on September 13, 2015. The RIWP was implemented in November 2015; data collected is summarized in Section 2.0. During a conference call on January 7, 2016, NYSDEC requested additional sampling to further delineate contaminant impacts detected during the 2015 RI. Based upon the RI findings, NYSDEC requested additional off-Site sampling and an SRIWP was submitted to NYSDEC in March 2016. The SRI was completed in December 2016.

The objective of the IRM Work Plan is to: provide the means and methods to maintain a negative pressure under the Mall #1 building footprint (outside of the Site footprint); to be protective of human health and the environment; and, mitigate the potential further migration of contaminants in soil vapors.

The IRM Work Plan will include the installation of an active sub-slab depressurization system (SSDS) to maintain a negative pressure beneath the entire footprint of Mall #1, outside of the Site footprint, and prevent any infiltration of vapors into the commercial spaces.

The procedures and reporting requirements contained in the IRM Work Plan are in accordance with NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010). Consistent with Sections 1.11 and 5.3 of the DER-10 document, this IRM Work Plan includes the following items:

- A summary of environmental investigation findings and a description of the Remedial Areas of Concern identified by these investigations;
- A description of the proposed interim remedial measures;
- Health and Safety and Community Air Monitoring Plans that describe monitoring procedures and vapor, odor and dust control to be implemented during the IRM;
- A schedule for implementation and reporting; and,
- A Professional Engineer's certification.

1.1 Site Location and Description

The Site is located at 165-50 Baisley Boulevard, in the Jamaica neighborhood of Queens, NY. The Site is currently vacant; the previous occupant, a dry cleaner (JS Cleaners), ceased operations in January 2017. The Site is located within the Rochdale Village Mall (Mall #1), which is part of a larger community development and housing complex known as Rochdale Village.

Rochdale Mall #1 is a one- and two-story retail and office building (141,000 gross square feet) with associated parking. The Rochdale Village complex is bounded by Baisley Boulevard, Bedell Street, 137th Avenue and Guy R. Brewer Boulevard. Mall #1 is located in the northwest corner of Rochdale Village with associated parking spaces fronting Baisley Boulevard and Guy R. Brewer Boulevard. The Site is a 3,160 square foot one-story retail space located in the eastern end of Rochdale Village Mall. The Site is located in Queens Community Board 12 and is generally identified as a portion of Block 12495, Lot 2.

The proposed IRM includes depressurizing under the entire Rochdale Mall #1 building slab, outside of the Site footprint, through the installation of an active SSDS. The off-site area to be depressurized is approximately 114,000 square-feet (sf).

The Site location is shown in Figure 1. The Site Layout is shown in Figure 2.

1.2 Description of Surrounding Property

The adjacent properties to the Site include commercial properties within Mall #1 and associated parking. The surrounding properties include commercial properties within the Rochdale Village Mall and associated parking and truck loading spaces. The Site is located less than 300 feet from two residential housing complexes to the east-southeast and south. The adjacent areas are predominantly residential and commercial areas within Rochdale Village. The properties across Baisley Boulevard to the north are commercial (restaurants, gas station) and religious (New Jerusalem Baptist Church). Properties across Guy R. Brewer Boulevard to the west are commercial (Walgreens) and residential. Residential buildings are present to the north and west of the Site in the surrounding area.

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

The approved RIWP (September 2015 RIWP) was fully implemented; however, an additional investigation was discussed with NYSDEC in a January 7, 2016 conference call. The Supplemental RI was completed in December 2016. The following sections summarize the sampling that has been completed to-date.

2.1 Summary of Remedial Investigations Performed

In 2010 and 2013, several environmental assessments or investigations were conducted at the Rochdale Village Community, including the Site, and are summarized in the following reports:

- *Phase I Environmental Site Assessment, Rochdale Village, 169-55 137th Avenue, Queens, NY 11434, Redacted May 25, 2010, GRS Group*
- *Phase II Environmental Assessment Limited Subsurface Investigation, Rochdale Village, 169-55 137th Avenue, Queens, NY 11434, Redacted September 17, 2010, GRS Group*
- *Soil Vapor Investigation, JS Rochdale Cleaners, 165-50 Baisley Boulevard, Queens, NY, 11434, December 2013, Jet Environmental*
- *Remedial Investigation, JS Rochdale Cleaners, 165-50 Baisley Boulevard, Queens, NY 11434, November 2015, Tenen Environmental*
- *Supplemental Remedial Investigation, JS Cleaners Rochdale Village, 165-50 Baisley Boulevard, Queens, NY 11434, December 2016, Tenen Environmental*

The findings of the above investigations are summarized below and in the September 2015 RIWP. Previous sample locations are shown on Figures 3 and 4.

Phase I Environmental Site Assessment, Rochdale Village, 169-55 137th Avenue, Queens, NY 11434, May 25, 2010, GRS Group.

A Phase I ESA for the entire Rochdale Village community was conducted in May 2010 identified historic and current use of the Site as a dry cleaner as a REC based upon information provided during the Site reconnaissance and records included in the database report. Based on the information included in the Phase I ESA, the duration of dry cleaning activities was approximately 19 years. JS Rochdale Cleaners was identified as a hazardous waste generator. A fuel oil tank located to the rear of JS Rochdale Cleaners was identified as a REC for the property. Records indicate a fuel oil release in 1995; Spill Number 9510922 was assigned in November 1995. Reportedly, only one gallon of product was spilled when fuel oil was being delivered to the Property, and the NY Spills listing was closed the same day.

Phase II Environmental Assessment Limited Subsurface Investigation, Rochdale Village, 169-55 137th Avenue, Queens, NY 11434, Redacted September 17, 2010, GRS Group

In September 2010, GRS Group conducted a soil and groundwater investigation at the Site. The investigation included the advancement of five borings, collection of five soil samples and collection of one groundwater sample from a temporary groundwater monitoring well. The

borings were advanced to depths of up to 16 ft-bg. Two borings, SB1 and SB2, were advanced on-Site near the containment room for the dry cleaning equipment. Boring SB3 was installed off-site to the east of the UST to a depth of 16 ft-bg, and was converted in temporary well TW1. Two additional borings were completed off-site; one to the south and one to the northwest of the Site. Each boring was field-screened for organic vapors using a photoionization detector (PID); the highest PID reading was 5.0 parts per million (ppm), identified in SB2 in the 0.5 to 2.0 ft. interval.

Soil samples were analyzed for volatile organic compounds (VOCs) using USEPA Method 8260. The groundwater sample was analyzed for VOCs using USEPA Method 8260.

The results of the soil sampling were compared to the NYSDEC Unrestricted Soil Cleanup Objectives (SCO) provided in 6 NYCRR Part 375. PCE was detected in SB1 at a concentration of 6.13 milligrams per kilogram (mg/kg), above the NYSDEC Unrestricted Use SCO of 1.3 mg/kg.

Groundwater results were compared to the NYSDEC Class GA Standards. PCE was detected in TW1 at a concentration of 12.3 micrograms per liter (ug/L) exceeding the NYSDEC Class GA Standard of 5.0 ug/L.

Soil Vapor Investigation, JS Rochdale Cleaners, 165-50 Baisley Boulevard, Queens, NY, 11434, December 2013, Jet Environmental

In December 2013, Jet Environmental Consulting LLC conducted a soil vapor investigation at the Site. The investigation included the collection of two sub-slab soil vapor samples, and one ambient indoor air sample. The soil vapor Investigation report has not been provided to Tenen; the laboratory analytical results from the investigation were provided. The results from the soil vapor investigation were compared to the NYSDOH Air Guideline Values (AGVs) as screening levels.

PCE was detected in the ambient indoor air sample at a concentration of 19,900 micrograms per cubic meter (ug/m^3), which exceeds the NYSDOH AGV of 30 ug/m^3. Trichloroethene (TCE) was also detected in the ambient indoor air sample at a concentration of 21.6 ug/m^3, above the NYSDOH AGV of 2 ug/m^3.

PCE was detected in both sub-slab soil vapor samples at concentrations of 747 ug/m^3 and 1,880 ug/m^3. TCE was detected in one sub-slab soil vapor sample at a concentration of 3.87 ug/m^3.

Remedial Investigation, JS Rochdale Cleaners Rochdale Village, 165-50 Baisley Boulevard, Queens, NY 11434, November 2015, Tenen Environmental

In November 2015 Tenen conducted a soil, groundwater, sub-slab and soil vapor remedial investigation at the Site in order to horizontally and vertically delineate the nature and extent of chlorinated solvent impacts at the Site and surrounding commercial and residential spaces with respect to the known location of PCE dry cleaning equipment. The methodology and results of the RI are summarized below.

Soil. A total of five soil borings (two interior and three exterior) were advanced at the Site. Interior soil borings were installed using a 420M Geoprobe® unit; off-Site soil borings were installed using a hollow-stem auger (HSA) drill rig. The two interior shallow soil borings were advanced within the Site building footprint at locations adjacent and crossgradient of the location of PCE storage areas and PCE-containing dry cleaning equipment. Three shallow and two deep exterior soil borings were advanced to delineate contamination to the north, east and south of the Site. Shallow soil borings were advanced to approximately seven feet below the water table; deep soil borings were advanced to a depth of 35 ft-bg. Within each boring, a soil sample from each of the following intervals was collected and analyzed: two feet below grade, from the zone of highest suspected contamination (if present), the next apparent non-impacted zone, from the water table interface, and from the terminal depth of the boring. Boring JS-SB-2D was extended to 50 ft-bg to determine the presence of a clay layer; no clay layer was encountered. A photoionization detector (PID) was used to screen the soil borings. Suspected contamination due to elevated PID readings (max 21.7 parts per million) was assumed for at location JS-SB-1(13-14); additional sampling was collected at this interval. The soil analytical results were compared to the New York State Department of Environmental Conservation (NYSDEC) Unrestricted Use, Restricted-Commercial Use and Protection of Groundwater Soil Cleanup Objectives (SCOs) provided in 6 NYCRR Part 375. PCE was detected above Unrestricted and Protection of Groundwater SCOs at 1.6 milligram per kilogram (mg/kg) at the groundwater interface, located inside the Site building footprint adjacent to the location of dry cleaning equipment. Sampling was collected at the next apparent clean zone, between the interval 19-20 ft-bg. PCE was detected at this interval at a low concentration of 0.0012 mg/kg, and subsequently was not detected at the end of the boring, between interval 20-21 ft-bg. PCE was not detected in any other soil boring locations except at low concentrations within the shallow intervals (one to five ft-bg) at JS-SB-5, located to the northeast of the Site. Total lead and one pesticide, Aroclor 1242, were detected at low levels above their respective Unrestricted Use SCOs within the shallow interval (0-2 ft-bg) at location JS-SB-3D. Aroclor 1242, was detected at 0.124 mg/kg above the 0.1 mg/kg Unrestricted Use SCO. Total lead was detected at 67 mg/kg, above the Unrestricted Use SCO of 63 mg/kg. No polychlorinated biphenyls (PCBs) or semivolatile organic compounds (SVOCs) were detected above SCOs.

Groundwater. Three boring locations were converted to permanent groundwater wells (including two cluster wells). One interior shallow groundwater well (JS-GW-1) was advanced to a depth of 20 ft-bg at soil boring location JS-SB-1. Cluster wells at locations JS-SB-2 and JS-SB-3 included co-located shallow and deep wells to evaluate the horizontal and vertical extent of contamination in groundwater. Groundwater samples were collected from all shallow and deep wells (five in total). Groundwater results were compared to the NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Water Quality Standards and Guidance Values (Class GA Standards). PCE was detected above the Class GA Standard of 5 micrograms per liter (ug/l) in the shallow interior well (JS-GW-1) located adjacent to the dry cleaning equipment at a concentration of 620 ug/l. Elevated concentrations were not detected in any of the other groundwater wells. Iron and manganese (dissolved and total) were detected in JS-GW-1, above their respective Class GA Standards. No PCBs, SVOCs or pesticides were detected above Class GA Standards.

All monitoring wells were surveyed and groundwater flow was measured in a northwesterly

direction. Depth to groundwater ranged from approximately 13.79 to 14.97 ft-bgs.

Soil Vapor. On- and off-Site soil vapor points were installed to confirm and delineate previously identified impacts. Sub-slab and soil vapor concentrations were compared to measured ambient air concentrations (JS-AA), located upwind of the Site. One on-Site interior sub-slab soil vapor point (JS-SS-1) was installed in the vicinity of the dry cleaning machine. PCE was detected at this location at a concentration of 5,280 micrograms per cubic meter (ug/m^3) above non-detect ambient air concentrations. Four exterior sub-slab vapor points (JS-SS-2 through JS-SS-5) were advanced within the neighboring commercial spaces of Rochdale Mall #1. Elevated levels of PCE were detected at all of these points with concentrations ranging from 2780 ug/m^3 at JS-SS-4 to 8610 ug/m^3 at JS-SS-5. Trichloroethane (TCE) was detected in three sub-slab locations, including one on-Site (JS-SS-1) and two within the adjacent commercial space (JS-SS-2 and JS-SS3). TCE concentrations ranged between 16.10 (JS-SS-2) to 37.20 ug/m^3 (JS-SS-1) above non-detect ambient air readings. Four off-site exterior soil vapor points (JS-SV-1 through JS-SV-4) were installed to a depth of six feet below grade in order to investigate the potential migration of chlorinated solvents with respect to the neighboring residential buildings. Elevated levels of PCE were detected in all four soil vapor points, ranging from 509 ug/m^3 (JS-SV-3) to 1830 ug/m^3 (JS-SV-2).

Three soil vapor sample points were advanced within the courtyard canopy area at Rochdale Mall #2. PCE was not detected at the two exterior locations closest to the Site (HIP-SV-1 and HIP-SV-2); however, it was detected at HIP-SV-3 at a concentration of 1,340 ug/m^3. Five off-site sub-slab points were installed at a depth of six inches below the slab. PCE was detected in all sub-slab points at elevated concentrations above ambient air. Detected concentrations ranged from 110 ug/m3 (HIP-SS-4) in the commercial space across the courtyard to 800,000 ug/m^3 (HIP-SS-3) in the adjacent commercial store. Trichloroethane (TCE) was detected in several sub-slab samples including on-Site and off-Site commercial spaces. The highest TCE concentration was identified within the adjacent commercial space at HIP-SS-3 with a concentration of 2,790 ug/m^3. Several petroleum-related compounds were detected at HIP-SS-4, likely attributable to off-site sources.

Remedial Investigation, JS Rochdale Cleaners Rochdale Village, 165-50 Baisley Boulevard, Queens, NY 11434, November 2015, Tenen Environmental

In December 2016 Tenen conducted a soil, groundwater, indoor air and soil vapor remedial investigation at the Site in order to horizontally delineate the nature and extent of chlorinated solvent impacts at the Site and surrounding commercial and residential spaces with respect to the known location of PCE dry cleaning equipment. The methodology and results of the Supplemental RI (SRI) are summarized below.

Soil. One shallow interior, off-Site soil boring was advanced using a Geoprobe® unit within the corridor space adjacent to the Site. Soil boring JS-SB-6 was advanced to approximately seven feet below the water table. A soil sample from each of the following intervals was collected and analyzed: two feet below grade, from the zone of highest suspected contamination (if present), the next apparent non-impacted zone, from the water table interface, and from the terminal depth of the boring.

Soil samples were analyzed for TCL VOCs plus 10 TICs. The soil analytical results were compared to the NYSDEC Unrestricted Use, Restricted-Commercial Use and Protection of Groundwater Soil Cleanup Objectives (SCOs) provided in 6 NYCRR Part 375. No VOCs were detected above Unrestricted, Protection of Groundwater, and Commercial Use SCOs.

Groundwater. One shallow soil boring (JS-SB-6) was converted to a permanent groundwater well. Sample JS-GW-6 was analyzed for TCL VOCs plus 10 TICs to evaluate horizontal cVOC contamination in the downgradient location within the interior service corridor of Mall #1. Groundwater results were compared to the NYSDEC Division of Water TOGS Class GA Water Quality Standards and Guidance Values (Class GA Standards).

PCE was detected at this off-Site location below the Class GA Standard with a concentration of 1.3 ug/L. This location, JS-GW-6, contained a headspace PID reading of 441 ppm during field sampling.

All monitoring wells were surveyed and groundwater flow was measured in a southeasterly direction. The groundwater elevation was measured to be approximately 8.82 ft-bgs.

Soil Vapor. Three off-site soil vapor points were installed at intermediate depths to investigate the potential presence of chlorinated solvents with respect to the surrounding neighborhood. Soil vapor point JS-SV-6 was advanced to delineate contamination adjacent to the residential building located approximately 210-feet to the south. PCE was detected at this location at 2.45 ug/m^3 above the non-detect ambient air concentration. Toluene was also detected at this location with a concentration of 6.93 ug/m^3 above the ambient air concentration of 2.26 ug/m^3. Soil vapor point JS-SV-7 was advanced to delineate contamination adjacent to the residential building approximately 160 feet to the east. PCE was detected at this location with a concentration of 4.55 ug/m^3 above the non-detect ambient air concentration. Soil vapor point JS-SV-6 was advanced to delineate contamination adjacent to the public school located approximately 450 feet to the north. PCE was detected at a concentration of 3.04 ug/m^3 above the non-detect ambient air concentration.

One indoor air sample (IA-JS) was collected and co-located with the highest 2015 RI PCE level in sub-slab vapor (JS-SS-5). PCE was detected in this sample at a concentration of 2.39 ug/m^3 above the non-detect ambient air concentration.

2.2 Summary of Remedial Investigation Findings

The findings of past environmental investigations indicate the presence of chlorinated solvents in soil, groundwater and indoor air above regulatory levels and at elevated levels in soil vapor. The concentrations of PCE in soil vapor and indoor air should be mitigated at the Site based on the NYSDOH Matrix 2. The concentrations of TCE in the indoor ambient air should be mitigated at the Site based on the NYSDOH Matrix 1.

The May 2010 Phase I ESA findings identified dry cleaning operations at the Site, including JS

Cleaners from 1996 to present. Additionally a UST was identified at the Site with no associated closure documentation. Records indicate a fuel oil release in 1995; Spill Number 9510922 was assigned in November 1995. Reportedly, only one gallon of product was spilled when fuel oil was being delivered to the Property, and the NY Spills listing was closed the same day. No closure documentation was provided for review. The Phase II investigation conducted in September 2010 confirmed the presence of PCE in soil and groundwater. The soil vapor investigation conducted in December 2013 identified elevated levels of chlorinated solvents (PCE and TCE) in the indoor ambient air, and elevated levels of PCE in the soil vapor. Based on comparison with the NYSDOH matrices, the levels at JS Rochdale Cleaners (165-60 Baisley Boulevard) require mitigation. Expanding upon previous sampling results, the September 2015 RI confirmed the presence of PCE in the groundwater, soil, sub-slab and soil vapor on-site and off-site within the adjacent and surrounding areas. Cluster groundwater wells were installed at two locations to evaluate vertical delineation of chlorinated solvents; on shallow groundwater well was advanced on-site adjacent to the location of dry cleaning equipment. Results showed that PCE was detected at a high concentration above the Class GA standard, in the on-site shallow well sample. PCE was detected above Unrestricted Use SCOs in the shallow interval in the corresponding soil boring. Detected sub-slab PCE concentrations above ambient air levels were detected throughout Rochdale Village Mall #1, the highest of which were on-site and within the adjacent and neighboring commercial spaces within the mall. Soil vapor sampling identified PCE in all four of the exterior locations.

The concentrations and distribution of chlorinated solvents, specifically PCE, are consistent with the presence of an on-Site source and confirm contamination previously documented at the Site. The results of the RI were presented to NYSDEC in a conference call on January 7, 2016. Based on these findings, and noting that the measured groundwater flow from the RI was inconsistent with the assumed flow direction, NYSDEC requested additional sampling to further delineate horizontal contamination. The supplemental sampling to be performed is described in this Work Plan and includes additional soil vapor sampling to further delineate impacts in the areas adjacent to public and residential spaces within the surrounding area. One soil boring, to be converted to a permanent shallow groundwater well, is proposed to delineate horizontally in the location of the measured groundwater flow between the Site and adjacent commercial spaces within Rochdale Mall #1 to the northwest.

The SRI was conducted in December 2016 to evaluate horizontal chlorinated VOC impacts with respect to the neighboring community. One interior soil boring was advanced within the hallway corridor space downgradient of the site and converted to a permanent groundwater well. Soil results identified no VOCs detected above Unrestricted, Protection of Groundwater, and Commercial Use SCOs. In groundwater sample results, PCE was detected below the Class GA Standard at a concentration of 1.3 ug/L. The groundwater monitoring well was surveyed and groundwater was measured to be flowing in a southeasterly direction. The groundwater elevation was measured to be approximately 8.82 ft-bgs.

As part of the SRI, three off-site soil vapor points were installed at intermediate depths to investigate the potential presence of chlorinated solvents with respect to the surrounding neighborhood. The concentrations of PCE in soil vapor samples collected as part of the SRI to delineate horizontal contamination between the Site and the neighboring community are

comparatively low.

The concentrations and distribution of chlorinated solvents, specifically PCE, are consistent with the presence of an on-site source and have delineated contamination previously documented at the Site. The results of the RI and SRI sampling have sufficiently delineated the horizontal extent of PCE impacts below the NYSDOH Air Guidance Value of 30 ug/m^3 in the NYSDOH Matrices within the exterior soil vapor at the Site and in the neighboring community. The results of the RI and SRI have adequately delineated the horizontal extent of PCE contamination in groundwater to concentrations below Class GA Standards. The results of the RI and SRI have adequately delineated the vertical and horizontal extent of PCE contamination in soil to concentrations below the Unrestricted Use SCO for PCE.

2.3 Geological Conditions

2.3.1 Topography

The surface topography slopes down to the southeast toward Jamaica Bay and the Atlantic Ocean. Based on the U.S. Geological Survey (Brooklyn-NY and Coney Island-NY Quadrangles) topographic maps, the property lies at an elevation of approximately 21 feet above the National Geodetic Vertical Datum of 1929 (an approximation of mean sea level).

2.3.2 Geology

Based on the 2015 RI sampling, the Site is underlain by shallow soils including historic fill material (silty sands mixed with anthropogenic materials) and fine to medium sand and silts to a depth of approximately ten feet below grade (ft-bg). The lithology below the shallow soils consists of medium to coarse grain sand and gravel to depths of up to 50 ft-bg. One soil boring was advanced to 50 ft-bg to investigate the potential presence of a confining layer; no clay layer was encountered. The approximate depth to bedrock (Ravenswood Granodiorite) is 800 ft-bg.

2.3.3 Hydrogeology

Groundwater was encountered at approximately 14 ft-bg. The groundwater flow direction measured in the most recent rounds of gauging is generally toward the southeast.

Investigations at the Site have documented contaminants levels above the NYSDEC Technical and Operation Guidance Series for NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Water Quality Standards and Guidance Values (Class GA Standard). There are no known wellhead protection areas or specifically designated groundwater recharge areas in the vicinity of the site. Groundwater in this area is not used as a source of potable water.

2.4 Contamination Conditions

The identified contaminant source includes the historic use of the Site as a dry cleaner. Given the presence of PCE in soil, soil vapor and groundwater, long-term discharge of the solvent used in dry cleaning operations is the assumed source of contamination.

2.5 Environmental and Public Health Assessments

2.5.1 Qualitative Human Health Exposure Assessment

Based upon the information collected to date, a preliminary qualitative exposure assessment (EA) has been completed in accordance with Section 3.3(c)4 of DER-10 and the NYSDOH guidance for performing a qualitative EA (NYSDEC DER-10; Technical Guidance for Site Investigation and Remediation; Appendix 3B). The qualitative exposure assessment evaluates the potential for populations to be exposed to contaminants during the implementation of the IRM.

An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: (1) a contaminant source; (2) contaminant release and transport mechanisms to an exposed population; (3) a receptor population; (4) a route of exposure; and (5) a point of exposure to a receptor population. Potential contaminant receptors include the following populations:

- Site and commercial store employees in Mall #1 and environmental professionals
- Mall visitors
- Off-Site residents/Rochdale Village staff

The following assessments evaluate how humans might be exposed to Site-related contaminants and whether there are any complete or potentially complete exposure pathways now and under the reasonably anticipated future land use of the Site.

Contaminant Sources

Based on the results of the 2015 RI and the 2016 SRI, the contaminants of concern at the Site include chlorinated solvents, specifically PCE; petroleum-related compounds; historic fill-related metals; and PCBs.

Chlorinated solvents and their breakdown products were detected at elevated levels in sub-slab and exterior soil vapor samples, indoor air and groundwater during the RI and SRI, with one compound (PCE) detected in soil above the Unrestricted Use SCO. Sampling identified PCE at elevated (above ambient level) soil vapor concentrations on- and off-Site below the sub-slab of Mall #1 and at lower concentrations at exterior off-Site locations. PCE was also detected in on- and off-Site groundwater wells, with a concentration above the Class GA standard at one well adjacent to the dry cleaning equipment. Several petroleum-related compounds, including xylenes, ethanol and trimethylbenzenes, were detected in soil vapor at concentrations above the ambient concentrations. One PCB isomer was detected above applicable regulatory levels in one soil sample. Two naturally occurring metals, iron and manganese, were identified in groundwater at total and dissolved concentrations above the Class GA Standard. Total lead and one PCB isomer were each detected slightly above the Unrestricted Use SCO in one sample.

Contaminant Release and Transport Mechanisms

Historic dry cleaning operations were conducted at the Site for a period of at least 19 years. Based upon the location and distribution of elevated PCE concentrations, these impacts are attributable to the dry cleaning operations involving the use, storage and disposal of PCE. The

distribution of PCE in groundwater, soil and soil vapor supports JS Cleaners as the source of the identified PCE impacts.

PCE impacts have been vertically and horizontally delineated to below regulatory levels and the NYSDOH AGV based on the findings of the 2015 RI and 2016 SRI.

Potential Receptor Populations
The potential on-site receptors include Site workers (primarily environmental professionals and contractors), employees and customers of the commercial spaces, visitors and trespassers. Future potential on-site receptors include future employers, employees, customers, workers and utility workers. The potential off-site receptors include off-site workers, customers and residents.

Potential Routes and Points of Exposure
The findings of prior investigations and the RI/SRI indicate that PCE is present in soil vapor and/or indoor air at the Site and in nearby commercial units within Mall #1. PCE is also present at lower concentrations in soil vapor in the surrounding area. PCE was detected above regulatory threshold concentrations in shallow soil below the basement of the historic dry cleaner. The potential exists for exposure via dermal absorption and inhalation, and incidental ingestion if proper protective measures are not implemented during ground-intrusive sampling and implementation of the anticipated Interim Remedial Measure (IRM), which will entail removal of portions of the building slab, removal of PCE hot spots and installation of a sub-slab depressurization system (SSDS). Exposure of environmental professionals during sampling and IRM implementation will be mitigated by adherence to a HASP. The potential for exposure of Site workers and nearby residents to contaminated soil via on-site handling and off-site transportation of disturbed soil will be avoided by implementation of a CAMP and HASP.

Groundwater concentrations of PCE and total and dissolved metals were detected above the Class GA Standards, which were developed to be protective of public health based upon groundwater as a potential drinking water source. Exposure to these contaminants via drinking water is not applicable to the Site given the fact that the Site and surrounding community are supplied by an upstate New York municipal system.

The Site will not be redeveloped and no dewatering will occur. Dermal and inhalation exposure to VOCs in groundwater should be limited to environmental professionals collecting groundwater samples for environmental analysis. This exposure would be mitigated by adherence to a HASP during sampling activities.

No future residential use of the Site is contemplated. There is potential for volatilization of chlorinated solvents and petroleum-related compounds into indoor and ambient air during implementation of the anticipated Interim Remedial Measure. Inhalation exposure of Site workers and nearby residents will be mitigated by adherence to a HASP during sampling and remedial activities.

The following potential exposure routes are considered incomplete or not applicable to the IRM:

Groundwater Ingestion

New York City code and the environmental easement for the Site prohibit the use of groundwater for potable purposes. Groundwater will not be encountered during implementation of the IRM, except during sampling by environmental professionals under the approved RIWP; this exposure route is considered below. The groundwater ingestion pathway is incomplete.

Inhalation of Vapors by Future Mall Building visitors and Commercial Stores Worker
This pathway will be evaluated following completion of the IRM. It is assumed that the potential for vapor exposure will remain and an active SSDS will address this pathway.

The following potential exposure routes are considered complete:

Inhalation of Vapors and Particulates by On-Site Environmental and Construction Workers
During the installation of the SSDS, on-Site personnel and construction workers may be exposed to dust and vapors via inhalation.

Dermal Contact with Soil by On-Site Environmental and Construction Workers
During the installation of the SSDS, on-Site personnel and construction workers may be exposed to contaminants in soil via dermal contact.

Inhalation of Vapors and Particulates by Mall Building Visitors and Commercial Stores Worker
SSDS installation may generate dust and vapors that could be inhaled by mall building visitors and commercial stores worker. Exposure via this route will be mitigated by excavating the soil inside an enclosure for SSDS installation purpose and implementation of the CAMP.

The above potential exposures are limited to the IRM phase and are temporary and of limited duration. Adherence to health and safety protocols will address worker exposure to contaminated soil vapors and particulates. Potential exposure of off-Site residents and building occupants will be addressed by implementation of the Community Air Monitoring Plan (CAMP) summarized in Section 4.0 of the HASP provided in Appendix A.

2.6 Interim Remedial Measure Objectives

The goal of the IRM is to induce a negative pressure, relative to the indoor air pressure, beneath the slab of Mall #1 building, outside of the Site footprint, to prevent infiltration of vapors into the building. Based on the results of previous investigations conducted at the Site, the following Remedial Action Objectives (RAOs) have been identified and will be achieved by the IRM described in Section 3.0 of this IRMWP.

The successful implementation of the IRM would result in the installation of an active SSDS to induce a negative pressure below the Site and Mall #1 Building floor. Installation of SSDS components will include minor shallow soil excavation.

2.6.1. Soil

PCE was detected in the shallow soil above the Unrestricted Use SCOs at the source area on the Site. No PCE was detected in the soil above the Unrestricted Use SCOs near or away from the Site.

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure to contaminants volatilizing from soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

2.6.2 Soil Vapor

PCE was detected in the soil vapor.

RAOs for Public Health Protection

- Reduce the risk of impacts to public health resulting from existing, or the potential, for, soil vapor intrusion into the Mall #1 commercial spaces, outside of the Site footprint.

2.6.3 Groundwater

PCE was detected above the Class GA Standard in the shallow on-site interior groundwater well; however, groundwater will not be encountered during the implementation of the IRMWP.

3.0 DESCRIPTION OF INTERIM REMEDIAL MEASURE

The IRM will include installation of an active SSDS at the Mall #1 building. The IRM will be implemented in accordance with the Standards, Criteria and Guidance (SCGs) described in Section 3.1.

3.1 Standards, Criteria and Guidance (SCGs)

The IRM SCGs are listed below.

SCG	Scope / Application
NYSDEC Brownfield Cleanup Program Guide (draft 2004)	General program guidance
NYSDOH Guidance for Evaluating Soil Vapor Intrusions in the State of New York (2006)	Soil vapor guidance
NYSDOH Generic Community Air Monitoring Plan	Plan for monitoring dust and volatile organics resulting from construction activities
New York State Codes, Rules and Regulations (NYCRR) Title 6 Part 360 – Solid Waste Management Facilities	Off-site disposal of waste
New York State Codes, Rules and Regulations (NYCRR) Title 6 Part 364 – Waste Transporter Permits	Transporter requirements for off-site disposal of waste
6 NYCRR Part 370 – Hazardous Waste Management System	Disposal of hazardous waste, if encountered
6 NYCRR Part 375 – Environmental Remediation Programs (December 2006)	General administrative guidance
6 NYCRR Part 376 – Land Disposal Restrictions	Disposal of hazardous waste, if encountered
Code of Federal Regulations (CFR) Title 29 Part 1910.120 - Hazardous Waste Operations and Emergency Response Standard	Worker safety
29 CFR Title 29 Part 1926 - Safety and Health Regulations for Construction	Worker safety

4.0 INTERIM REMEDIAL PROGRAM

4.1 Governing Documents

4.1.1 Site Specific Health and Safety Plan

A Site Specific HASP has been created for the Site and is included in Appendix A. All remedial work performed under this plan will be in full compliance with governmental requirements, including Site and worker safety requirements mandated by Federal OSHA. An emergency contact sheet with names and phone numbers is included in Table 1 of the HASP and defines the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency. The HASP and requirements defined in this IRM pertain to all remedial and invasive work performed at the Site until the issuance of a Certificate of Completion.

4.1.2 Soil/Materials Management Plan

The Soil/Materials Management Plan (SMMP) includes plans for managing all soils/materials that are disturbed at the Site. The SMMP, which describes procedures for handling, storage, and transport and disposal is included in Appendix C.

4.1.3 Community Air Monitoring Plan

The purpose of the Community Air Monitoring Plan (CAMP) is to protect downwind and nearby receptors (e.g., Mall #1 workers and visitors, residences, businesses, schools, and the public) from potential airborne contaminants released as a direct result of the Remedial Action being performed at the Site. A summary of the CAMP plan is included in Section 4.0 of the HASP, which is presented in Appendix A.

4.1.4 Citizen Participation Plan

The Citizen Participation Plan (CPP) enables citizens to participate more fully in decisions that affect their health, environment and social well-being. The CPP was included as part of the Remedial Investigation Work Plan. No additional comments have been made.

4.2 General Remedial Construction Information

4.2.1 Project Organization

An organization chart with emergency contacts is included in Table 1. Resumes of key personnel involved in the IRM are included as Appendix F.

4.2.2 Remedial Engineer

The Remedial Engineer (RE) for this project will be Matthew M. Carroll, P.E. The RE is a registered professional engineer (PE) licensed by the State of New York. The RE will have primary direct responsibility for implementation of the remedial program for the JS Rochdale Cleaners, Block 12495, portion of Lot 2 Site (NYSDEC BCA Site No. C241165). The RE will certify in the an IRMCCR that the IRM was performed by qualified environmental professionals under his supervision and that the remediation requirements set forth in the IRMWP and any other relevant provisions of ECL 27-1419 have been achieved in conformance with that Plan.

The RE will coordinate the work of other contractors and subcontractors involved in all aspects of remedial construction, including air monitoring. The RE will be responsible for all appropriate communication with NYSDEC and NYSDOH.

4.2.3 Remedial Action Construction Schedule

A general IRM schedule is included in Table 2.

4.2.4 Utility Markout and Easement Layout

The Participant and its contractors are solely responsible for the identification of utilities that might be affected by work under the IRM and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this IRM. The Participant and its contractors are solely responsible for safe execution of all invasive and other work performed under this IRM. The Participant and its contractors must obtain any local, State or Federal permits or approvals pertinent to such work that may be required to perform work under this IRM. Approval of this IRM by NYSDEC does not constitute satisfaction of these requirements.

4.2.5 Required Permits

Any permits will be listed in the RAWP and IRMCCR.

4.2.6 Site Security and Signage

The existing walls at the Site and adjoining units will be maintained as required throughout the IRM. A project sign will be erected at the entrance to the Site prior to the start of any remedial activities; sign details and specifications will be provided to the NYSDEC Project Manager prior to its commissioning. Rochdale Mall #1 has security 24 hours a day, seven days a week.

4.2.7 Deviations from the Interim Remedial Measures Work Plan

During the implementation of the IRMWP, any material deviation will be noted and immediately brought to the attention of the RE. The RE or his/her representative will contact the NYSDEC Project Manager and determine if the deviation necessitates a formal IRM modification and NYSDEC approval. If no formal IRM modification is required, the deviation will be noted in the Site reports and explained in the IRMCCR.

4.2.8 Work Hours

The hours for operation of remedial construction will conform to the requirements of the City of New York, New York or according to specific variances issued by the governing agency. NYSDEC reserves the right to deny alternate remedial construction hours.

4.2.9 Traffic Control

A truck route to and from the Site from the nearest major highway has been selected considering:

- Limited transport through residential areas
- Use of defined truck routes
- Limiting the total distance to the major thoroughfares, and
- Safety in access to highways

Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during site remediation and development; trucks exiting the Site will be securely covered. Drivers of trucks leaving the Site with soil/fill will be instructed to proceed without stopping in the vicinity of the Site to prevent neighborhood impacts.

It is contemplated that all soil generated will be placed in 55-gallon drums that will be stored at Rochdale Village until a pickup is scheduled; this will limit the truck traffic from the implementation of this IRMWP.

4.2.11 Worker Training and Monitoring

Site workers involved with hazardous waste, as determined by 40 CFR 262.11 and ECL 27-0903 or a "source area" as determined by DER-10 1.3(b)70 at the Site will be required, at a minimum, to have completed 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response (HAZWOPER), site safety training and medical monitoring for site workers. HAZWOPER training completion certificates will be submitted to the RE before commencement of site work.

4.2.12 Pre-Construction Meeting with NYSDEC

The NYSDEC project manager will be invited to attend a pre-IRM meeting at the Site with all parties involved in the remedial process prior to implementation of the IRM.

4.2.13 Emergency Contact Information

An emergency contact sheet with names and phone numbers is included in Table 1. That document will define the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency.

4.3 Site Preparation

4.3.1 Mobilization

The remediation contractor will mobilize all necessary materials and equipment on Site directly prior to the initiation of any remedial activities. Mobilization includes field personnel orientation, equipment mobilization, marking/staking sampling locations and utility mark-outs. Each field team member will attend an orientation meeting to become familiar with the general operation of the Site, health and safety requirements, and field procedures.

4.3.2 Equipment and Material Staging

Equipment and materials will be stored and staged in a manner that complies with applicable laws and regulations. There will be no specific material or equipment staging area; any staging will be

in areas where space permits. Excavated soil is expected to be secured in 55-gallon drums, labeled and staged within the designated staging area. Soil stockpiles are not anticipated; in the event that stockpiling is necessary, they will be placed in clear areas in accordance with Section 1.2 of the Soil/Materials Management Plan included as Appendix C.

4.3.3 Construction Loading Zone

Measures will be taken to ensure that adjacent commercial spaces and surrounding roadways will be kept clean of project-related soils, fill and debris. Additional information is included in Section 5.6.

5.0 INTERIM REMEDIAL MEASURE IMPLEMENTATION: INSTALL ACTIVE SSDS

The off-Site vapor mitigation will be accomplished with the installation of an active SSDS to depressurize the footprint of Mall #1 outside of the Site.

5.1 Sub-slab Depressurization System

An active SSDS will be installed to minimize the potential for vapor intrusion by creating a preferential pathway for sub-slab vapors. The system designs and layouts are shown on drawings X-100 (SSDS sub-slab layout and pressure test locations), X-101 (SSDS at-grade piping and layout), X-102 (roof layout) and X-103 (SSDS details), all of which are located in Appendix E.

The SSDS will depressurize below the current at-grade slab. The principal components of the SSDS include the installation of seven suction pits (final number to be confirmed by a pressure field extension test) beneath the existing at-grade slab, to be connected to a fan on the roof via cast iron (interior) and PVC (exterior) piping. To create the suction pits, the existing slab will be saw cut and the underlying soil will be removed to a depth of at least 24-inches. The void space will be lined with geotextile fabric and a layer of ¾" clean stone aggregate (or similar material).

The suction pits will be installed under an actively vented tent or sealed structure. At each location, a portable blower fan with a minimum flow of 2,000 cubic feet per minutes (CFM) will be mobilized. Disposable plastic ventilation ducting will be used to vent the exhaust. The exhaust location will be above the roof of the building. The active SSDS is a permanent engineering control for the off-site commercial spaces within Mall #1. The layout of the proposed suction pits is included on drawing X-100 and the details are shown on drawing X-103, both in Appendix E.

The goals of the systems are to create a pressure differential of at least -0.02 inches of water column (in-wc) between the indoor and sub-slab environments; however, differential pressure readings at or above -0.004 in-wc will be considered acceptable. An alarm system will be installed that will notify the building management if a drop in pressure indicates that the system is not operating as designed. The system has been designed in general accordance with NYSDOH's Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006 (NYSDOH Soil Vapor Guidance), including Section 4.2.2, *System-specific recommendations*. The exhaust location will be located on the roof and meet the requirements of the NYSDOH Soil Vapor Guidance, specifically Section 4.2.2 c (6), which reads:

> To avoid entry of extracted subsurface vapors into the building, the vent pipe's exhaust should be:
>
> i. above the eave of the roof (preferably, above the highest eave of the building at least 12 inches above the surface of the roof),
>
> ii. at least 10 feet above ground level,
>
> iii. at least 10 feet away from any opening that is less than 2 feet below the exhaust point, and

iv. 10 feet from any adjoining or adjacent buildings, or HVAC intakes or supply registers.

A pressure field extension test will be completed prior to installation of the suction pits. A shop vac or similar will be used to apply suction at one-inch diameter holes through the slab at the proposed suction pit locations. The shop vac will be vented outside of Mall #1. At select locations, a ¼-inch hole will be drilled through the slab and the pressure measured when suction is applied.

If necessary, following the installation of the suction pits, a suction test will be completed in order to size a blower. A regenerative blower will be mobilized to the Site and a step-test will be completed to determine the flows from each suction pit to depressurize below the slab at least -0.02 in-wc. The above-grade head losses will be modeled using the Darcy-Weisbach equation.

A Site Management Plan (SMP) will be prepared following the implementation of the IRMWP and kept at the Site. The operation of the SSDSs will not be discontinued without written approval by NYSDEC and NYSDOH. A proposal to discontinue the SSDS may be made based on confirmatory sampling.

An alarm system will be installed that will notify the building management if a drop in pressure indicates that the system is not operating as designed. In general, a pressure switch will be placed on the main risers with a field-set switch point. The alarm will be a horn-strobes mounted in the service corridor adjacent to the Site.

The locations of the pressure switches and alarms are shown on drawings X-101 and X-102 in Appendix E.

Initial Start-Up Prior to Building Occupancy

After the depressurization system has been installed, the following will be completed to ensure that the system meets the remedial requirement of a -0.004 in-wc or greater pressure differential.

- Visual inspection of basement slab for any cracks or holes. If any are identified, they will be sealed using caulk.
- Measurement of the sub-slab pressure at permanent pressure-monitoring points to ensure that the remedial requirement of -0.004 in-wc has been achieved. If the start-up is not conducted during heating season, the pressure differential will also be measured during heating season to ensure that the remedial requirement of -0.004 in-wc has been achieved.
- If appliances that rely on natural draft for exhaust of carbon monoxide and other combustion gases are identified, the potential for back draft will be tested. The potential for back draft will be determined using a carbon monoxide meter. If any back draft is identified, it will be corrected.

A written record of the annual monitoring will be kept with the SMP. If any of the above items suggest that the SSDS may have been impacted beyond the need for routine maintenance, the building management will contact an environmental professional. If the operation of the SSDS has been impacted, NYSDEC will be contacted. If non-routine maintenance or repairs are

required based on the annual inspection or an alarm condition, the system will be restarted as described in the "Initial Start-Up Prior to Building Occupancy" section.

6.0 REPORTING

This section outlines the reporting requirements for the Site. All daily and monthly reports will be included in an IRMCCR. Job-site record keeping for all remedial work will be appropriately documented. These records will be maintained on-Site at all times during the project and be available for inspection by NYSDEC and NYSDOH staff.

6.1 Daily Reports

Daily reports will be submitted to NYSDEC and NYSDOH Project Managers by the end of each day following the reporting period and will include:

- An update of progress made during each day;
- Locations of work and quantities of material imported and exported during the IRM;
- References to alpha-numeric map for IRM activities;
- A summary of any and all complaints with relevant details (names, phone numbers);
- A summary of CAMP findings, including excursions; and,
- An explanation of notable Site conditions.

Daily reporting will be conducted during active remediation periods including all slab penetrations.

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill, etc.), requests for changes to the Remedial Action Plan or other sensitive or time critical information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the Remedial Action Plan will be addressed directly to NYSDEC Project Manager via personal communication.

Daily reports will include a description of daily activities keyed to an alphanumeric map for the Site that identifies work areas. These reports will include a summary of air sampling results, odor and dust problems and corrective actions, and any complaints received from the public. All complaints received will immediately be reported to NYSDEC and NYSDOH.

The NYSDEC assigned project number will appear on all reports.

6.2 Monthly Reports

Monthly reports will be submitted to NYSDEC and NYSDOH Project Managers by the 10th day of the following month and will include:

- Activities relative to the IRM implementation during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (i.e., tons of material exported and imported, etc.);
- Description of approved activity modifications, including changes of work scope and/or schedule;

- Sampling results received following internal data review and validation, as applicable; and,
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

6.3 Interim Remedial Measures Construction Completion Report

An IRMCCR will be submitted to NYSDEC after completion of the IRM, and will include the following documentation of the IRM:

1. Certification by the RE that the data generated is useable and meets the remedial requirements;
2. Certification by the RE that the interim remedial measures conformed to the IRMWP;
3. Certification by the RE that dust, odor, and vapor control measures were implemented during invasive work and conformed with the IRMWP;
4. Certification by the RE that all the remedial waste was transported and disposed in accordance with the IRMWP;
5. Certification by the RE that the source approval and sampling of imported acceptable fill was completed in a manner consistent with the methodology of the IRMWP;
6. Summary of the remedy and all remedial actions completed;
7. Description of any problems encountered and their resolutions;
8. Description of the deviations from the approved IRMWP;
9. Listing of waste streams, quantity of materials disposed, and where they were disposed;
10. Analytical QA/QC completed for the environmental media sampling during the remedial activities, including DUSR or other data validation;
11. List of the remediation standards applied to the remedial actions;
12. List of all applicable local, regional, and national governmental permits, certificates, or other approvals required for the remedial and development work;
13. Tables and figures containing all pre- and post-remedial data, including volumes of soil removed (as applicable);
14. Description of source and quality of fill (as applicable);
15. Air quality and dust monitoring data, including any supporting documentation on the decisions made based on the data;
16. Copies of all the submitted periodic reports; and
17. Copies of all manifests of off-site transport of waste material.

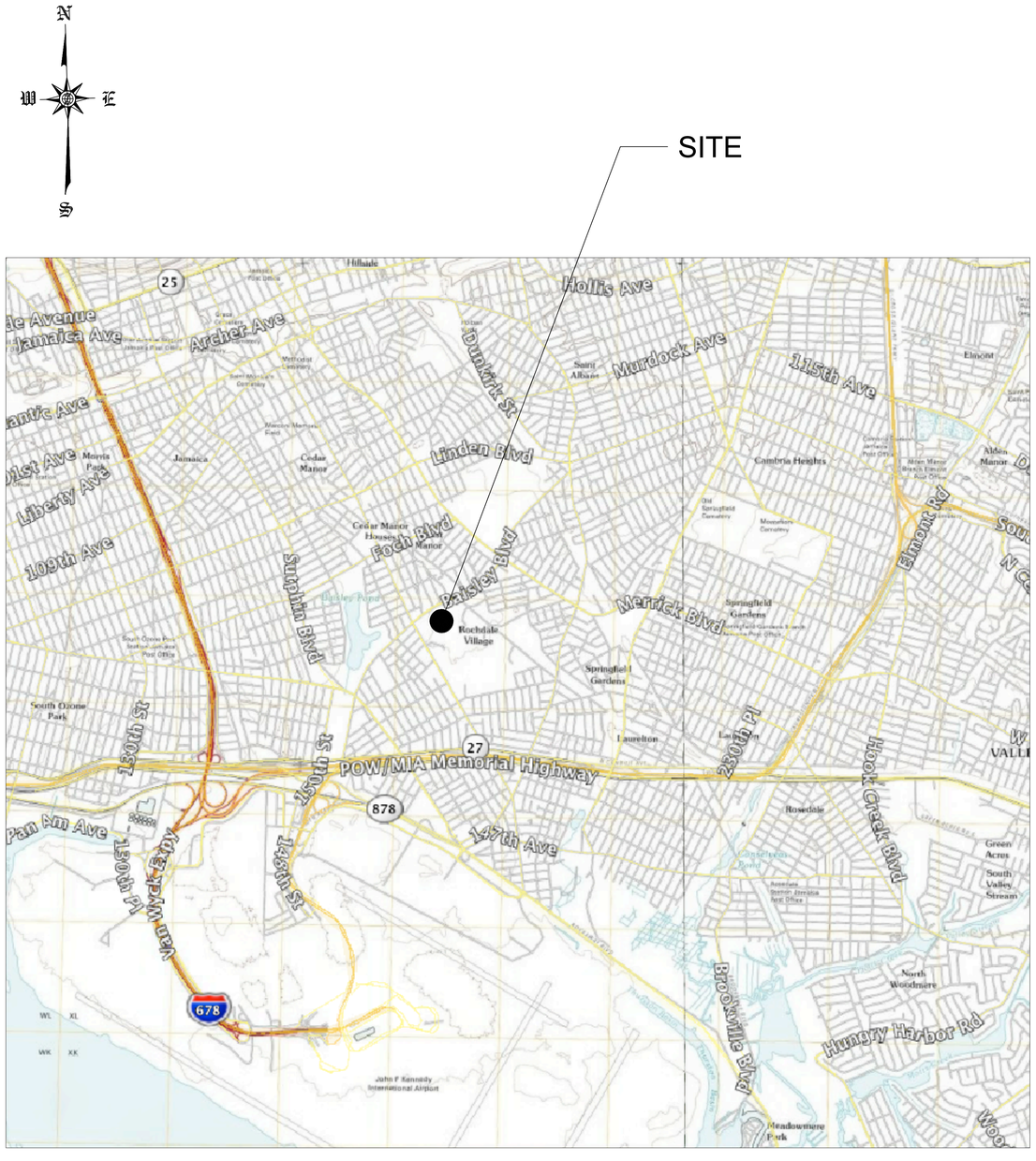
All documents and reports submitted to the NYSDEC will be in both hard copy and in digital format on CD. These digital documents shall be in PDF form and, where appropriate, supplemented by photos and Microsoft Excel files. Laboratory analytical data will be submitted in an electronic data deliverable (EDD) format that complies with the NYSDEC's electronic data warehouse standards.

In the event that the successful implementation results in a Track 1 remedy, the IRMCCR may be submitted with a Final Engineering Report (FER) assuming approval by NYSDEC.

6.4 Remedial Action Work Plan

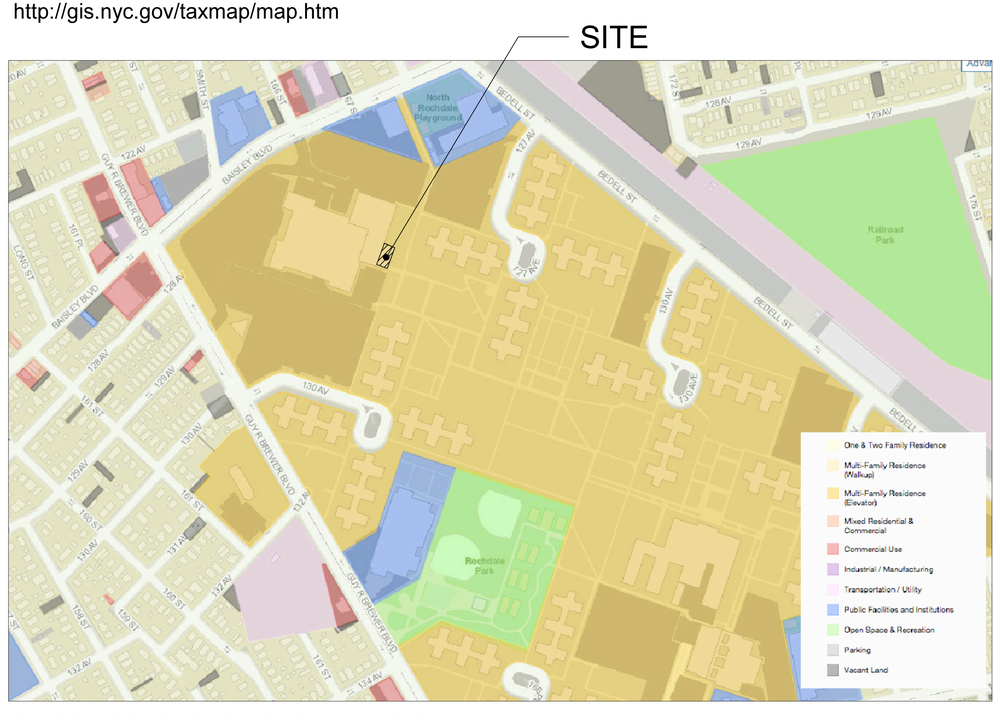
A Remedial Action Work Plan (RAWP) will also be submitted after completing the IRM. The RAWP will include a summary of the IRM, an alternatives analysis and description of a final remedy for the Site. Documentation of the IRM activities will be also be included in the IRMCCR that will be completed after the implementation of the RAWP.

Figures



Re: USGS JAMAICA - NY QUADRANGLE, 2013
http://www.usgs.gov

Re: DEPARTMENT OF FINANCE, DIGITAL TAX MAP, 2014
http://gis.nyc.gov/taxmap/map.htm



Re: DEPARTMENT OF CITY PLANNING ZOLA, 2014
http://gis.nyc.gov/doitt/nyscitymap/template?applicationsName=ZOLA

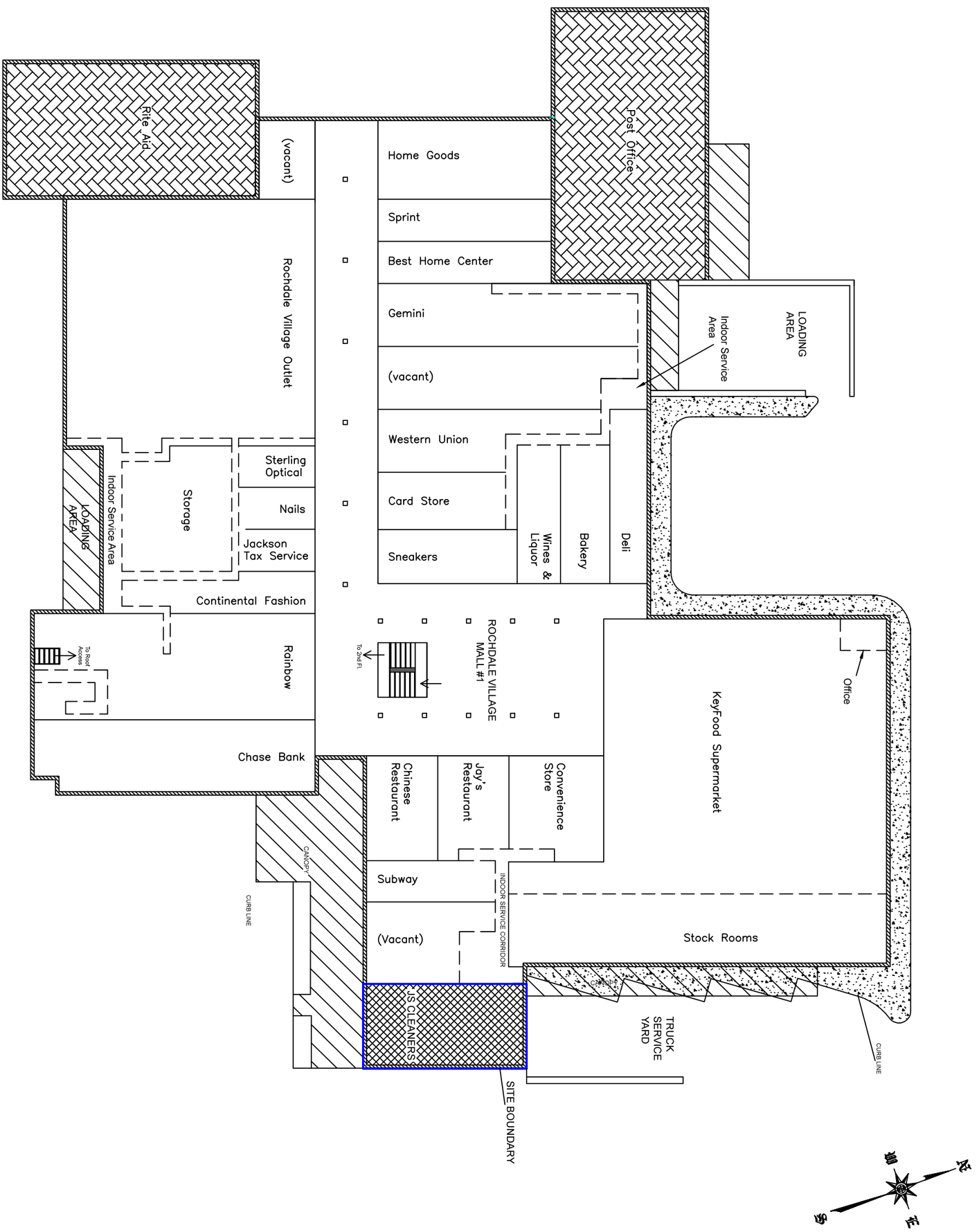
CLIENT
JS Cleaners
Rochdale Village
165-50 Baisley Boulevard
Jamaica, Queens

CONSULTANT
TENEN ENVIRONMENTAL
TENEN ENVIRONMENTAL, LLC
121 West 27th Street
Suite 1004
New York, NY 10001
O: 646-606-2332
F: 646-606-2379

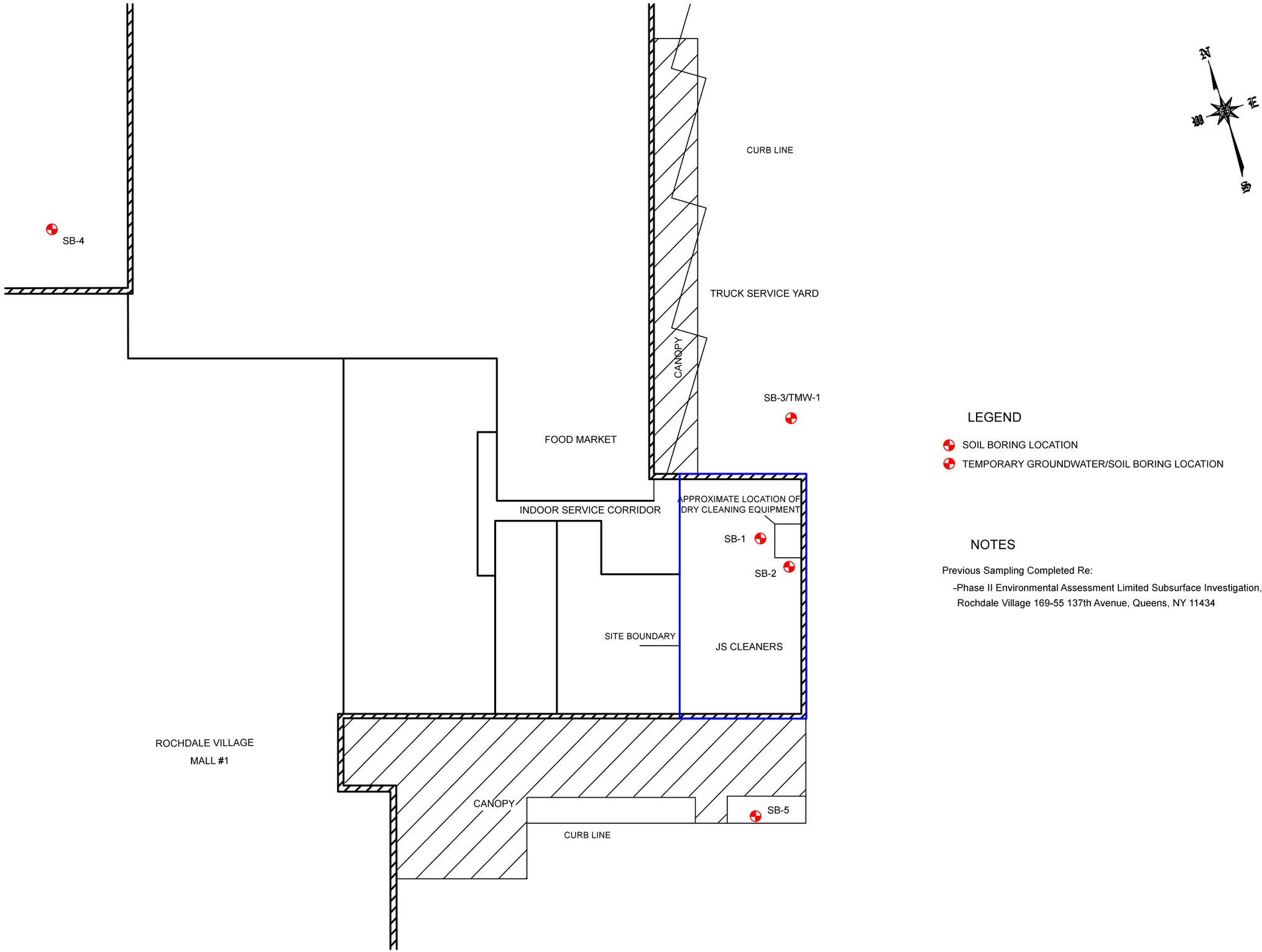
DRAWN BY	CHECKED BY	DATE	SCALE:
KM	MC	MAY 2015	AS NOTED

DRAWING TITLE: Site Location

DRAWING NO.: Figure 1



DRAWING TITLE. FIGURE 2	DRAWN BY KM	CONSULTANT TENEN ENVIRONMENTAL TENEN ENVIRONMENTAL, LLC 121 West 27th Street Suite 702 New York, NY 10001 O: 646-606-2332 F: 646-606-2379	CLIENT JS Cleaners Rochdale Village BCP # C241165 165-50 Baisley Boulevard Jamaica, Queens
DRAWING NO. SITE LAYOUT	CHECKED BY MC		
	DATE MARCH 2016		
	SCALE: AS NOTED		



LEGEND

- SOIL BORING LOCATION
- TEMPORARY GROUNDWATER/SOIL BORING LOCATION

NOTES

Previous Sampling Completed Re:

-Phase II Environmental Assessment Limited Subsurface Investigation, Rochdale Village 169-55 137th Avenue, Queens, NY 11434

SCALE: 1" = 30' 0 15 30

CLIENT
JS Cleaners
Rochdale Village
165-50 Baisley Boulevard
Jamaica, Queens

CONSULTANT
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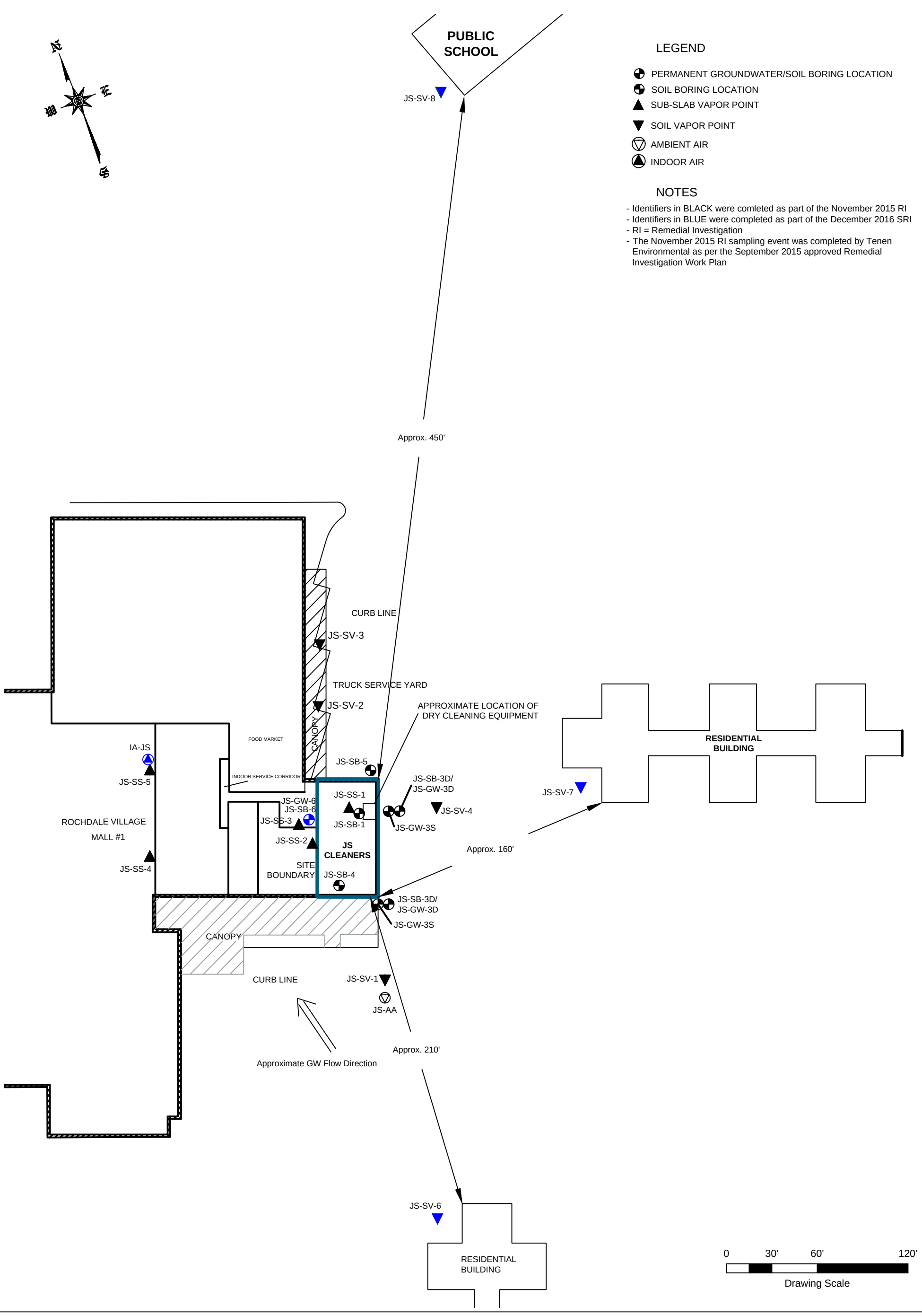
DRAWN BY	CHECKED BY	DATE	SCALE:
KM	MC	MAY 2015	AS NOTED

DRAWING TITLE: PREVIOUS SAMPLING LOCATIONS

DRAWING NO.: FIGURE 3



LEGEND

- PERMANENT GROUNDWATER/SOIL BORING LOCATION
- SOIL BORING LOCATION
- SUB-SLAB VAPOR POINT
- SOIL VAPOR POINT
- AMBIENT AIR
- INDOOR AIR

NOTES

- Identifiers in BLACK were comleted as part of the November 2015 RI
- Identifiers in BLUE were completed as part of the December 2016 SRI
- RI = Remedial Investigation
- The November 2015 RI sampling event was completed by Tenen Environmental as per the September 2015 approved Remedial Investigation Work Plan

DRAWING TITLE. Soil, Groundwater and Soil Vapor Sampling Locations	DRAWN BY LM	CONSULTANT TENEN ENVIRONMENTAL, LLC 121 West 27th Street Suite 702 New York, NY 10001 O: 646-606-2332 F: 646-606-2379	CLIENT JS Cleaners Rochdale Village 165-50 Baisley Boulevard Jamaica, Queens
DRAWING NO. Figure 4	CHECKED BY KM		
	DATE February 2017		
	SCALE: As Noted		

Tables

Table 1
Project Organization and Emergency Contacts
JS Cleaners, Rochdale Village
BCP Site #C241165

Title / Role	**Name**	**Entity**	**Contact Information**
Professional Engineer	Matthew Carroll	--	(646) 827-1061
QEP	Mohamed Ahmed	Tenen Environmental	(646) 606-2332
NYSDEC	Sondra Martinkat	NYSDEC	(718) 482-4891
Site Representative	Pius Danquah	Rochdale Village	(718) 276-5700
Emergency	Ambulance	FDNY	911

Table 2
Project Organization and Emergency Contacts
JS Cleaners, Rochdale Village
BCP Site #C241165

Task	Duration (days)	Start	End
NYSDEC Approval of IRM Work Plan	30	TBD	TBD
NYCDOB Permit for Exhaust Piping	30		
Mobilization	10		
Install and Start-up SSDS	30		
Re-route Exhaust Piping *	30		
Prepare Construction Completion Report	45		

IRM - Interim Remedial Measure

Appendix A
Health and Safety Plan

Health and Safety Plan

for
JS Cleaners – Rochdale Mall #1
Interim Remedial Work Plan

165-50 Baisley Boulevard, Jamaica
Block 12495, Lot 2 (portion)
BCP Site # C241165

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau B
1 Hunters Point Plaza
47-40 21st Street
Long Island City, NY 11101

Prepared for:
Rochdale Village, Inc.
c/o Herman Lessey, Safety Department
169-55 137th Avenue
Queens, New York 11434

Prepared by:
TENEN ENVIRONMENTAL
121 West 27th Street, Suite 702
New York, NY 10001

March 2017

TABLE OF CONTENTS

1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared in conformance with the Occupational Safety and Health Administration (OSHA) standards and guidance that govern site investigation activities, other applicable regulations, and Tenen Environmental LLC (Tenen) health and safety policies and procedures. The purpose of this HASP is the protection of Tenen field personnel and others during the implementation of the Interim Remedial Measures Work Plan (IRM WP).

The Site is located at 165-50 Baisley Boulevard, in the Jamaica neighborhood of Queens, NY. The Site is currently vacant; the previous occupant, a dry cleaner (JS Cleaners), ceased operations in January 2017. The Site is located within the Rochdale Village Mall (Mall #1), which is part of a larger community development and housing complex known as Rochdale Village.

Rochdale Mall #1 is a one- and two-story retail and office building (141,000 gross square feet) with associated parking. The Rochdale Village complex is bounded by Baisley Boulevard, Bedell Street, 137th Avenue and Guy R. Brewer Boulevard. Mall #1 is located in the northwest corner of Rochdale Village with associated parking spaces fronting Baisley Boulevard and Guy R. Brewer Boulevard. The Site is a 3,160 square foot one-story retail space located in the eastern end of Rochdale Village Mall. The Site is located in Queens Community Board 12 and is generally identified as a portion of Block 12495, Lot 2.

1.1 Scope of HASP

This HASP includes safety procedures to be used by Tenen staff during the following activities:

- Installation of an active sub-slab depressurization unit

Subcontractors will ensure that performance of the work is in compliance with this HASP and applicable laws and regulations.

2.0 PROJECT SAFETY AUTHORITY

The following personnel are responsible for project health and safety under this HASP.

- Project Manager, Matthew Carroll
- Health and Safety Officer (HSO), Mohamed Ahmed

In addition, each individual working at the Site will be responsible for compliance with this HASP and general safe working practices. All Site workers will have the authority to stop work if a potentially hazardous situation or event is observed.

2.1 Designated Personnel

The Project Manager is responsible for the overall operation of the project, including compliance with the HASP and general safe work practices. The Project Manager may also act as the Health and Safety Officer (HSO) for this project.

Tenen will appoint one of its on-site personnel as the on-site HSO. This individual will be responsible for the implementation of the HASP. The HSO will have a 4-year college degree in occupational safety or a related science/engineering field, and at least two (2) years of experience in implementation of air monitoring and hazardous materials sampling programs. The HSO will have completed a 40-hour training course that meets OSHA requirements of 29 CFR Part 1910, Occupational Safety and Health Standards.

The HSO will be present on-site during all field operations involving subsurface disturbance, and will be responsible for all health and safety activities and the delegation of duties to the field crew. The HSO has stop-work authorization, which he/she will execute on his/her determination of an imminent safety hazard, emergency situation, or other potentially dangerous situation. If the HSO must be absent from the field, a replacement who is familiar with the Health and Safety Plan, air monitoring and personnel protective equipment (PPE) will be designated.

3.0 HAZARD ASSESSMENT AND CONTROL MEASURES

Known previous and current uses of the site include operations that used chlorinated solvents and petroleum products, containing volatile organic contaminants (VOCs) and semi-volatile organic contaminants (SVOCs). The following previous investigation summarizes contaminants of concern detected on the site:

2010 GRS Group Phase I and II Environmental Site Assessment

GRS conducted a Phase I ESA of the entire Rochdale Village community, including the Rochdale Mall (Mall #1). The following environmental concerns in relation to the JS Cleaners Site were identified in the Phase I ESA:

- Dry Cleaner facility use and storage of PCE
- An out of use UST

GRS conducted a soil and groundwater investigation at the Site in 2010 which included the collection of five soil samples and one groundwater sample, from a temporary well, for laboratory analysis. The results and conclusions were as follows:

- PCE in one of the five soil samples at concentrations that exceeded the Unrestricted Use Soil Cleanup Objectives (SCO);
    1. The PCE concentration was 6.13 parts per million (ppm) in soil sample SB-1 collected just below the floor slab in vicinity of the dry cleaning machine.
- Analysis of the ground water sample, SB-3/TW-1, indicated a concentration of PCE of 12.3 parts per billion (ppb) which is above the NYS Groundwater Quality Standard (GQS) of 5 ppb;
- No soil vapor sampling was conducted during this investigation.

Soil Vapor Sampling, December 2013

Jet Environmental Consulting LLC conducted a soil vapor investigation at the Site in December 2013 which included the collection of two sub-slab vapor samples and one ambient indoor air sample for laboratory analysis. The results were as follows:

- PCE and trichloroethene (TCE) were identified in the ambient indoor air sample at a concentration of 19,900 and 21.6 ug/m^3, respectively, which are above the NYSDOH air guideline values (AGV) of 30 ug/m^3 for PCE and 5 ug/m^3 for TCE; and
- PCE was identified in both soil vapor samples at concentrations of 747 ug/m^3 and 1880 ug/m^3 which are both above the NYSDOH AGV for PCE of 30 ug/m^3; TCE was detected in one of the two soil vapor samples at 3.87 ug/m^3which is below the NYSDOH AGV for TCE of 5 ug/m^3.

The depth to groundwater is assumed to be between 10 and 12 feet below ground surface.

November 2015 Remedial Investigation (RI) and December 2016 Supplemental Remedial Investigation *(SRI)—Tenen Environmental LLC*

In November 2015 Tenen conducted a soil, groundwater, sub-slab and soil vapor remedial investigation at the Site in order to horizontally and vertically delineate the nature and extent of chlorinated solvent impacts at the Site and surrounding commercial and residential spaces with respect to the known location of PCE dry cleaning equipment. The RI confirmed the presence of PCE in the shallow groundwater, soil, sub-slab and soil vapor on-site and off-site within the adjacent and surrounding areas. Cluster groundwater wells were installed at two locations to evaluate vertical delineation of chlorinated solvents; one shallow groundwater well was advanced on-site adjacent to the location of dry cleaning equipment. Results showed that PCE was detected at elevated levels above the Class GA Standard in shallow groundwater wells; samples from deep wells contained PCE at concentrations below the Class GA standard. PCE was detected above Unrestricted Use SCOs in the shallow interval at one soil boring located adjacent to the dry cleaning equipment. Samples collected from deeper soil intervals did not contain elevated levels of PCE. Detected sub-slab PCE concentrations above ambient air levels were detected throughout Rochdale Village Mall #2, the highest of which were on-Site and in the adjacent commercial space. TCE, a breakdown component of PCE, and petroleum compounds, likely related to an off-site source, were also detected at elevated levels. Soil vapor sampling did not identify PCE in two of the three courtyard locations.

The SRI was conducted in December 2016 to evaluate horizontal chlorinated VOC impacts with respect to the neighboring community. One interior soil boring was advanced within the hallway corridor space downgradient of the site and converted to a permanent groundwater well. Soil results identified no VOCs detected above Unrestricted, Protection of Groundwater, and Commercial Use SCOs. In groundwater sample results, PCE was detected below the Class GA Standard at a concentration of 1.3 ug/L. The groundwater monitoring well was surveyed and groundwater was measured to be flowing in a southeasterly direction. The groundwater elevation was measured to be approximately 8.82 ft-bgs.

As part of the SRI, three off-site soil vapor points were installed at intermediate depths to investigate the potential presence of chlorinated solvents with respect to the surrounding neighborhood. The concentrations of PCE in soil vapor samples collected as part of the SRI to delineate horizontal contamination between the Site and the neighboring community are comparatively low.

The concentrations and distribution of chlorinated solvents, specifically PCE, are consistent with the presence of an on-site source and have delineated contamination previously documented at the Site. The results of the RI and SRI sampling have sufficiently delineated the horizontal extent of PCE impacts below the NYSDOH Air Guidance Value of 30 ug/m^3 in the NYSDOH Matrices within the exterior soil vapor at the Site and in the neighboring community. The results of the RI and SRI have adequately delineated the horizontal extent of PCE contamination in groundwater to concentrations below Class GA Standards. The results of the RI and SRI have adequately

delineated the vertical and horizontal extent of PCE contamination in soil to concentrations below the Unrestricted Use SCO for PCE.

3.1 Human Exposure Pathways

The media of concern at the Site include potentially-impacted soil, groundwater and soil vapor. Potential exposure pathways include dermal contact, incidental ingestion and inhalation of vapors. The risk of dermal contact and incidental ingestion will be minimized through general safe work practices, a personal hygiene program and the use of PPE. The risk of inhalation will be minimized through the use of an air monitoring program for VOCs and particulates.

3.2 Chemical Hazards

Based on historic uses, the following contaminants of concern may be present at the Site:

Chlorinated solvents
- Tetrachloroethylene (PCE)
- Trichloroethene (TCE)

Petroleum-related compounds
- Xylenes
- Ethanol
- Trimethylbenzenes

PCBs
- Aroclor 1242

Metals:
- Iron
- Manganese

Material Safety Data Sheets (MSDSs) for each contaminant of concern are included in Appendix C. All personnel are required to review the MSDSs included in this HASP.

3.3 Physical Hazards

The physical hazards associated with the field activities likely present a greater risk of injury than the chemical constituents at the Site. Activities within the scope of this project shall comply with New York State and Federal OSHA construction safety standards.

Head Trauma
To minimize the potential for head injuries, field personnel will be required to wear National Institutes of Occupational Safety and Health (NIOSH)-approved hard hats during field activities. Hats must be worn properly and not altered in any way that would decrease the degree of

protection provided.

Foot Trauma
To avoid foot injuries, field personnel will be required to wear steel-toed safety shoes while field activities are being performed. To afford maximum protection, all safety shoes must meet American National Standards Institute (ANSI) standards.

Eye Trauma
Field personnel will be required to wear eye protection (safety glasses with side shields) while field activities are being performed to prevent eye injuries caused by contact with chemical or physical agents.

Noise Exposure
Field personnel will be required to wear hearing protection (ear plugs or muffs) in high noise areas (noise from heavy equipment) while field activities are being performed.

Buried Utilities and Overhead Power Lines
Boring locations will be cleared by an underground utility locator service. In addition, prior to intrusive activities, the drilling subcontractor will contact the One Call Center to arrange for a utility mark-out, in accordance with New York State requirements. Protection from overhead power lines will be accomplished by maintaining safe distances of at least 15 feet at all times.

Thermal Stress
The effects of ambient temperature can cause physical discomfort, personal injury, and increase the probability of accidents. In addition, heat stress due to lack of body ventilation caused by protective clothing is an important consideration. Heat-related illnesses commonly consist of heat stroke and heat exhaustion.

The symptoms of heat stroke include: sudden onset; change in behavior; confusion; dry, hot and flushed skin; dilated pupils; fast pulse rate; body temperature reaching 105° or more; and/or, deep breathing later followed by shallow breathing.

The symptoms of heat exhaustion include: weak pulse; general weakness and fatigue; rapid shallow breathing; cold, pale and clammy skin; nausea or headache; profuse perspiration; unconsciousness; and/or, appearance of having fainted.

Heat-stress monitoring will be conducted if air temperatures exceed 70 degrees Fahrenheit. The initial work period will be set at 2 hours. Each worker will check his/her pulse at the wrist for 30 seconds early in each rest period. If the pulse rate exceeds 110 beats per minute, the next work period will be shortened by one-third.

One or more of the following precautions will reduce the risk of heat stress on the Site:

- Provide plenty of liquids to replace lost body fluids; water, electrolytic drinks, or both will be made available to minimize the risk of dehydration and heat stress

- Establish a work schedule that will provide appropriate rest periods
- Establish work regimens consistent with the American Conference of Governmental Industrial Hygienists (ACGIH) guidelines
- Provide adequate employee training on the causes of heat stress and preventive measures

In the highly unlikely event of extreme low temperatures, reasonable precautions will be made to avoid risks associated with low temperature exposure.

Traffic

Field activities will occur near public roadways. As a result, vehicular traffic will be a potential hazard during these activities and control of these areas will be established using barricades or traffic cones. Additional staff will be assigned, as warranted, for the sole purpose of coordinating traffic. Personnel will also be required to wear high-visibility traffic vests while working in the vicinity of the public roadways and local requirements for lane closure will be observed as needed. All work in public rights-of-way will be coordinated with local authorities and will adhere to their requirements for working in traffic zones.

Hazardous Weather Conditions

All Site workers will be made aware of hazardous weather conditions, specifically including extreme heat, and will be requested to take the precautions described herein to avoid adverse health risks. All workers are encouraged to take reasonable, common sense precautions to avoid potential injury associated with possible rain or high wind, sleet, snow or freezing.

Slip, Trip and Fall

Areas at the Site may be slippery from mud or water. Care should be taken by all Site workers to avoid slip, trip, and fall hazards. Workers shall not enter areas that do not have adequate lighting. Additional portable lighting will be provided at the discretion of the HSO.

Biological Hazards

Drugs and alcohol are prohibited from the Site. Any on-site personnel violating this requirement will be immediately expelled from the site.

Any worker or oversight personnel with a medical condition that may require attention must inform the HSO of such condition. The HSO will describe appropriate measures to be taken if the individual should become symptomatic.

Due to the Site location in an urban area, it is highly unlikely that poisonous snakes, spiders, plants and insects will be encountered. However, other animals (dogs, cats, etc.) may be encountered and care should be taken to avoid contact.

4.0 AIR MONITORING

Air quality monitoring equipment will be used during all work activities to measure total organic vapors. A PID (to monitor total volatile organic concentrations) will be used during on-site

activities. The equipment will be calibrated daily and the results noted in the project field book. A background level will be established, at a minimum, on a daily basis, and recorded in the field book. 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 shut down.
4. All 15-minute readings must be recorded. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate monitoring will be performed using a real-time particulate monitor that will monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

Object to be measured: Dust, Mists, Aerosols
Size range: <0.1 to 10 microns
Sensitivity: 0.001 mg/m3
Range: 0.001 to 10 mg/m3
Overall Accuracy: ±10% as compared to gravimetric analysis of stearic acid or reference dust.

Particulate levels will be monitored immediately downwind at the working site and integrated over a period not to exceed 15 minutes. The action level will be established at 150 ug/m^3 over the integrated period not to exceed 15 minutes.

5.0 PERSONAL PROTECTIVE EQUIPMENT

The personal protection equipment required for various kinds of site investigation tasks is based on 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, "General Description and Discussion of the Levels of Protection and Protective Gear."

Tenen field personnel and other site personnel will wear Level D personal protective equipment. During activities such as drilling, well installation, or sampling, where there is a chance of contact with contaminated materials, modified Level D equipment will be worn. The protection will be upgraded to Level C if warranted by the results of the air monitoring. A description of the personnel protective equipment for Levels D and C is provided below.

Level D
Respiratory Protection: None
Protective Clothing: Hard hat, steel-toed shoes, long pants, nitrile gloves

Modified Level D
Respiratory Protection: None
Protective Clothing: Hard hat, steel-toed shoes, coveralls/tyvek, nitrile gloves

Level C
Respiratory Protection: Air purifying respirator with organic vapor cartridges and filters.
Protective Clothing: Same as modified Level D

6.0 EXPOSURE MONITORING

Selective monitoring of workers in the exclusion area may be conducted, as determined by the HSO, if sources of hazardous materials are identified. Personal monitoring may be conducted in the breathing zone at the discretion of the Project Manager or HSO and, if workers are wearing respiratory protective equipment, outside the face-piece.

7.0 SITE ACCESS

Access to the Site during the investigation will be controlled by the Project Manager or HSO. Unauthorized personnel will not be allowed access to the sampling areas.

8.0 WORK AREAS

During any activities involving subsurface disturbance, the work area must be divided into various zones to prevent the spread of contamination, clarify the type of protective equipment needed, and provide an area for decontamination.

The Exclusion Zone is defined as the area where potentially contaminated materials are generated as the result of drilling, sampling, or similar activities. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located adjacent to the Exclusion Zone. The Support Zone is the area where support facilities such as vehicles, a field phone, fire extinguisher and/or first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all Site workers will assemble in the event of an emergency. These zones shall be designated daily, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

Control measures such as "Caution" tape and traffic cones will be placed around the perimeter of the work area when work is being done in the areas of concern (i.e., areas with exposed soil) to prevent unnecessary access.

9.0 DECONTAMINATION PROCEDURES

Personnel Decontamination
Personnel decontamination (decon), if deemed necessary by the HSO, will take place in the designated decontamination area delineated for each sampling location. Personnel decontamination will consist of the following steps:

- Soap and potable water wash and potable water rinse of gloves;
- Tyvek removal;
- Glove removal;
- Disposable clothing removal; and
- Field wash of hands and face.

Equipment Decontamination
Sampling equipment, such as split-spoons and bailers, will be decontaminated in accordance with U.S. Environmental Protection Agency methodologies, as described in the work plan.

Disposal of Materials
Purged well water, water used to decontaminate any equipment and well cuttings will be containerized and disposed off-site in accordance with federal, state and local regulations.

10.0 GENERAL SAFE WORK PRACTICES

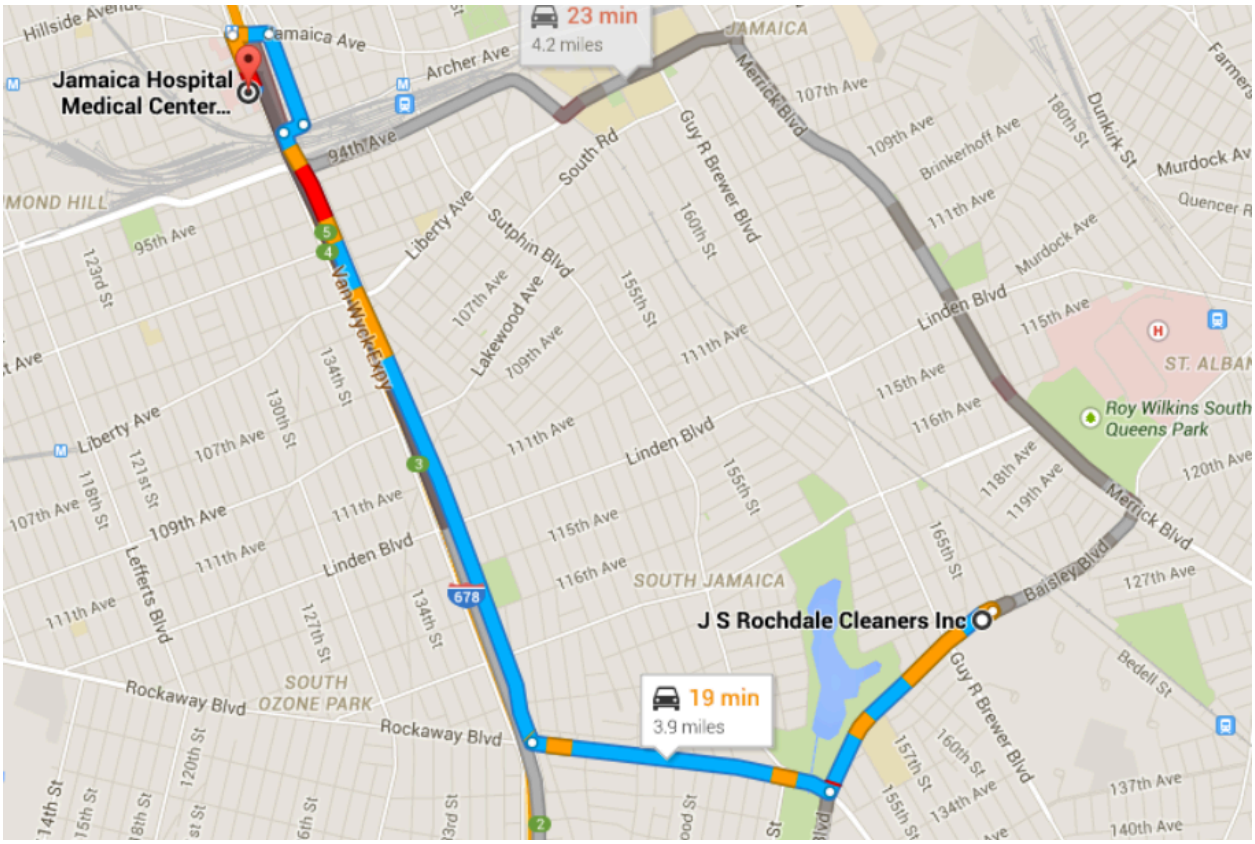
To protect the health and safety of the field personnel, all field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance.

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited, except in designated areas on the site. These areas will be designated by the HSO.
- Workers must wash their hands and face thoroughly on leaving the work area and before eating, drinking, or any other such activity. The workers should shower as soon as possible after leaving the site.
- Removal of potential contamination from PPE and equipment by blowing, shaking or any means that may disperse materials into the air is prohibited.
- Contact with contaminated or suspected surfaces should be avoided.
- The buddy system should always be used; each buddy should watch for signs of fatigue, exposure, and heat stress.
- Personnel will be cautioned to inform each other of symptoms of chemical exposure such as headache, dizziness, nausea, and irritation of the respiratory tract and heat stress.
- No excessive facial hair that interferes with a satisfactory fit of the face-piece of the respirator to the face will be allowed on personnel required to wear respiratory protective equipment.
- On-site personnel will be thoroughly briefed about the anticipated hazards, equipment requirements, safety practices, emergency procedures, and communications methods.

11.0 EMERGENCY PROCEDURES

The field crew will be equipped with emergency equipment, such as a first aid kit and disposable eye washes. In the case of a medical emergency, the HSO will determine the nature of the emergency and will have someone call for an ambulance, if needed. If the nature of the injury is not serious—i.e., the person can be moved without expert emergency medical personnel—onsite personnel should drive him to a hospital. **The nearest emergency room is at Jamaica Hospital Medical Center located at 8900 VanWyck Expressway, Queens, NY 11418. The phone number is (718) 206-6000.** The route to the hospital is shown and detailed on the next page.

11.1 Route to Hospital



Driving directions to **Jamaica Hospital Medical Center** from **165-50 Baisley Bloulevard, Queens, New York.**

Driving Directions

1. Head northeast on Baisley Blvd toward 166th St (456 feet).

2. Make a U-turn at 167th St (0.7 mile).

3. Turn right onto Rockaway Blvd (0.8 mile).

4. Turn right onto Van Wyck Blvd (2.1 mile).

5. Turn left onto Jamaica Ave (253 feet).

6. Turn left at the 1st cross street onto Van Wyck Blvd.

7. Destination will be on the right.

11.2 Emergency Contacts

There will be an on-site field phone. Emergency and contact telephone numbers are listed below:

Table 1 – Emergency Contacts

Ambulance	911
Emergency Room	(718) 963-8000
NYSDEC Spill Hotline	(800) 457-7362
NYSDEC Manager, Sondra Martinkat	(718) 482-4891
Tenen QEP, Mohamed Ahmed	(917) 612-6018
On-site Field Phone, Matthew Carroll	(646) 827-1061
Client representative, Pius Danquah, Safety Director	(718) 276-5700

12.0 TRAINING

All personnel performing the field activities described in this HASP will have received the initial safety training required by 29 CFR, 1910.120. Current refresher training status also will be required for all personnel engaged in field activities.

All those who enter the work area while intrusive activities are being performed must recognize and understand the potential hazards to health and safety. All field personnel must attend a training program covering the following areas:

- potential hazards that may be encountered;
- the knowledge and skills necessary for them to perform the work with minimal risk to health and safety;
- the purpose and limitations of safety equipment; and
- protocols to enable field personnel to safely avoid or escape from emergencies.

Each member of the field crew will be instructed in the above objectives before he/she goes onto the site. The HSO will be responsible for conducting the training program.

13.0 MEDICAL SURVEILLANCE

All Tenen and subcontractor personnel performing field work involving drilling or other subsurface disturbance at the site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). The medical examination for Tenen employees will, at a minimum, be provided annually and upon termination of hazardous waste site work.

Appendix A

Acknowledgement of HASP

ACKNOWLEDGMENT OF HASP

Below is an affidavit that must be signed by all Tenen Environmental employees who enter the site. A copy of the HASP must be on-site at all times and will be kept by the HSO.

AFFIDAVIT

I have read the Construction Health and Safety Plan (HASP) for the HIP Cleaners-Rochdale Mall #2 Site in Queens, NY. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the site.

Signature: _____ Date: _____
Signature: _____ Date: _____
Signature: _____ Date: _____
Signature: _____ Date: _____
Signature: _____ Date: _____

Appendix B

Injury Reporting Form (OSHA Form 300)

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name ________________

City ____________ State ________

Identify the person			Describe the case			Classify the case: CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "Injury" column or choose one type of illness:					
(A) Case no.	(B) Employee's name	(C) Job title (e.g., Welder)	(D) Date of injury or onset of illness	(E) Where the event occurred (e.g., Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g., Second degree burns on right forearm from acetylene torch)	Death (G)	Days away from work (H)	Remained at Work: Job transfer or restriction (I)	Remained at Work: Other record-able cases (J)	Away from work (K)	On job transfer or restriction (L)	(M) Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)
			/ month/day			☐	☐	☐	☐	days	days	☐	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	days	days	☐	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	days	days	☐	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	days	days	☐	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	days	days	☐	☐	☐	☐	☐	☐
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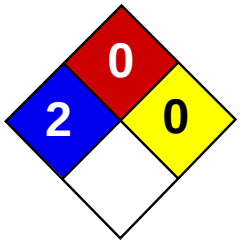
			/ month/day			☐	☐	☐	☐	days	days	☐	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	days	days	☐	☐	☐	☐	☐	☐
					Page totals ➤	___	___	___	___	___	___	Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Appendix C

Material Safety Data Sheets (MSDS)



Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet
Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolvel; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C2-Cl4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium , barium. Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Publishe Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects(teratogenic). May affect genetic material (mutagenic). May cause cancer.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symtoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorentiation, seizures, enotional instability, stupor, coma). It may cause pulmonary edema Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver(hepatitis,fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/ central nervous system/peripheral nervous system (impaired memory, numbness of extremeties, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fatthead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

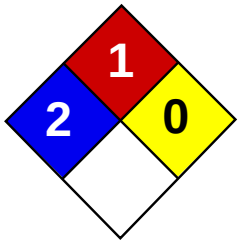
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:29 PM

Last Updated: 05/21/2013 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Material Safety Data Sheet
Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C2HCl3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/

spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m3) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:
Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:54 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

Material Safety Data Sheet

Revision Issued: 6/09/98 Supercedes: 9/17/97 First Issued: 4/10/89

Section I - Chemical Product And Company Identification

Product Name: Xylene

CAS Number: 1330-20-7 HBCC MSDS No. CX01000

HILL BROTHERS Chemical Co.
1675 NORTH MAIN STREET • ORANGE, CALIFORNIA 92867-3499
(714) 998-8800 • FAX: (714) 998-6310
http://hillbrothers.com

1675 No. Main Street, Orange, California 92867
Telephone No: 714-998-8800 | Outside Calif: 800-821-7234 | Chemtrec: 800-424-9300

Section II - Composition/Information On Ingredients

			Exposure Limits (TWAs) in Air		
Chemical Name	CAS Number	%	ACGIH TLV	OSHA PEL	STEL
Xylene	1330-20-7	79-82	100 ppm	100 ppm	150 ppm
			435 mg/m³	435 mg/m³	
Ethylbenzene	100-41-4	18-20	100 ppm	100 ppm	125 ppm
			435 mg/m³	435 mg/m³	
Toluene	108-88-3	< 1	50 ppm	50 ppm	150 ppm

Section III - Hazard Identification

Ingestion: Liquid ingestion may result in vomiting; aspiration (breathing) of vomitus into the lungs must be avoided as even small quantities in the lungs may result in chemical pneumonitis and pulmonary edema/hemorrhage.

Inhalation: High vapor/aerosol concentrations (greater than approximately 1000 ppm) are irritating to the respiratory tract, may cause headaches, dizziness, anesthesia, drowsiness, unconsciousness, and other central nervous system effects, including death. Negligible hazard at ambient temperature (-18 to 38 Deg C; 0 to 100 Deg F)

Skin: Prolonged and repeated liquid contact can cause defatting and drying of the skin which may result in skin irritation and dermatitis.

Eyes: Short-term liquid or vapor contact may result in slight eye irritation. Prolonged and repeated contact may be more irritating. High vapor/aerosol concentrations (greater than approximately 1000 ppm) are irritating to the eyes.

Summary of Chronic Health Hazards: N/A

Signs and Symptoms of Exposure: Prolonged or repeated skin contact with this product tends to remove oils possibly leading to irritation and dermatitis; however, based on human experience and available toxicological data, this product is judged to be neither a "corrosive" nor an "irritant" by OSHA criteria.

Effects of Overexposure: High vapor concentration (greater than approximately 1000 ppm) are irritating to the eyes and the respiratory tract, may cause headaches and dizziness, are anesthetic, and may have other central nervous system effects including death.

Medical Conditions Generally Aggravated by Exposure: Petroleum Solvents/Petroleum Hydrocarbons - Skin contact may aggravate an existing dermatitis.

Note to Physicians: If more than 2.0 ml per kg has been ingested and vomiting has not occurred, emesis should be induced with supervision. Keep victim's head below hips to prevent aspiration. If symptoms such as loss of gag reflex, convulsions or unconsciousness occur before emesis, gastric lavage using a cuffed endotracheal tube should be considered. Inhalation of high concentrations of this material, as could incur in enclosed spaces or during deliberate abuse, may be associated with

cardiac arrhythmias. Sympathomimetic may initiate cardiac arrhythmias in persons exposed to this material. This material is an aspiration hazard. Potential danger from aspiration must be weighed against possible oral toxicity when deciding whether to induce vomiting. Preexisting disorders of the following organs (or organ systems) may be aggravated by exposure to this material: skin, lung (for example, asthma-like conditions), kidney, auditory system. Individuals with preexisting heart disorders may be mre susceptible to arrhythmias (irregular heartbeats) if exposed to high concentrations of this material.

Section IV - First Aid Measures

Ingestion: If individual is drowsy or unconscious, do not give anyhting by mouth; place individual on the left side with the head down. Contact a physician, medical facility, or poison control center for advice about whether to induce vomiting. If possible, do not leave individual unattended. GET MEDICAL ATTENTION IMMEDIATELY.

Inhalation: Remove victim to fresh air and provide oxygen if breathing is difficult. Give artificial respiration if not breathing. GET MEDICAL ATTENTION IMMEDIATELY.

Skin: Wash with soap and water. Remove contaminated clothing and shoes; do not reuse until cleaned. If persistent irritation occurs, GET MEDICAL ATTENTION IMMEDIATELY.

Eyes: If splashed into eyes, flush with water for 15 minutes while holding eyelids open or until irritation subsides. If irritation persists, GET MEDICAL ATTENTION IMMEDIATELY.

Section V - Fire Fighting Measures

Flash Point: 80°F (26.6°C) **Autoignition Temperature:** 980°F (526.6°C)

Lower Explosive Limit: 1% **Upper Explosive Limit:** 6.6%

Unusual Fire and Explosion Hazards: Vapors are heavier than air and may accumulate in low areas and may travel along the ground or may be moved by ventilation and ignited by pilot lights, other flames, sparks, heaters, smoking, electric motors, static discharge, or other ignition sources at locations distant from handling point. Flashback of flame to the handling site may occur. Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively. The following may form: carbon dioxide, and carbon monoxide, and various hydrocarbons.

Extinguishing Media: Use water fog, foam, dry chemical or CO_2. Do not use a direct stream of water. Product will float and can be reignited on surface of water.

Special Firefighting Procedures: Evacuate hazard area of unprotected personnel. Wear proper protective clothing including a NIOSH approved self-contained breathing apparatus. Cool fire-exposed containers with water. In the case of large fires, also cool surrounding equipment and structures with water. If a leak or spill has not ignited, use water spray to disperse the vapors.

Section VI - Accidental Release Measures

[Spills may need to be reported to the National Response Center (800/424-8802) CERCLA Reportable Quantity (RQ) is 1000 pounds]. Shut off and eliminate all ignition sources. Keep people away. Recover by pumping (use an explosion proof or hand pump) or with a suitable absorbent such as sand, earth or other suitable absorbent to spill area. Do not use combustible materials such as sawdust. Minimize breathing vapors. Minimize skin contact. Ventilate confined spaces. Open all windows and doors. Keep product out of sewers and watercourses by diking or impounding. Advise authorities if product has entered or may enter sewers, watercourses, or extensive land areas.

Section VII - Handling and Storage

Keep away from heat, sparks and open flames. Keep containers tightly closed. Store away from strong oxidizing agents in a cool, dry place with adequate explosion-proof ventilation. Ground equipment to prevent accumulation of static charge. If pouring or transferring materials, containers must be bonded and grounded.

Other Precautions: Do Not weld, heat or drill on or near container; even emptied containers can contain explosive vapors.

Section VIII - Exposure Controls/Personal Protection

Respiratory Protection: Use either an atmosphere-supplying respirator or an air-purifying respirator in confined or enclosed spaces for organic vapors, if needed.

Ventilation: Use only with ventilation sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air. Use explosion-proof equipment.

Protective Clothing: Use chemical-resistant apron or other impervious clothing, if needed, to avoid contaminating regular

clothing which could result in prolonged or repeated skin contact.
Eye Protection: Use chemical splash goggles or face shield when eye contact may occur.
Other Protective Clothing or Equipment: Use chemical-resistant gloves, if needed, to avoid prolonged or repeated skin contact.
Work/Hygienic Practices: Minimize breathing vapor or mist. Avoid prolonged or repeated contact with skin. Remove contaminated clothing; launder or dry-clean before reuse. Remove contaminated shoes and thoroughly clean and dry before reuse. Cleanse skin thoroughly after contact, before breaks and meals, and at end of work period. Product is readily removed from skin by waterless hand cleaners followed by washing thoroughly with soap and water.

Section IX - Physical and Chemical Properties

Physical State: Liquid
pH: N/A
Melting Point/Range: N/A
Boiling Point/Range: 279°F (137.2°C)
Appearance/Color/Odor: Colorless, light aromatic odor
Solubility in Water: Less than 0.08%
Vapor Pressure(mmHg): 2.4 @ 68°F
Specific Gravity(Water=1): 0.87
Molecular Weight: 106
Vapor Density(Air=1): 3.7
% Volatiles: 100
How to detect this compound : N/A
Evaporation Rate, n-BuAcetate=1: 0.86
Odor Threshold: 0.5 ppm
Freezing Point: -54.0°F (-47.7°C)

Section X - Stability and Reactivity

Stability: Stable
Hazardous Polymerization: Will Not Occur
Conditions to Avoid: Avoid heat, sparks, and open flames.
Materials to Avoid: Strong oxidizing agents, concentrated nitric and sulfuric acids, and molten sulphur. Temperatures above ambient.
Hazardous Decomposition Products: Fumes, smoke, carbon monoxide, aldehydes, various hydrocarbons, and other organic compounds may be formed during combustion.

Section XI - Toxicological Information

N/A

Section XII - Ecological Information

N/A

Section XIII - Disposal Considerations

Use non-leaking containers, seal tightly and label properly. Dispose of in accordance with applicable local, county, state and federal regulations.

Section XIV - Transport Information

DOT Proper Shipping Name: Xylene
DOT Hazard Class/ I.D. No.: 3, UN1307, III

Section XV - Regulatory Information

CALIFORNIA PROPOSITION 65: WARNING
This product contains the following substance known to the state of California to cause cancer: Benzene
This product contains the following substance known to the state of California to cause birth defects: Toluene
Reportable Quantity: 1000 Pounds (454 Kilograms) (139.50 Gals)
NFPA Rating: Health - 2; Fire - 3; Reactivity - 0
0=Insignificant 1=Slight 2=Moderate 3=High 4=Extreme
Carcinogenicity Lists: No **NTP:** No **IARC Monograph:** No **OSHA Regulated:** Yes

Section 313 Supplier Notification: This product contains the following toxic chemcial(s) subject to the reporting requirements of SARA TITLE III Section 313 of the Emergency Planning and Community Right-To Know Act of 1986 and of 40 CFR 372:

CAS #	Chemical Name	% By Weight
1330-20-7	Xylene	79-82%
100-41-1	Ethylbenzene	18-20%
108-88-3	Toluene	< 1%

Section XVI - Other Information

Synonyms/Common Names: Xylol; Dimethyl Benzene; Methyl Toluene
Chemical Family/Type: Aromatic Hydrocarbon

IMPORTANT! Read this MSDS before use or disposal of this product. Pass along the information to employees and any other persons who could be exposed to the product to be sure that they are aware of the information before use or other exposure. This MSDS has been prepared according to the OSHA Hazard Communication Standard [29 CFR 1910.1200]. The MSDS information is based on sources believed to be reliable. However, since data, safety standards, and government regulations are subject to change and the conditions of handling and use, or misuse are beyond our control, **Hill Brothers Chemical Company** makes no warranty, either expressed or implied, with respect to the completeness or continuing accuracy of the information contained herein and disclaims all liability for reliance thereon. Also, additional information may be necessary or helpful for specific conditions and circumstances of use. It is the user's responsibility to determine the suitability of this product and to evaluate risks prior to use, and then to exercise appropriate precautions for protection of employees and others.

HOME PAGE

Material Safety Data Sheet

Version 4.3
Revision Date 07/03/2013
Print Date 05/19/2014

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	1,2,4-Trimethylbenzene
Product Number	:	T73601
Brand	:	Aldrich
Supplier	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052
Emergency Phone # (For both supplier and manufacturer)	:	(314) 776-6555
Preparation Information	:	Sigma-Aldrich Corporation Product Safety - Americas Region 1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards
Combustible Liquid

Target Organs

Central nervous system

GHS Classification
Flammable liquids (Category 3)
Acute toxicity, Inhalation (Category 4)
Acute toxicity, Oral (Category 5)
Skin irritation (Category 2)
Eye irritation (Category 2A)
Specific target organ toxicity - single exposure (Category 3)
Acute aquatic toxicity (Category 2)

GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)

H226	Flammable liquid and vapour.
H303	May be harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H335	May cause respiratory irritation.
H401	Toxic to aquatic life.

Precautionary statement(s)

P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if

present and easy to do. Continue rinsing.

HMIS Classification

Health hazard: 1
Chronic Health Hazard: *
Flammability: 2
Physical hazards: 0

NFPA Rating

Health hazard: 2
Fire: 2
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : C9H12
Molecular Weight : 120.19 g/mol

Component		Concentration
1,2,4-Trimethylbenzene		
CAS-No.	95-63-6	<=100%
EC-No.	202-436-9	
Index-No.	601-043-00-3	

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability
Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat/sparks/open flame/hot surface. No smoking.

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Carbon oxides

Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
1,2,4-Trimethylbenzene	95-63-6	TWA	25 ppm 125 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	25 ppm 123 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		TWA	25 ppm 125 mg/m3	USA. NIOSH Recommended Exposure Limits
Remarks	hemimellitene is a mixture of the 1,2,3-isomer with up to 10% of related aromatics such as the 1,2,4-isomer.			

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Splash contact
Material: butyl-rubber
Minimum layer thickness: 0.3 mm
Break through time: 30 min
Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid, clear
Colour	light blue colourless

Safety data

pH	no data available
Melting point/freezing point	-43.7 °C (-46.7 °F)
Boiling point	168.0 - 169.0 °C (334.4 - 336.2 °F)
Flash point	48.0 °C (118.4 °F) - closed cup
Ignition temperature	515 °C (959 °F)
Auto-ignition temperature	515.0 °C (959.0 °F)
Lower explosion limit	0.9 %(V)
Upper explosion limit	6.4 %(V)
Vapour pressure	2.3 hPa (1.7 mmHg) at 20.0 °C (68.0 °F) 6.0 hPa (4.5 mmHg) at 37.7 °C (99.9 °F) 9.3 hPa (7.0 mmHg) at 44.4 °C (111.9 °F)
Density	0.88 g/cm3
Water solubility	insoluble
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evapouration rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions
no data available

Conditions to avoid
Heat, flames and sparks.

Materials to avoid
Strong oxidizing agents

Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50
LD50 Oral - rat - 5,000 mg/kg

Inhalation LC50
LC50 Inhalation - rat - 4 h - 18,000 mg/m3

Dermal LD50
no data available

Other information on acute toxicity
no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitisation
no data available

Germ cell mutagenicity

Genotoxicity in vitro - in vitro assay - S. typhimurium - with and without metabolic activation - negative

Genotoxicity in vivo - rat - male and female - Intraperitoneal - negative

Carcinogenicity

no data available

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure
prolonged or repeated exposure can cause:, narcosis, Bronchitis., Symptoms and signs include headache, dizziness, fatigue, muscular weakness, drowsiness and in extreme cases, loss of consciousness., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects
no data available

Additional Information
RTECS: DC3325000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 7.72 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 3.6 mg/l - 48 h

Persistence and degradability
no data available

Bioaccumulative potential
no data available

Mobility in soil
no data available

PBT and vPvB assessment
no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3295 Class: 3 Packing group: III
Proper shipping name: Hydrocarbons, liquid, n.o.s.
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 3295 Class: 3 Packing group: III EMS-No: F-E, S-D
Proper shipping name: HYDROCARBONS, LIQUID, N.O.S.
Marine pollutant: No

IATA
UN number: 3295 Class: 3 Packing group: III
Proper shipping name: Hydrocarbons, liquid, n.o.s.

15. REGULATORY INFORMATION

OSHA Hazards
Combustible Liquid

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
1,2,4-Trimethylbenzene	95-63-6	2007-07-01

SARA 311/312 Hazards
Fire Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
1,2,4-Trimethylbenzene	95-63-6	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
1,2,4-Trimethylbenzene	95-63-6	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
1,2,4-Trimethylbenzene	95-63-6	2007-07-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Monsanto
Material Safety Data

POLYCHLORINATED BIPHENYLS (PCBs)

Emergency Phone No.
(Call Collect)
314-694-1000

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: POLYCHLORINATED BIPHENYLS (PCBs)
Aroclor® Series 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, 1268
Therminol® FR Series

MSDS Number: M00018515 Date: 12/95

Chemical Family:	Chlorinated Hydrocarbons
Chemical Name:	Polychlorinated biphenyls
Synonyms:	PCBs, Chlorodiphenyls, Chlorinated biphenyls

Trade Names/Common Names:

PYRANOL® and INERTEEN® are trade names for commonly used dielectric fluids that may have contained varying amounts of PCBs as well as other components including chlorinated benzenes.

ASKAREL is the generic name for a broad class of fire resistant synthetic chlorinated hydrocarbons and mixtures used as dielectric fluids that commonly contained about 30 - 70% PCBs. Some ASKAREL fluids contained 99% or greater PCBs and some contained no PCBs.

PYDRAUL® is the trade name for hydraulic fluids that, prior to 1972, may have contained varying amounts of PCBs and other components including phosphate esters.

The product names/trade names are representative of several commonly used Monsanto products (or products formulated with Monsanto products). Other trademarked PCB products were marketed by Monsanto and other manufacturers. PCBs were also manufactured and sold by several European and Japanese companies. Contact the manufacturer of the trademarked product, if not in this listing, to determine if the formulation contained PCBs.

In 1972, Monsanto restricted sales of PCBs to applications involving only closed electrical systems, (transformers and capacitors). In 1977, all manufacturing and sales were voluntarily terminated. In 1979, EPA restricted the manufacture, processing, use, and distribution of PCBs to specifically exempted and authorized activities.

MONSANTO COMPANY, 800 N. LINDBERGH BLVD., ST. LOUIS, MO 63167

FOR CHEMICAL EMERGENCY, SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT
Call CHEMTREC - Day or Night - 1-800-424-9300 Toll free in the continental U.S., Hawaii, Puerto Rico, Canada, Alaska, or Virgin Islands. For calls originating elsewhere: 202-483-7616 (collect calls accepted)

For additional nonemergency information, call: 314-694-3344.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemically, commercial PCBs are defined as a series of technical mixtures, consisting of many isomers and compounds that vary from mobile, oily liquids to white crystalline solids and hard noncrystalline resins. Technical products vary in composition, in the degree of chlorination, and possibly according to batch.

The mixtures generally used contain an average of 3 atoms of chlorine per molecule (42% chlorine) to 5 atoms of chlorine per module (54% chlorine). They were used as components of dielectric fluids in transformers and capacitors. Prior to 1972, PCB applications included heat transfer media, hydraulic, and other industrial fluids, plasticizers, carbonless copy paper, paints, inks, and adhesives.

Component	CAS No.
chlorinated biphenyl	1336-36-3
Aroclor 1016	12674-11-2
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1242	53469-21-9
Aroclor 1248	12672-29-6
Aroclor 1254	11097-69-1
Aroclor 1260	11096-82-5
Aroclor 1262	37324-23-5
Aroclor 1268	11100-14-4

There are also CAS Numbers for individual PCB congeners and for mixtures of Aroclor® products.

PCBs are identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Seventh).

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Appearance and Odor: PCB mixtures range in form and color from clear to amber liquids to white crystalline solids. They have a mild, distinctive odor and are not volatile at room temperature. Refer to Section 9 for details.

WARNING!
CAUSES EYE IRRITATION
MAY CAUSE SKIN IRRITATION

PROCESSING AT ELEVATED TEMPERATURES MAY RELEASE VAPORS OR FUMES WHICH MAY CAUSE RESPIRATORY TRACT IRRITATION

POTENTIAL HEALTH EFFECTS

Likely Routes of Exposure: Skin contact and inhalation of heated vapors

Eye Contact: Causes moderate irritation based on worker experience.

Skin Contact: Prolonged or repeated contact may result in redness, dry skin and defatting based on human experience. A potential exists for developing chloracne. PCBs can be absorbed through intact skin.

Inhalation: Due to the low volatility of PCBs, exposure to this material in ambient conditions is not expected to produce adverse health effects. However, at elevated processing temperatures, PCBs may produce a vapor that may cause respiratory tract irritation if inhaled based on human experience.

Ingestion: No more than slightly toxic based on acute animal toxicity studies. Coughing, choking and shortness of breath may occur if liquid material is accidentally drawn into the lungs during swallowing or vomiting.

Other: Numerous epidemiological studies of humans, both occupationally exposed and nonworker environmentally exposed populations, have not demonstrated any causal relationship between PCB exposure and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs at high dosage can cause skin symptoms; however, these subside upon removal of the exposure source.

Refer to Section 11 for toxicological information.

4. FIRST AID MEASURES

IF IN EYES, immediately flush with plenty of water for at least 15 minutes. If easy to do, remove any contact lenses. Get medical attention. Remove material from skin and clothing.

IF ON SKIN, immediately flush the area with plenty of water. Wash skin gently with soap as soon as it is available. Get medical attention if irritation persists.

IF INHALED, remove person to fresh air. If breathing is difficult, get medical attention.

IF SWALLOWED, do NOT induce vomiting. Rinse mouth with water. Get medical attention. Contact a Poison Control Center. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

NOTE TO PHYSICIANS: Hot PCBs may cause thermal burn. If electrical equipment arcs between conductors, PCBs or other chlorinated hydrocarbon dielectric fluids may decompose to produce hydrochloric acid (HCl), a respiratory irritant. If large amounts are swallowed, gastric lavage may be considered.

5. FIRE FIGHTING MEASURES

Flash Point: 284 degrees F (140 degrees C) or higher depending on the chlorination level of the Aroclor product

Fire Point: 349 degrees F (176 degrees C) or higher depending on the chlorination level of the Aroclor product

NOTE: Refer to Section 9 for individual flash points and fire points.

Extinguishing Media: Extinguish fire using agent suitable for surrounding fire. Use dry chemical, foam, carbon dioxide or water spray. Water may be ineffective. Use water spray to keep fire-exposed containers or transformer cool.

PCBs are fire-resistant compounds. They may decompose to form CO, CO2, HCl, phenolics, aldehydes, and other toxic combustion products under severe conditions such as exposure to flame or hot surfaces.

Dielectric fluids having PCBs and chlorinated benzenes as components have been reported to produce polychlorinated dibenzo-p-dioxins (PCDDs) and furans (PCDFs) during fire situations involving electrical equipment. At temperatures in the range of 600-650 degrees C in the presence of excess oxygen, PCBs may form polychlorinated dibenzofurans (PCDFs). Laboratory studies under similar conditions have demonstrated that PCBs do not produce polychlorinated dibenzo-p-dioxins (PCDDs).

Federal regulations require all PCB transformers to be registered with fire response personnel.

If a PCB transformer is involved in a fire-related incident, the owner of the transformer may be required to report the incident. Consult and follow appropriate federal, state and local regulations.

Fire Fighting Equipment: Fire fighters and others exposed to products of combustion should wear self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

6. ACCIDENTAL RELEASE MEASURES

Cleanup and disposal of liquid PCBs and other PCB items are strictly regulated by the federal government. The regulations are found at 40 CFR Part 761. Consult these regulations as well as applicable state and local regulations prior to any cleanup or disposal of PCBs, PCB items, or PCB contaminated items.

If PCBs leak or are spilled, the following steps should be taken immediately:

All nonessential personnel should leave the leak or spill area.

The area should be adequately ventilated to prevent the accumulation of vapors.

The spill/leak should be contained. Loss to sewer systems, navigable waterways, and streams should be prevented. Spills/leaks should be removed promptly by means of absorptive material, such as sawdust, vermiculite, dry sand, clay, dirt or other similar materials, or trapped and removed by pumping or other suitable means (traps, drip-pans, trays, etc.).

Personnel entering the spill or leak area should be furnished with appropriate personal protective equipment and clothing as needed. Refer to Section 8 for personal protection equipment and clothing.

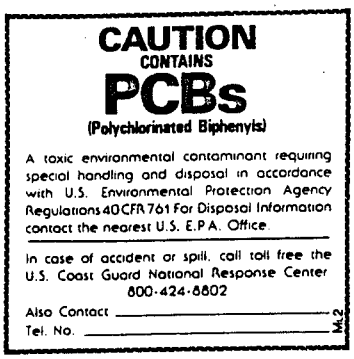
Personnel trained in emergency procedures and protected against attendant hazards should shut off sources of PCBs, clean up spills, control and repair leaks, and fight fires in PCB areas.

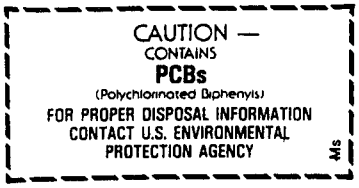
Refer to Section 13 for disposal information and Sections 14 and 15 for information regarding reportable quantity, and Section 7 for marking information.

7. HANDLING AND STORAGE

Care should be taken to prevent entry into the environment through spills, leakage, use vaporization, or disposal of liquid or containers. Avoid prolonged breathing of vapors or mists. Avoid contact with eyes or prolonged contact with skin. If skin contact occurs, remove by washing with soap and water. Following eye contact, flush with water. In case of spillage onto clothing, the clothing should be removed as soon as practical, skin washed, and clothing laundered. Comply with all federal, state, and local regulations.

Federal regulations under the Toxic Substances Control Act require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be marked (check regulations, 40 CFR 761, for details).





Storage: The storage of PCB items or equipment (those containing 50 ppm or greater PCBs) and PCB waste is strictly regulated by 40 CFR Part 761. The storage time is limited, the storage area must meet physical requirements, and the area must be labeled.

Avoid contact with eyes.
Wash thoroughly after handling.
Avoid breathing processing fumes or vapors.
Process using adequate ventilation.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection: Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.

Skin Protection: Wear appropriate protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine the appropriate type glove for a given application. Wear chemical goggles, face shield, and chemical resistant clothing such as a rubber apron when splashing is likely. Wash immediately if skin is contacted. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.

ATTENTION! Repeated or prolonged skin contact may cause chloracne in some people.

Respiratory Protection: Avoid breathing vapor, mist, or dust. Use NIOSH/MSHA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended when airborne exposure limits are exceeded and, if used, replaces the need for face shield and/or chemical splash goggles. Consult respirator manufacturer to determine the type of equipment for a given application. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs must be in compliance with 29 CFR Part 1910.134.

ATTENTION! Repeated or prolonged inhalation may cause chloracne in some people.

Ventilation: Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of vapor or mist, such as open process equipment.

Airborne Exposure Limits:

Product: Chlorodiphenyl (42% chlorine)

OSHA PEL: 1 mg/m^3 8-hour time-weighted average - Skin*
ACGIH TLV: 1 mg/m^3 8-hour time-weighted average - Skin*

Product: Chlorodiphenyl (54% chlorine)

OSHA PEL: 0.5 mg/m^3 8-hour time-weighted average - Skin*
ACGIH TLV: 0.5 mg/m^3 8-hour time-weighted average - Skin*

*For Skin notation see Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Government Industrial Hygienists, 1995-1996.

9. PHYSICAL AND CHEMICAL PROPERTIES

PROPERTIES OF SELECTED AROCLORS®							
PROPERTY	**1016**	**1221**	**1232**	**1242**	**1248**	**1254**	**1260**
Color (APHA)	40	100	100	100	100	100	150
Physical state	mobile oil	mobile oil	mobile oil	mobile oil	mobile oil	viscous liquid	sticky resin
Stability	inert	inert	inert	inert	inert	inert	inert
Density (lb/gal 25°C)	11.40	9.85	10.55	11.50	12.04	12.82	13.50
Specific gravity x/15.5°C	1.36-1.37 x-25°	1.18-1.19 x-25°	1.27-1.28 x-25°	1.30-1.39 x-25°	1.40-1.41 x-65°	1.49-1.50 x-65°	1.55-1.56 x-90°
Distillation range (°C)	323-356	275-320	290-325	325-366	340-375	365-390	385-420
Acidity mg KOH/g, maximum	.010	.014	.014	.015	.010	.010	.014
Fire point (°C)	none to boiling point	176	238	none to boiling point	none to boiling point	none to boiling point	none to boiling point
Flash point (°C)	170	141-150	152-154	176-180	193-196	none	none
Vapor pressure (mm Hg @ 100°F)	NA	NA	0.005	0.001	0.00037	0.00006	NA
Viscosity (Saybolt Univ. Sec. @ 100°F) (centistokes)	71-81 13-16	38-41 3.6-4.6	44-51 5.5-7.7	82-92 16-19	185-240 42-52	1800-2500 390-540	— —

NA—*Not Available*

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

Stability: PCBs are very stable, fire-resistant compounds.
Materials to Avoid: None
Hazardous Decomposition
Products: PCBs may decompose to form CO, CO_2, HCl, phenolics, aldehydes, and other toxic combustion products under severe conditions such as exposure to flame or hot surface.
Hazardous Polymerization: Does not occur.

11. TOXICOLOGICAL INFORMATION

Data from laboratory studies conducted by Monsanto and from the available scientific literature are summarized below.
Single exposure (acute) studies indicate:
Oral - Slightly Toxic (Rat LD50 - 8.65 g/kg for 42% chlorinated; 11.9 g/kg for 54% chlorinated)

The liquid products and their vapors are moderately irritating to eye tissues. Animal experiments of varying duration and at different air concentrations show that for similar exposure conditions, the 54% chlorinated material produces more liver injury than the 42% chlorinated material.

There are literature reports that PCBs can impair reproductive functions in monkeys. The National Cancer Institute (NCI) performed a study in 1977 using Aroclor 1254 with both sexes of rats. NCI stated that the PCB, Aroclor 1254, was not carcinogenic under the conditions of their bioassay. There is sufficient evidence in the scientific literature to conclude that Aroclor 1260 can cause liver cancer when fed to rodents at high doses. Similar experiments with less chlorinated PCB products have produced negative or equivocal results.

The consistent finding in animal studies is that PCBs produce liver injury following prolonged and repeated exposure by any route, if the exposure is of sufficient degree and duration. Liver injury is produced first, and by exposures that are less than those reported to cause cancer in rodents. Therefore, exposure by all routes should be kept sufficiently low to prevent liver injury.

Numerous epidemiological studies of humans, both occupationally exposed and nonworker environmentally exposed population, have not demonstrated any causal relationship between PCB exposure and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs at high dosage can cause skin symptoms; however, these subside upon removal of the exposure source.

PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Seventh Annual Report on Carcinogens.

12. ECOLOGICAL INFORMATION

Care should be taken to prevent entry of PCBs into the environment through spills, leakage, use, vaporization or disposal of liquid or solids. PCBs can accumulate in the environment and can adversely affect some animals and aquatic life. In general, PCBs have low solubility in water, are strongly bound to soils and sediments, and are slowly degraded by natural processes in the environment.

13. DISPOSAL CONSIDERATIONS

The disposal of PCB items or equipment (those containing 50 ppm or greater PCBs) and PCB wastes is strictly regulated by 40 CFR Part 761. For example, all wastes and residues containing PCBs (wiping cloths, absorbent material, used disposable protective gloves and clothing, etc.) should be collected, placed in proper containers, marked and disposed of in the manner prescribed by EPA regulations (40 CFR Part 761) and applicable state and local regulations.

14. TRANSPORT INFORMATION

The data provided in this section are for information only. Please apply the appropriate regulations to properly classify a shipment for transportation.

DOT Classification:	IF WEIGHT OF PCBs TO BE SHIPPED IS OVER ONE POUND, THE FOLLOWING CLASSIFICATION AND LABEL APPLY.	
DOT Label:	LIQUID:	Environmentally Hazardous Substance, liquid, n.o.s. (Contains PCB), 9, UN 3082, III
	SOLID:	Environmentally Hazardous Substance, solid, n.o.s. (Contains PCB), 9, UN 3077, III
DOT Label:	Class: 9	
DOT Reportable Quantity:	One Pound	
IMO Classification:	Polychlorinated Biphenyls, IMO Class 9, UN 2315, II IMO Page 9034, EMS 6.1-02	
IATA/ICAO Classification:	Polychlorinated Biphenyls, 9, UN2315, II	

15. REGULATORY INFORMATION

For regulatory purposes, under the Toxic Substances Control Act, the term "PCBs" refers to a chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain such a substance (40 CFR Part 761).

TSCA Inventory: not listed.

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370): Immediate, Delayed.
SARA Section 313 Toxic Chemical(s): Listed-1993 (De Minimis concentration 0.1%.)

Reportable Quantity (RQ) under DOT (49 CFR) and CERCLA Regulations: 1 lb. (polychlorinated biphenyls) PCBs.

Release of more than 1 (one) pound of PCBs to the environment requires notification to the National Response Center (800-424-8802 or 202-426-2675).

Various state and local regulations may require immediate reporting of PCB spills and may also define spill cleanup levels. Consult your attorney or appropriate regulatory officials for information relating to spill reporting and spill cleanup.

16. OTHER INFORMATION

Reason for revision: Conversion to the 16 section format. Supersedes MSDS dated 10/88.

FOR ADDITIONAL NONEMERGENCY INFORMATION, CONTACT:

Gary W. Mappes
Manager, Product & Environmental Safety

Robert G. Kaley, II
Director, Environmental Affairs

Monsanto Company
800 North Lindbergh Boulevard
St. Louis, MO 63167
(314) 694-3344

CALEDON LABORATORY CHEMICALS

MATERIAL SAFETY DATA SHEET

MANGANESE, METAL

PRODUCT CODE NUMBER(S): 4940-1

PRODUCT IDENTIFICATION

Chemical Name and Synonyms: *Manganese, metal*
Chemical Family: *Metal*
Chemical Formula: *Mn*
Product Use: *Laboratory reagent*
Manufacturer's Name and Address:
Caledon Laboratories Ltd.
40 Armstrong Avenue
Georgetown, Ontario L7G 4R9
Telephone No: *(905) 877-0101*
Fax No: *(905) 877-6666*
Emergency Telephone No: *CANUTEC (613) 996-6666*

HAZARDOUS INGREDIENTS OF MATERIALS

Ingredients	*%*	*TLV Units*	*CAS No.*
Manganese	*>99*	*0.2 mg/m^3*	*7439-96-5*

PHYSICAL DATA

Physical State: *Solid*
Odour and Appearance: *Metallic-grey chunks or black, shiny powder, odourless*
Odour Threshold (ppm): *Not applicable*
Vapour Pressure (mm Hg): *~0*
Vapour Density (Air = 1): *Not applicable*
Evaporation Rate: *Not applicable*
Boiling Point (degrees C): *1962°C*
Melting Point (degrees C): *1244°C*
pH: *Not applicable*
Specific Gravity: *0.72 @ 20°C*
Coefficient of Water/Oil distribution: *Not applicable*

SHIPPING DESCRIPTION

UN: *Not regulated*
T.D.G. Class: *Not regulated*
Pkg. Group: *Not regulated*

REACTIVITY DATA

Chemical Stability: *Stable*
Incompatibility with other substances: *May react vigoroulsy or violently with acids, bases, halogens, phosphorus, sulfur oxides. Reacts slowly with water, more rapidly with steam, and with acids or alkalis, to release flammable/explosive hydrogen gas. Reacts violently with halogenated products. As powder, can ignite spontaneously under certain conditions.*
Reactivity: *Avoid gemeration of dust, excessive heat and ignition sources, and all incompatible materials.*
Hazardous Decomposition Products: *Flammable/ explosve hydrogen gas.*

FIRE AND EXPLOSION DATA

Flammability: *Solid not combustible. Dust or powder is flammable in contact with an ignition source. Dust can form explosive mixtures with air.*
Extinguishing Media: *Dry chemical powder, class "D" extinguisher, dry sand. Water may be used as a spray or fog, liberally applied. Fight fire from upwind, from a safe distance.Firefighters must wear protective equipment and clothing sufficient to prevent inhalation of dust or fumes, and contact with skin and eyes.*
Flash Point (Method Used): *Not available*
Autoignition Temperature: *Not available*
Upper Flammable Limit (% by volume): *Not available*
Lower Flammable Limit (% by volume): *Not available*
Hazardous Combustion Products: *Emits toxic fumes under fire conditions.*
Sensitivity to Impact: *None*
Sensitivity to Static discharge: *Mixtures of dust with air may be sensitive under certain conditions, when ignited by an electrostatic or other high-voltage spark, or other ignition source.*

TOXICOLOGICAL PROPERTIES AND HEALTH DATA

Toxicological Data:

LD_{50}: *(oral, rat) 9 gm/kg*
LC_{50}: *Not available*

Effects of Acute Exposure to Product:

Inhaled: *Inhalation of dust or vapour may cause irritation, shortness of breath, coughing. Inhalation of high concentrations can cause "metal fume fever" with headache, metallic taste in the mouth, cough, thirst, shortness of breath, fever, pains in the legs and chest. Recovery occurs within two days after exposure is terminated, and there are no known permanent effects.*
In contact with skin: *May cause mechanical irritation with redness and itching.*
In contact with eyes: *May cause mechanical irritation, with redness, tearing, itching. May cause mild abrasion of cornea.*
Ingested: *Not generally considered toxic by ingestion, but large amounts may cause gastrointestinal disturbances, wi,\th metallic taste in mouth, nausea, vomiting and diarrhea, abdominal pain.*

Effects of Chronic Exposure to Product:

Chronic manganese poisoning involves the central nervous system with languor, sleepines, weakness in the legs, a spastic gait and tendency to fall, mask-like appearance of the face, and emotional disturbances such as uncontrollable laughter.

Carcinogenicity: *Not listed as a carcinogen by NTP, IARC, OSHA.*

Teratogenicity: *Prolonged oral administration to rats produced fetotoxicity.*
Reproductive Effects: *Men exposed to manganese dust showed decreased fertility (RTECS No. OO9275000).*
Mutagenicity: *Prolonged oral administration to rats produced mutagenic effects.*
Synergistic Products: *None known*

PREVENTIVE MEASURES

Engineering Controls: *Local explosion-proof exhaust system.*
Respiratory Protection: *Dust mask. Up to 10 mg/m^3 (dust, not fume): NIOSH approved dust and mist respirator. Up to 25 mg/m^3 (dust, not fume): continuous-flow supplied-air respirator. Up to 50 mg/m^3: full face-piece respirator with high-efficiency particulate filters, or continuous-flow or powered supplied-air respirator with tight-fitting face-piece. Up to 500 mg/m^3: positive-pressure supplied-air respirator. For higher or unknown concentrations, as in fire or spill conditions, positive pressure, full face-piece self-contained breathing apparatus, or positive pressure, full face-piece supplied-air respirator, with an auxiliary positive pressure self-contained breathing apparatus.*
Eye Protection: *Chemical safety glasses. Do not wear contact lenses when working with chemicals.*
Skin Protection: *Rubber or plastic gloves. Other protective clothing, labcoat, sleeves sufficient to limit contact*
Other Personal Protective Equipment: *Safety shower and eye-wash fountain in work area.*
Leak and Spill Procedure: *Elminate ignition sources if dust is present. Cleanup personnel must be thoroughly trained in the hazards of this material and its safe handling, and must wear protective equipment and clothing sufficient to prevent inhalation of dust or fumes, and contact with skin and eyes. Use non-sparking tools. Gather up in a manner that does not raise dust. Recycle if possible. Transfer what cannot be recycled into container and arrange removal by disposal company. After thorough clean up, wash site of spillage thoroughly with water and detergent.*
Waste Disposal: *Follow all federal, provincial and local regulations for disposal.*
Handling Procedures and Equipment: *Workers using this chemical must be properly trained in its hazards and its safe use, and must wear appropriate prorective equipment and clothing. Avoid generating dust. If there is dust, keep away from heat, sparks, and all sources of ignition; avoid the accumulation of static charge, use anti-sparking tools and ground and bond equipment and containers. Use the smallest amount possible for the purpose, in a designated area with adequate ventilation. Use good housekeeping to prevent accumulations of dust. Avoid contact with skin and eyes. Avoid inhalation. Wash thoroughly after handling. Empty containers may contain hazardous resdiues, treat with caution.*
Storage Requirements: *Store in suitable, labelled containers, in a cool, dry, well-ventilated area, out of direct sunlight and away from incompatible materials. Keep away from water, and isolate from air. Keep containers tightly closed when not in use and when empty. Protect from damage.*

FIRST AID MEASURES

Specific Measures:

Eyes: *Flush eyes thoroughly with gently running water, holding eyelids open while flushing, for five to ten (5-10) minutes, or until no trace of chemical remains. Get medical advice if irritation develops.*
Skin: *Remove contaminated clothing. Brush or wipe off dry material. Flush skin with plenty of running water until no evidence of chemical remains. If irritation develops get medical attention.*
Inhalation: *Remove to fresh air. Give oxygen and get medical attention for any breathing difficulty.*
Ingestion: *If victim is alert and not convulsing, give 1 to 2 glasses of water to drink to dilute material. If discomfort occurs, or if a large amount has been ingested, obtain medical attention.*

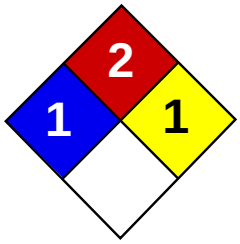
REFERENCES USED

CCINFO disc: Cheminfo, MSDS's
Budavari: The Merck Index, 12th ed., 1997
Sax, Lewis: Hawley's Condensed Chemical Dictionary, 11th ed., 1987
Sax: Dangerous Properties of Industrial Materials, 5th ed., 1979
Suppliers' Material Safety Data Sheets

ADDITIONAL INFORMATION

Date Issued: *August 19, 1991*
Revision: *February 2011*
MSDS: *4940-1*
Proposed WHMIS Designation: *B4; D2A*

Prepared by: Caledon Laboratories Ltd. (905) 877-0101



Material Safety Data Sheet
Iron Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Iron Metal

Catalog Codes: SLI2047, SLI1996

CAS#: 7439-89-6

RTECS: NO4565500

TSCA: TSCA 8(b) inventory: Iron Metal

CI#: Not applicable.

Synonym:

Chemical Name: Iron

Chemical Formula: Fe

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Iron Metal, powder	7439-89-6	100

Toxicological Data on Ingredients: Not applicable.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to liver, cardiovascular system, upper respiratory tract, pancreas. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Chlorine Trifluoride reacts with iron with incandescence. Powdered iron reacts with fluorine below redness with incandescence. Reduced iron decomposes with nitrogen dioxide @ ordinary temperature with incandescence. Reacting mass formed by mixture of phosphorus and iron can become incandescent when heated. This material is flammable in powder form only.

Special Remarks on Explosion Hazards: Material in powdered form can explode when exposed to heat or flame

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe dust. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Moisture sensitive.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Solid metallic powder.)

Odor: Odorless.

Taste: Tasteless.

Molecular Weight: 55.85 g/mole

Color: Black to Grey.

pH (1% soln/water): Not applicable.

Boiling Point: 3000°C (5432°F)

Melting Point: 1535°C (2795°F)

Critical Temperature: Not available.

Specific Gravity: Density: 7.86 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, ignition sources, incompatible materials, water/moisture, air, dust generation.

Incompatibility with various substances:
Reactive with oxidizing agents, acids. Slightly reactive to reactive with moisture.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:
Hot iron(wire) burns in Chlorine gas. Violent decompositon of hydrogen peroxide (53% by weight or greater) may be caused by contact with iron. Readily oxidizes in moist air forming rust. Reactive with halogens. Incompatible with acetaldehyde, ammonium peroxodisulfate, chloroformamidinum, chloric acid, ammonium nitrate, dinitorgen tetroxide, nitryl fluoride, polystyrene, sodium acetylide, potassium dichromate, peroxyformic acid, sulfuric acid, sodium carbide. Readily attacked by dilute mineral acids and or attacked or dissolved by organic acids. Not appreciably attacked by cold sulfuric acid, or nitric acid, but is attacked by hot acids.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 30000 mg/kg [Rat].

Chronic Effects on Humans: May cause damage to the following organs: liver, cardiovascular system, upper respiratory tract, pancreas.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Iron metal filings or dust: May cause skin irritation by mechanical action. Iron metal wire: Not likely to cause skin irritation Eyes: Iron metal filings or dust: Can irritate eyes by mechanical action. Iron metal wire: No hazard. Will not cause eye irritation. Inhalation: Iron dust: Can irritate the respiratory tract by mechanical action. Iron metal wire or filings: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Iron metal wire: Not an ingestion hazard: Iron metal filings or dust: The amount of ingested iron which constitutes a toxic dose is not well defined. Proposed toxic doses of elemental iron are 20 mg/kg for gastrointestinal irritation to greater than 60 mg/kg for systemic toxicity. Gastrointestinal effects are the first signs to appear, with hemorrhagic vomiting and diarrhea, hematochezia, abdominal pain, lethargy, metabolic acidosis, coagulaopathy, shock, coma and convulsions developing from 0 to 6 hours after ingestion. Leukocytosis may also occur. An asymptomatic phase may ensue at 6 to 12 hours postingestion, followed by hypoglycemia or hyperglycemia, hepatic and renal failure, severe acidosis, cyanosis, fever, CNS depression (lethargy, restlessness and/or confusion seizures), hypotension, and cardiovascular collapse/cardiac failure in 12 to 48 hours. Hepatic cirrhosis, gastrointestinal scarring and/or strictures may arise in 2 to 6 weeks. It may also cause an anaphylactoid reaction. Non-cardiogenic pulmonary edema also develop in severe cases of iron intoxication. Chronic Potential Health Effects: Inhalation: Chronic inhalation of iron dust can lead to accumulation in the lungs and a characteristic stippled appearance on X-rays. This condition, called SIDEROSIS, is considered benign in that it does not interfere with lung function and does not predispose to other disease. Chronic inhalation of iron dust may also cause fibrosis in the lungs. Ingestion: Clinical signs of iron overload appear when the total body iron is 5 to 10 times higher than normal. Neurobehavioral defects including depression, decreased activity, habituation, reflex startle, and conditioned avoidance response performance may occur. However, similiar effects were also seen in iron defficiency. It is therefore likely that these behavioral effects are secondary to general toxicity. High serum iron levels may be associated with an increased risk of fatal acute myocardial infarction (MI). Skin: Prolonged or repeated contact may cause hypersensivity.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Metal powder, flammable, n.o.s. (Iron metal powder) UNNA: 3089 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California Director's List of Hazardous Substances: Iron Metal TSCA 8(b) inventory: Iron Metal

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS B-4: Flammable solid.

DSCL (EEC):
R11- Highly flammable. S16- Keep away from sources of ignition - No smoking. S22- Do not breathe dust.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 2

Reactivity: 1

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 2

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:52 PM

Last Updated: 05/21/2013 12:00 PM

Appendix B
Soil / Materials Management Plan

Appendix B
Soil/Materials Management Plan

for
HIP Cleaners
Interim Remedial Measures Work Plan

169-55 137th Avenue, Jamaica, New York
Block 12495, Lot 2 (portion)
BCP Site # C241166

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau B
625 Broadway, 12th Floor
Albany, NY 12233-7016

Prepared for:
Rochdale Village, Inc.
169-55 137th Avenue
Queens, New York 11434

Prepared by:
Matthew M. Carroll, P.E.
&
TENEN ENVIRONMENTAL
121 West 27th Street, Suite 702
New York, NY 10001

March 2017

TABLE OF CONTENTS

1.0 INTRODUCTION

This Soil/Materials Management Plan (SMMP) has been developed for the Interim Remedial Measures (IRM) Work Plan prepared for JS Cleaners (Site). This plan pertains to management of all soils and materials that are disturbed at the Site and includes provisions for sediment and erosion control and stormwater management.

The Site is located at 169-47 137th Avenue, in the Jamaica neighborhood area of Queens, NY. The Site is an active dry cleaners (HIP Cleaners), located within the Rochdale Village Mall (Mall #2), which is part of a larger community development and housing complex known as Rochdale Village.

Rochdale Mall #2 is a one-story retail and office building (approximately 50,000 gross square feet) with associated parking. The Rochdale Village complex is bounded by Baisley Boulevard, Bedell Street, 137th Avenue and Guy R. Brewer Boulevard. Mall #2 is located in the southeast corner of the Rochdale Village with associated parking spaces fronting 137th Avenue. The Site is a 2,800 square foot one-story retail space located in the northern end of Mall #2. The Site is located in Queens Community Board 12 and is generally identified as a portion of Block 12495, Lot 2.

The proposed IRM includes depressurizing under the entire Rochdale Mall #2 building slab, outside of the Site footprint, through the installation of an active SSDS. The area to be depressurized is approximately 50,000 square-feet (sf).

1.1 Soil Screening Methods

Visual, olfactory and photoionization detector (PID) soil screening and assessment will be performed under the supervision of the Remedial Engineer (RE) and will be reported in the IRM Construction Completion Report (IRMCCR). Soil screening will be performed during invasive work during the IRM implementation.

1.2 Soil Stockpiling Methods

Excavated soil from the sub-slab depressurization system (SSDS) pits will be placed in 55-gallon drums. While drums are on-site and work is occurring, they will be inspected daily. All drum management will be compliant with applicable laws and regulations.

1.3 Characterization of Excavated Materials

Soil/fill or other excavated media that is transported off the Site for disposal will be sampled in a manner required by the receiving facility, and in compliance with applicable laws and regulations. Soils are not proposed for reuse on-Site.

1.4 Materials Excavation, Load-Out and Departure

The RE overseeing the remedial activities, or a qualified environmental professional under his/her supervision, will:

- Oversee remedial work and the excavation and drumming of excavated material;
- Ensure that there is a party responsible for the safe execution of invasive and other work performed under this IRM Work Plan;
- Ensure that Site development activities and development-related grading cuts will not interfere with, or otherwise impair or compromise the remedial activities proposed in this IRM Work Plan;
- Ensure that the presence of utilities and easements on the Site has been investigated and that any identified risks from work proposed under this IRM Work Plan are properly addressed by appropriate parties;
- Ensure that 55-gallon drums are inspected, properly sealed and cleaned if necessary before leaving the Site; and,
- Ensure that all egress points for truck and equipment transport from the Site will be kept clean of Site-derived materials during Site remediation.

Locations where vehicles exit the Site shall be inspected daily for evidence of soil tracking off premises. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials. Mechanical processing of historical fill and contaminated soil on the Site is prohibited.

1.5 Off-Site Materials Transport

Loaded vehicles leaving the Site will comply with all applicable materials transportation requirements (including appropriate covering, manifests, and placards) in accordance with applicable laws and regulations, including use of licensed haulers in accordance with 6 NYCRR Part 364.

Trucks leaving from the Rochdale Mall #2 will exit the parking lot and go right onto 137th Avenue (local truck route) and then left on Guy R Brewer Blvd (local truck route). Trucks will go right onto the N Conduit Road and merge onto the Van Wyck Expressway (expressway through routes).

This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) limiting total distance to major highways; (d) promoting safety in access to highways; and, (e) overall safety in transport. All trucks loaded with Site materials will exit the vicinity of the Site using only the most-current New York City Department of Transportation (NYCDOT)-approved truck routes (currently the 2011-2012 New York City Truck Route Map).

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

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

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

Based on the limited amount of historic fill/soil to be generated and the limited access to the Site and the adjoining units, the material will be staged in labeled 55-gallon drums located at Rochdale Village. The containers will be inspected for loose material prior to off-site disposal. Trucks will pick up the containers when full and the plastic will be disposed as solid waste.

1.6 Materials Disposal Off-Site

To document that the disposal of regulated material exported from the Site complies with applicable laws and regulations, the following documentation will be established and reported by the RE for each disposal destination used in this project:

(1) a letter from the RE or Applicant to each disposal facility describing the material to be disposed and requesting written acceptance of the material. This letter will state that material to be disposed is regulated material generated at an environmental remediation Site in New York under a governmental remediation program. The letter will provide the project identity and the name and phone number of the RE or Applicant, and will include as an attachment a summary of all chemical data for the material being transported; and,
(2) a letter from each disposal facility stating it is in receipt of the correspondence, (1) above, and is approved to accept the material.

These documents will be included in the IRMCCR.

The IRMCCR will include an itemized account of the destination of all material removed from the Site during this IRM. Documentation associated with disposal of all material will include records and approvals for receipt of the material. This information will be presented in the IRMCCR.

All soil, fill and other waste excavated and removed from the Site will be managed as regulated material (municipal solid waste per 6NYCRR Part 360-1.2) and will be disposed in accordance with applicable laws and regulations. Historic fill and material that does not meet Track 1 Unrestricted Use soil cleanup objectives (SCOs) is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility). Historic fill and contaminated soils taken off-Site will be handled as solid waste and will not be disposed at a Part 360-16 Registration Facility (also known as a Soil Recycling Facility).

Several 55-gallon drums of soil are proposed for off-Site disposal. Final disposal facilities will be identified to NYSDEC prior to shipping material to any facility. Waste characterization will be performed for off-Site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the IRMCCR. A

manifest system for off-Site transportation of exported materials will be employed. Manifest information will be reported in the IRMCCR. Hazardous wastes derived from on-Site will be stored, transported and disposed of in compliance with applicable laws and regulations.

If disposal of soil and fill from this Site is proposed for unregulated disposal (i.e., clean soil removed for development purposes), including transport to a Part 360-16 Registration Facility, a formal request will be made for approval by NYSDEC with an associated plan compliant with 6NYCRR Part 360-16. This request and plan will include the location, volume and a description of the material to be recycled, including verification that the material is not impacted by site uses and that the material complies with receipt requirements for recycling under 6 NYCRR Part 360. This material will be appropriately handled on-Site to prevent mixing with impacted material.

1.7 Materials Reuse On-Site

Soil reuse is not proposed on-Site.

1.8 Demarcation

Soil is not anticipated to be imported to the Site for use as clean cover.

1.9 Import of Backfill Soil from Off-Site Sources

Groundwater will not be encountered during implementation of the IRM Work Plan.

1.10 Fluids Management

All work will be completed in the cellar and stormwater pollution prevention practices are not required.

1.11 Stormwater Pollution Prevention

All work will be completed from grade and erosion and sediment control measures are not required.

1.12 Contingency Plan

This contingency plan is developed for the remedial construction to address the discovery of unknown structures or contaminated media during excavation. Identification of unknown contamination source areas during invasive Site work will be promptly communicated to the NYSDEC Project Manager. Petroleum spills will be reported to the NYSDEC Spill Hotline. These findings will be included in applicable daily report(s). If previously unidentified contaminant sources are found during on-Site remedial excavation or development-related excavation, sampling will be performed on contaminated source material and surrounding soils and reported to NYSDEC. Analysis will be performed for Full List volatiles and semi-volatiles, pesticides/PCBs, and TAL metals, as appropriate.

1.13 Odor, Dust and Nuisance Control

A Site-specific Community Air Monitoring Plan (CAMP) is included in the Health and Safety Plan (HASP) included as Appendix A of the IRM Work Plan.

Odor Control

All necessary means will be employed to prevent on- and off-Site odor nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) use of foams to cover exposed odorous soils. If odors develop and cannot otherwise be controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-Site disposal; and (e) use of chemical odorants in spray or misting systems.

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC will be notified of all odor complaint events. Implementation of all odor controls, including halt of work, will be the responsibility of the RE.

Dust Control

Dust management during invasive on-Site work will include, at a minimum:

- Use of a dedicated water spray method for roads, excavation areas and stockpiles;
- Use of properly anchored tarps to cover stockpiles;
- Exercise of extra care during dry and high-wind periods; and,
- Use of gravel or recycled concrete aggregate on egress and other roadways to provide a clean and dust-free road surface.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted and the source of dusts will be identified and corrected. Work will not resume until all nuisance dust emissions have been abated. NYSDEC will be notified of all dust complaint events. Implementation of all dust controls, including halt of work, will be the responsibility of the RE.

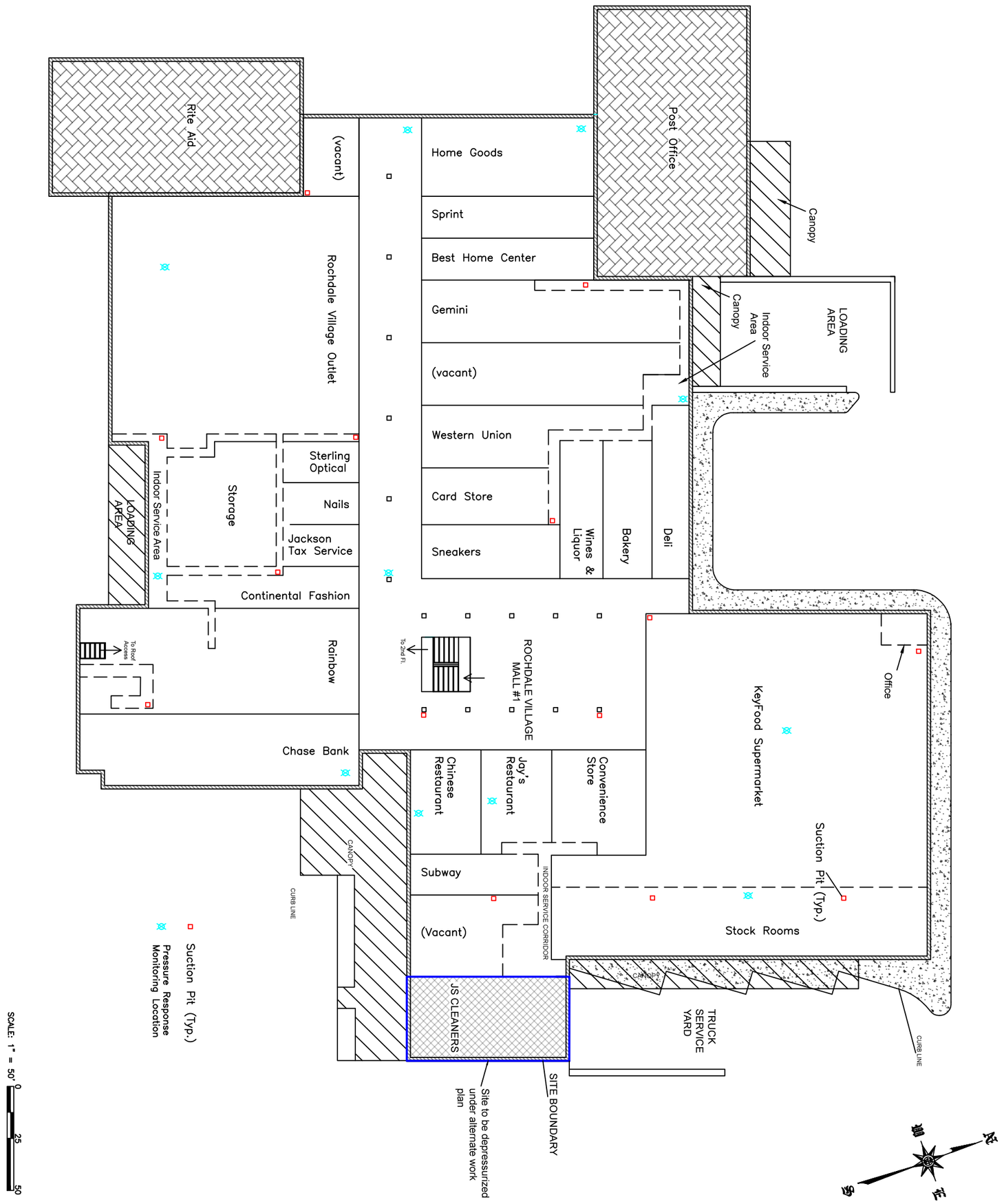
Other Nuisances

Noise control will be exercised during the remedial program. All remedial work will conform, at a minimum, to NYC noise control standards.

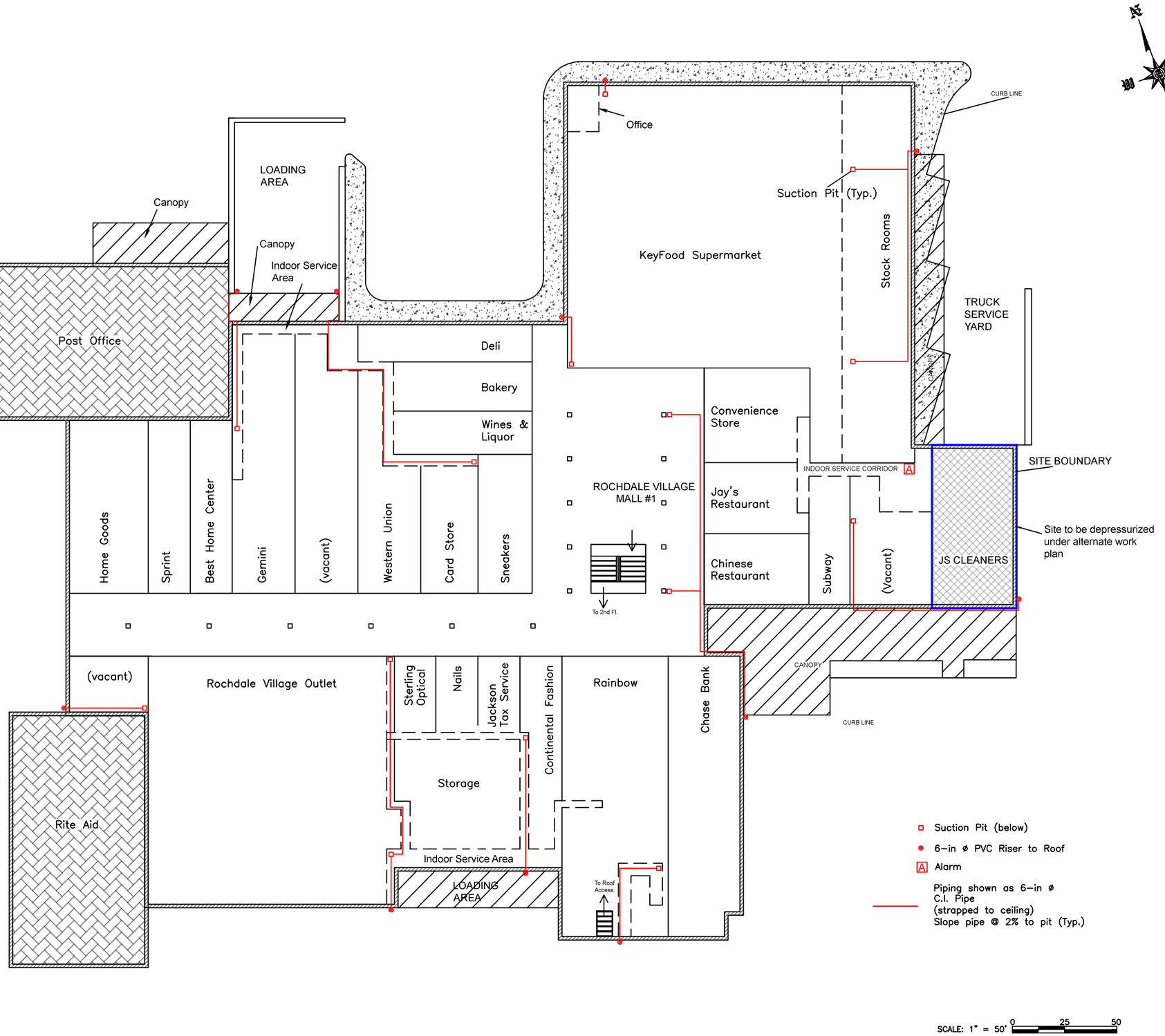
1.14 Import of Clean Cover and Fill Material

Soil is not anticipated to be imported to the Site for use as clean cover.

Appendix C
Sub-Slab Depressurization (SSDS) Specifications



DRAWING TITLE. SSDS LAYOUT AND PRESSURE TEST LOCATIONS	DRAWN BY KM	CONSULTANT TENEN ENVIRONMENTAL TENEN ENVIRONMENTAL, LLC 121 West 27th Street Suite 702 New York, NY 10001 O: 646-606-2332 F: 646-606-2379	CLIENT JS Cleaners Rochdale Village BCP # C241165 165-50 Baisley Boulevard Jamaica, Queens
DRAWING NO. X-100	CHECKED BY MC		
	DATE MARCH 2017		
	SCALE: AS NOTED		



CLIENT

JS Cleaners
Rochdale Village
BCP # C241165
165-50 Baisley Boulevard
Jamaica, Queens

CONSULTANT

TENEN ENVIRONMENTAL

TENEN ENVIRONMENTAL, LLC
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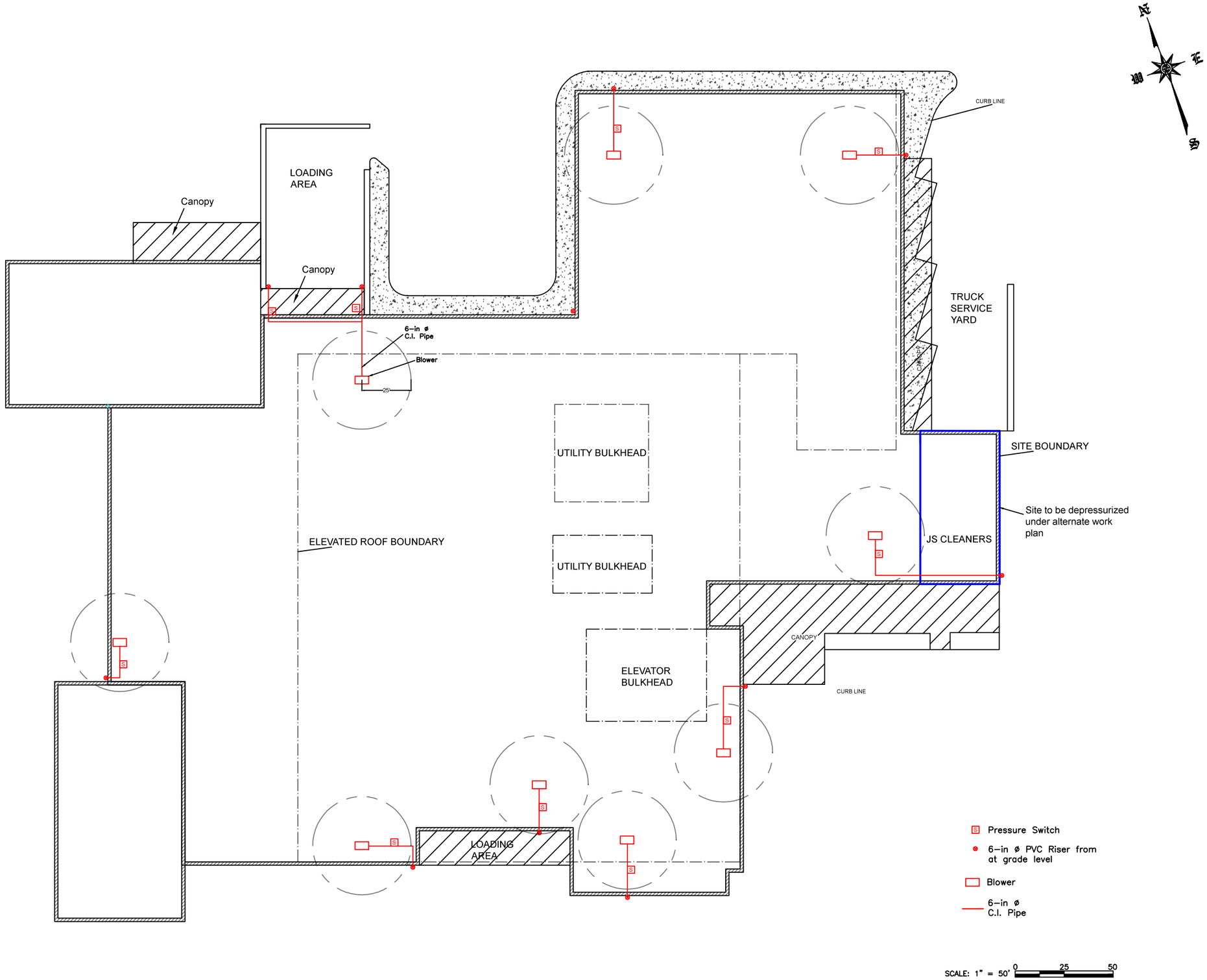
DRAWN BY	CHECKED BY	DATE	SCALE:
KM	MC	MARCH 2017	AS NOTED

DRAWING TITLE.

SSDS AT-GRADE LAYOUT

DRAWING NO.

X-101



CLIENT

JS Cleaners
Rochdale Village
BCP # C241165
165-50 Baisley Boulevard
Jamaica, Queens

CONSULTANT

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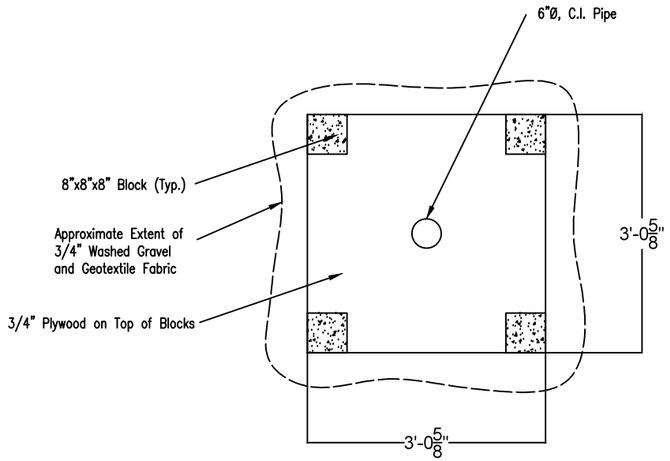
DRAWN BY	CHECKED BY	DATE	SCALE:
KM	MC	MARCH 2017	AS NOTED

DRAWING TITLE: SSDS ROOF LAYOUT

DRAWING NO. X-102

1



Suction Pit – Plan View

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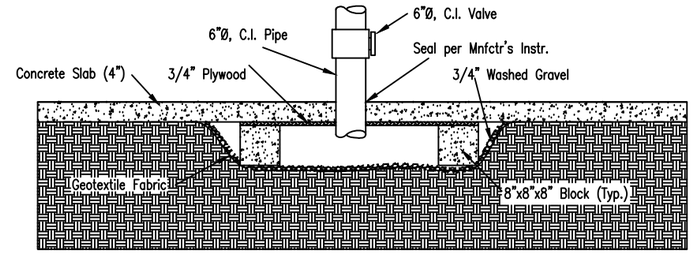

Suction Pit – Section View

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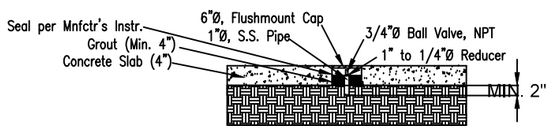
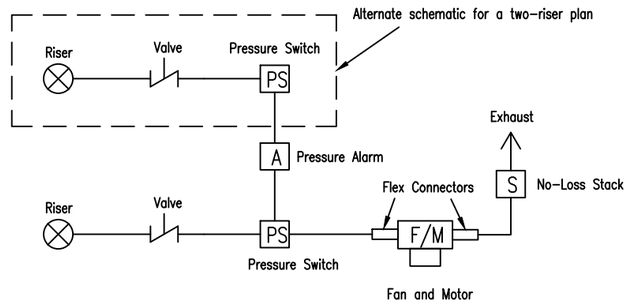


Sub-Slab Depressurization Monitoring Point – Side View

4



Sub-Slab Depressurization System – Schematic from Riser to Exhaust Location

CLIENT
JS Cleaners
Rochdale Village
BCP # C241165
165-50 Baisley Boulevard
Jamaica, Queens

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DRAWN BY	CHECKED BY	DATE	SCALE:
KM	MC	MARCH 2017	AS NOTED

DRAWING TITLE.
SSDS Details

DRAWING NO.
X-103

Appendix D
Draft Operations, Maintenance and Monitoring (OM&M) Plan

Sub-Slab Depressurization System (SSDS) Operations, Maintenance and Monitoring (OM&M) Plan

For

165-50 Baisley Boulevard, Jamaica

Block 12495, Lot 2 (portion)

BCP Site # C241165

Prepared for:

Rochdale Village, Inc.

169-55 137th Avenue

Queens, New York 11434

Prepared by:

TENEN ENVIRONMENTAL
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MARCH 2017

OPERATIONS, MAINTENANCE AND MONITORING (OM&M) PLAN

TABLE OF CONTENTS

APPENDICES

OPERATIONS, MAINTENANCE AND MONITORING (OM&M) PLAN

1.0 INTRODUCTION

This Operations, Maintenance and Monitoring (OM&M) Plan has been developed to detail the engineering controls (ECs) implemented at the property located at 165-50 Baisley Boulevard, in the Jamaica neighborhood of Queens, NY (Site). The ECs were incorporated as part of the New York State Department of Environmental Conservation (NYSDEC) requirements for soil vapor mitigation. The Site is a former dry cleaners (JS Cleaners), located within the Rochdale Village Mall (Mall #1), which is part of a larger community development and housing complex known as Rochdale Village.

Rochdale Mall #1 is a one- and two-story retail and office building (141,000 gross square feet) with associated parking. The Rochdale Village complex is bounded by Baisley Boulevard, Bedell Street, 137th Avenue and Guy R. Brewer Boulevard. Mall #1 is located in the northwest corner of Rochdale Village with associated parking spaces fronting Baisley Boulevard and Guy R. Brewer Boulevard. The Site is a 3,160 square foot one-story retail space located in the eastern end of Rochdale Village Mall. The Site is located in Queens Community Board 12 and is generally identified as a portion of Block 12495, Lot 2.

The objective of the Interim Remedial Measures Work Plan (IRM WP) is to maintain a negative pressure under the entire building footprint of Mall #2. The Site (HIP Cleaners) will be depressurized under an alternate work plan. The Site location is shown in Figure 1 of the IRM WP.

1.1 Background

A Phase II Remedial Investigation was conducted at JS Cleaners in November 2015. Additional soil, groundwater and soil vapor investigations were completed as part of the December 2016 SRI. The results of the investigations showed the presence of PCE in the shallow groundwater, soil, sub-slab and soil vapor on- and off-site within the adjacent and surrounding areas.

In order to address the potential for indoor air quality impacts within Mall #2, an active sub-slab depressurization system (SSDS) will be designed and incorporated into the current building plan.

1.2 Summary of Engineering Controls (ECs)

Engineering Controls (ECs) to address residual contamination through physical protective measures at the Site have been incorporated to ensure that the Site remains protective of public health and the environment.

A sub-slab depressurization system (SSDS) will be installed below the current slab-on-grade. The principal components of the SSDS will include several suction pits within the gravel layer, solid-construction piping from each suction pit to an exterior suction fan on the roof and monitoring points through the basement slab. The goal of the system was to create a pressure differential of at least -0.004 inches of water column (in-wc). A visual and audible alarm will be installed in the basement to notify the building management if the pressure at the suction fan has dropped below 50% of the start-up pressure. The system was designed in general accordance with NYSDOH's Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006 (NYSDOH Soil Vapor Guidance). SSDS design specifications can be found in Appendix C of the IRMWP.

2.0 Engineering Control Operations

One permanent EC was incorporated into the building to address potential residual contamination at the Site. The EC includes:

- an active sub-slab depressurization system (SSDS).

General design drawings and specifications are included in the Appendices.

2.1 Sub-Slab Depressurization System (SSDS)

The SSDS will reduce the potential for soil vapor migration into the building. The SSDS will be inspected at specific intervals as defined in this OM&M.

3.0 Routine Maintenance and Monitoring

EC inspections will be performed by a person knowledgeable with the mechanical systems present in the building and familiar with the property and may include a building or property superintendent.

3.1 EC Inspection Frequency

Site inspection and certification for performance of the active SSDS will be performed on a schedule detailed in the IRM CCR and reported in an annual Periodic Review Report (PRR).

3.2 EC Inspection Components

The EC inspections will evaluate the following:

- continued performance of ECs as designed;
- compliance with this IRM;
- continued achievement of remedial performance criteria;
- accuracy and completeness of Site records;
- necessity for any changes to the remedial systems; and
- general Site conditions at the time of inspection.

In the event of an emergency, such as a natural disaster or an unforeseen failure of any of the ECs, an inspection of the ECs will be conducted by a Qualified Environmental Professional (QEP), as defined by NYSDEC.

3.3 Engineering Control (EC) Inspections

3.3.1 Sub-Slab Depressurization System (SSDS)

EC inspections of the SSDS components shall include the following:

- Observe visible components (fan, vacuum alarm/monitor, vacuum gauge, tubing, riser pipe, etc.) for physical wear, damage and operational issues, and replace as necessary;
- Remove any blockages in vacuum monitor and gauge tubing and riser pipe taps;
- Verify operation of vacuum monitor by disconnecting tubing from riser pipe and noting if the building notification system goes into alarm mode;
- Verify operation of vacuum gauge by disconnecting tubing from riser pipe and noting if the indicator moves to zero (check high and low pressure ports to see if they are plugged correctly);
- Inspect riser pipe penetrations in concrete slab for proper seal;
- Inspect riser pipe connections at fan for leaks and tightness;
- Inspect condition of muffler (if installed) at end of outlet pipe; and
- Inspect power to fan by operating dedicated switch.

3.4 Inspection Reporting

EC inspections will be performed by a person with knowledge of the mechanical systems present in the building and familiar with the property. Such person may include a building or property superintendent. Inspections will be completed and reported to NYCDEC at the frequency detailed in Section 3.1. The letter report will include, at a minimum:

- Date of inspection;
- Personnel conducting inspection;
- Description of the inspection activities performed;
- Observations for each EC inspected, noting any deficiencies, conclusions and recommendations;
- Copies of inspection forms;
- Indoor air sampling results if applicable; and
- Certification of ECs, as discussed below.

PRR's containing the findings from inspections and associated certifications will be submitted to NYCDEC by March 31 of the year the report is due. PRR's will be submitted in digital format to NYCDEC.

3.5 Certifications

The results of the EC inspections will be certified at the time of the inspection and the signed certifications included with the PRR.

The Inspection Certification will certify whether:

- on-site ECs are unchanged from the previous certification;
- on-site ECs remain in-place and effective;
- on-site ECs are performing as designed; and
- anything has occurred that would impair the ability of the controls to protect public health and the environment.

4.0 EMERGENCY CONTACT NUMBERS

In the event of any emergency condition pertaining to any EC, the current Owner's representative(s) should contact the appropriate parties from the contact list below. Prompt contact should also be made to a Qualified Environmental Professional (QEP), as defined by NYSDEC. These emergency contact lists must be maintained in an easily accessible location at the Site.

Emergency Contact Numbers

Contact	Number
Medical, Fire and Police:	911
One Call Center:	(800) 272-4480 (3 day notice required for utility markout)
Poison Control Center:	(800) 222-1222
Pollution Toxic Chemical Oil Spills:	(800) 424-8802
NYSDEC Spills Hotline	(800) 457-7362

Project Contact Numbers

Contact	Number
Matthew Carroll Tenen Environmental	(646) 606-2332

Appendix A

Sub-Slab Depressurization System

Appendix A-1

SSDS Design – As-Built

Appendix A-2

SSDS Operation – Routine Operating Procedure

Sub-Slab Depressurization System (SSDS)

Routine Operating Procedures

The long-term operation and maintenance program described below shall continue throughout the life cycle of the sub-slab depressurization system (SSDS) to ensure a proper working order. The long-term operation and maintenance program for the major SSDS components includes manufacturer's recommendations for the reinstallation of SSDS components if modifications to the existing system need to be made, inspection procedures, an operation schedule, typical routine maintenance activities and schedules, and troubleshooting. Refer to Section 3.3.3 for an overall inspection procedure of the SSDS.

The alarm system, described below, shall run continuously and only be disconnected for routine maintenance and inspection activities or replacement. The system includes the following:

- vacuum gauge/switch (Ashcroft pressure switch, watertight enclosure, product model B4-24-B-000-NEG50"H20
- building alarm system, activated through network interface device (NID) box

In case there is a need to relocate the vacuum gauge/switch, the new location shall ensure that the vacuum gauge/switch remains in close proximity to the riser pipe and is installed correctly. If the vacuum gauge is not indicating a vacuum while the SSDS is on, make sure that the tubing connected to the riser pipe is connected to the low pressure port. High pressure ports on the vacuum gauge/switch should be vented to atmosphere.

The vacuum gauge/switch does not require lubrication or periodic servicing. The vacuum gauge is not field serviceable and should be returned to the manufacturer or supplier if repair is needed. Repairs or alterations made to the vacuum gauge/switch by others will void the unit's warranty. The vacuum gauge/switch is factory calibrated and cannot be recalibrated in the field. The installation and operating instructions for the vacuum alarm/monitor have been included in Appendix C-3.

When testing the vacuum alarm/monitor, the tubing that connects the vacuum alarm/monitor to the riser pipe shall be disconnected and the low set point raised above the current reading. If the vacuum alarm/monitor is powered at the time of disconnecting the tubing from the riser pipe, the building system will go into alarm. The building system should go back on-line when the tubing is reconnected to the riser pipe. If the building system is in alarm when there is a vacuum

present in the riser pipe, inspect the tubing and riser pipe tap to ensure that there are no blockages. If there is a blockage in either the tubing or the riser pipe tap, remove the blockage and retest the vacuum alarm/monitor.

Common troubleshooting tips that can be followed if the vacuum gauge/switch will not indicate a vacuum or is sluggish include the following:

- The pressure ports (high or low) are not hooked up correctly;
- The fittings or sensing lines are blocked, pinched or leaking;
- The cover is loose;
- The pressure sensor is improperly located;
- The ambient temperature is too low (below 20ºC).

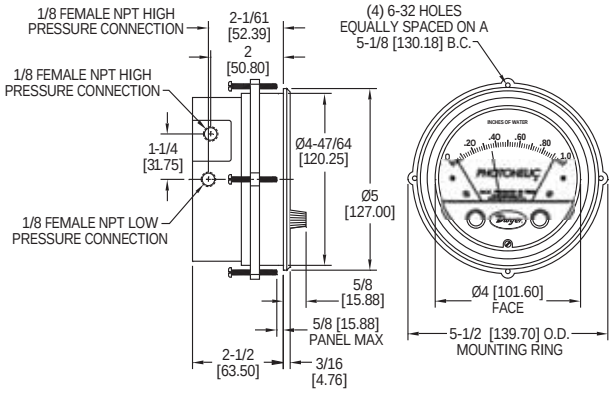
The Industrial Plastic Fan direct-drive suction fan model 180 (CDD180) with a 1 horsepower Premium Efficiency BALDOR motor shall operate continuously and only be turned off for routine maintenance and inspection activities or replacement. The SSDS fan and motor shall not be left on the system piping without electrical power for more than 48 hours due to possible fan failure that could result from this non-operational storage. The SSDS fan unit does not require periodic servicing and should be returned to the manufacturer or supplier for service. Repairs or alterations made to the SSDS fan unit by others will void the unit's warranty. The installation and operating instructions for the SSDS fan unit have been included in Appendix A-4.

Appendix A-3

SSDS Vacuum Gauge and Switch – Installation and Operating Instructions

Series 3000MR Photohelic® Differential Pressure Switch/Gage

Specifications — Installation and Operating Instructions



Using solid state technology, the Series 3000MR Photohelic® switch/gage combines the functions of a precise, highly repeatable differential pressure switch with a large easy-to-read analog pressure gage employing the durable, time-proven Magnehelic® gage design. Switch setting is easy to adjust with large external knobs on the gage face. Gage reading is unaffected by switch operation — will indicate accurately even if power is interrupted. Solid state design now results in greatly reduced size and weight. Units can be flush mounted in 4¹³⁄₁₆″ (122 mm) hole or surface mounted with hardware supplied. 3000MR models employ versatile electromechanical relays with gold over silver contacts — ideal for dry circuits. All models provide both low and high limit control and include 18-inch (45 cm) cable assemblies for electrical connections.

Gage accuracy is ±2% of full scale and switch repeatability is ±1%. Switch deadband is one pointer width — less than 1% of full scale. Compatible with air and other non-combustible, non-corrosive gases, they can be used in systems with pressures to 25 psig (1.725 bar). Optional construction is available for use to either 35 psig (2.42 bar) or 80 psig (5.51 bar).

Accessories

Mounting ring, snap ring
18″ (45 cm) cable assembly
(2) ³⁄₁₆″ tubing to ⅛″ NPT adapters
(2) ⅛″ NPT pipe plugs
(4) 6-32 x 1¼″ RH machine screws (panel mounting)
(3) 6-32 x ⅝″ RH machine screws (surface mounting)

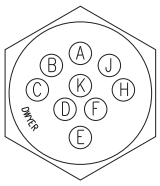
SPECIFICATIONS

GAGE SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult Factory.
Accuracy: ±2% of full scale (3000-0 ±3% of full scale).
Pressure Limit: -20″ Hg. to 25 psig (-0.677 bar to 1.72 bar). MP option; 35 psig (2.41 bar), HP option; 80 psig (5.52 bar).
Temperature Limits: 20 to 120°F. (-6.67 to 48.9°C).
Process Connections: 1/8 female NPT (duplicated side and back).
Size: 4″ (101.6 mm) dial face, 5″ (127mm) O.D. x 3-1/8″ (79.38 mm).
Weight: 1.8 lb., (816 g).

SWITCH SPECIFICATIONS 3000MR

Switch Type: Each setpoint has 1 Form C relay (SPDT).
Relay Contacts: (resistive load) 1 Form C rated 1.0 amp @ 30 VDC, 0.3 amp @ 110 VDC or 0.5 amp @ 125 VAC. Gold over clad silver - suitable for dry circuits.
Electrical Connections: 18″ (46 cm) cable assembly with 8 conductors. Optional lengths to 100′ (30.5 m).
Power Requirements: 24 VDC, regulated ± 10%.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Adjustable knobs on face.



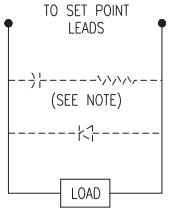
		LETTER	COLOR
Power Supply	+	A	Red
	-	E	Black
Low Set Point	COM	C	Brown
	NC	B	Violet
	NO	D	Blue
High Set Point	COM	H	Green
	NC	J	White
	NO	F	Orange

ELECTRICAL CONNECTIONS

CAUTION: Do not exceed specified electrical ratings. Permanent damage not covered by warranty will result. This unit is not designed for AC line voltage operation.

Electrical connections are made by means of the cable assembly supplied which has a multi-pin female plug installed on one end which mates with the male connector on the rear of the gage. Wire leads on the opposite end of the assembly are connected in accordance with the drawing and chart to the right.

Note: An R/C (resistor/capicitator) snubber is required when switching inductive loads such as a solenoid or contactor. specify Dwyer Instruments, Inc. part number A-600. For DC circuits, also include a 1N4005 diode.



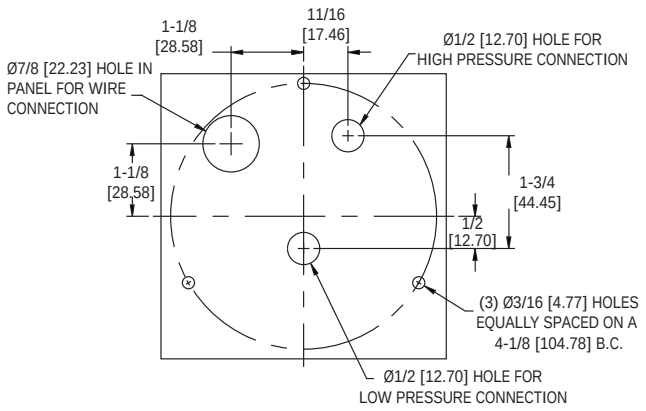
DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361, U.S.A.
Phone: 219/879-8000 **www.dwyer-inst.com**
Fax: 219/872-9057 **e-mail: info@dwyer-inst.com**

INSTALLATION

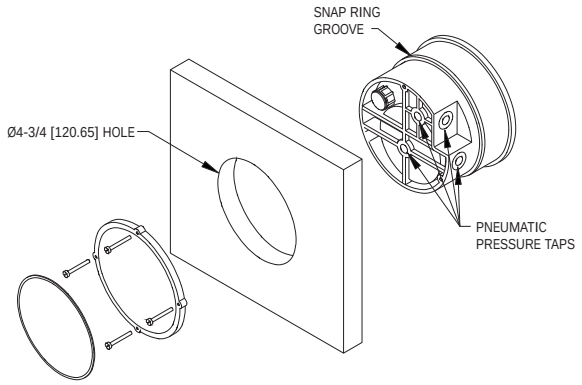
1. **LOCATION:** Select a location where the temperature of the unit will be between 20°F and 120°F (-6.67 to 48.9°C). The tubing feeding pressure to the instrument can be run practically any length required but long lengths will increase response time slightly. Avoid surfaces with excessive vibration.

2. **POSITION:** All standard models are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If your application requires mounting in other than a vertical position, be sure to specify this when ordering.

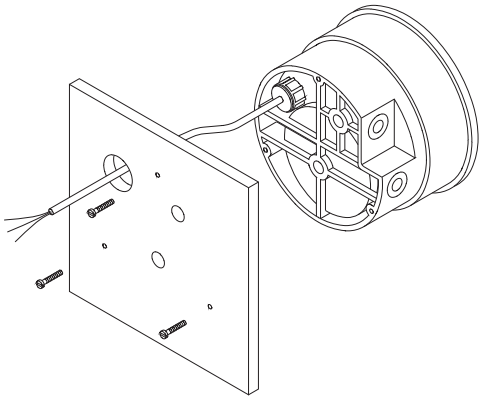
3. **PRESSURE CONNECTIONS:** For convenience, two sets of 1/8″ female NPT ports are available. Plug the unused set with pipe plugs provided. Attach tubing from positive pressure source to port marked "HI" or from negative (Vacuum) source to port marked "LOW". In either case, opposite port must be vented to atmosphere. In dusty environments, we recommend use of an A-331 Filter Vent Plug to keep interior of instrument clean. For differential pressures the higher source is connected to the "HI" port and lower to the "LOW" port.



4. **MOUNTING:** The Photohelic® Switch/Gage may be either panel mounted or surface mounted.



A. PANEL MOUNTING: Cut a 4-3/4″ or 120mm dia. hole in panel and insert the complete unit from the front. Slip on the mounting ring and install the split snap ring in the groove on the bezel. Seat the mounting ring against the snap ring and thread the four screws through the tapped holes. Tighten screws against rear of panel.



B. SURFACE MOUNTING: Drill (3) 3/16″ dia. holes for mounting screws and (1) 7/8″ dia. hole for wire assembly as shown in hole location drawing. Insert screws from rear of panel and thread into tapped holes on back of Photohelic® Switch/Gage case. If rear pressure connections are to be used, make 1/2″ dia. holes located as shown in hole location drawing in left column.

Once Photohelic® Switch/Gage unit is securely mounted, plug wire assembly into 9 pin connector on rear of unit, being careful to match pin locations.

5. **ZEROING:** Once the Photohelic® Switch/Gage is mounted in its final position, check to be sure pointer aligns with zero on scale, when no pressure is applied and both low and high pressure ports are vented to atmosphere. To adjust, turn small slotted screw at center-bottom of gage face.

MAINTENANCE

Upon final installation of the Dwyer® Photohelic® Switch/Gage, no routing maintenance is required. A periodic check of system calibration is recommended.

The Series 3000MR Photohelic® Differential Pressure Switch/Gage is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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fax: 208.226.7280
ams@ams-samplers.com
www.ams-samplers.com

The world's finest
sampling equipment.

Gas Vapor Probe (GVP) Kit

DESCRIPTION:

The Gas Vapor Probe System is the finest system available today for environmental assessment and monitoring. It is available as a series of kits from a Basic Kit without a drill to a Heavy Duty Kit that also includes AMS Flighted Augers. Used for collecting samples of soil gas at shallow depths. Tips are offered in a dedicated tip or a retract-a-tip, which is removable.

BENEFITS AND FEATURES:

The AMS Gas Vapor Probe has been designed specifically for placement of devices used to recover soil gas samples. The GVP kit may also be used for collection of soil and groundwater samples when used with accessory screens that are sold separately.

USE:

The site should be surveyed for the presence of underground utilities, pipelines, underground tanks and piping, as well as other structures or objects. The position of underground objects should be flagged and/or marked to local protocols. Use the electric drill with 1 1/2" Concrete Bit to cut a hole in the pavement if necessary, prior to using the tile probe. Once the pilot hole has been made, proceed sampling using the GVP points. Following the determination of sample collection depth, cut a length of Flouropolymer tubing slightly longer than collection depth. This extra length is to aid in the ease of sampling with tip installed. Attach one end to the barbed nipple on the selected sampling tip. Assemble from the sampling tip up. Place the assembled sampler, comprising tip assembly, extension, and extension drive adapter tip downward into the hole prepared by the Tile Probe. Certain soil conditions may allow for the assembled piece to be driven directly into the soil itself. Driving may be accomplished via AMS Slide Hammer, or electric rotary hammer drill. Once the first extension has been lowered or driven into the ground, place at clamp (not supplied) at ground level to stabilize it. Lift the driving device off the probe assembly, loosen and remove extension drive adapter from the extension and Teflon tubing. Pass the tubing through another GVP extension with the coupling down. Remove ground clamp, and continue to drive and add extensions until sampling point(s) have been reached.

PREPARING TO SAMPLE - GVP TIP

Prior to sample collection, it is necessary to expose tip and possibly remove the drive tip end, GVP extensions & extension drive adapter. Taking care to keep the tubing clean will allow it to pass unobstructed into the Extension Drive Adapter during the assembly & removal process. After removal, fill in around tubing with sand or native soils, followed by bentonite chips or powder to provide a permanent seal to protocol. Attach Flouropolymer Tubing to the sample collection system with a short piece of flexible tubing.

PREPARING A SAMPLE - RETRACT-A-TIP

When sampling depth is reached, pull back the sampler assembly 3" either manually or with the Removal Jack. Take the sample and then proceed to the next sampling depth. When sampling is completed, remove the sampler and pack the hole with native soils and/or bentonite chips, powder or grout.

Application of a gentle vacuum to the proximal end of the Flouropolymer tube will draw soil gas through the selected Gas Vapor Tip, through the tubing, and eventually the pump.

HELPFUL HINTS:

Suggested use of the tile probe in preparation of hole allows for the location of unknown obstructions, thereby eliminating potential damage of GVP Probe & speeding up the sampling process. Threads should always be cleaned after each use. Vegetable oil, used sparingly, can be used for thread lubrication. It is important to never contaminate any part(s) of the system that may come in contact with the sample. Always check to make sure that the power supply and cord are in proper working condition. Please refer to operator's manual and instructional video prior to use of this product.

ANCILLARY ITEMS:

Soil Probes, Tile Probes, Ground Clamps, Screens, Electric Vacuum pump or Vacuum Station

GAS VAPOR PROBE KITS WITH RETRACT-A-TIP, WITHOUT DRILL

209.16 GVP Kit w/Dedicated Tips and Retract-A-Tip w/o Drill

209.26 Heavy Duty GVP Kit w/Dedicated Tips and Retract-A-Tip and Flighted Augers w/o Drill

GAS VAPOR PROBE KITS WITH RETRACT-A-TIP, WITH DRILL

210.02 GVP Kit w/Dedicated Tips, Retract-A-Tip and Dewalt D25600K Hammer Drill

209.86 GVP Kit w/Dedicated Tips, Retract-A-Tip and Bosch 11245 EVS Hammer Drill

209.95 Heavy Duty GVP Kit w/Dedicated Tips, Retract-A-Tip, Flighted Augers and Bosch 11245EVS Hammer Drill

Sampling Equipment
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Well Management
Pest Control
PowerCore

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www.ams-samplers.com

The world's finest
sampling equipment.

Sub-Slab Gas Vapor Probe Kit

DESCRIPTION:

The Sub-Slab Gas Vapor Probe (GVP) Kit allows the user to sample for volatile organic and inorganic compounds from beneath floor slabs. The kit provides a semi-permanent probe, designed to allow repeated sampling over time in order to assess the potential of contaminated vapor intrusion from beneath buildings.

BENEFITS AND FEATURES:

The AMS Sub-Slab Gas Vapor Probe has been designed to lay flush on the upper surface of the slab as to not interfere with daily use of the area. The probe is sealed with a threaded stainless steel cap which includes a tamper-resistant spanner fitting.

USE:

Prior to drilling holes in a foundation or slab, contact local utility companies to identify and mark utilities coming into the building from the outside (e.g., gas, water, sewer, refrigerant, and electrical lines). Consult with a local electrician and plumber to identify the location of the utilities inside the building.

Prior to fabrication of sub-slab vapor probes, drill a pilot hole to assess the thickness of a slab. Use a small portable vacuum cleaner or shop vac to remove cuttings from the hole.

Using a 2" diameter core bit, bore a hole approximately 3/16" deep. This will allow you to counter sink the top cap so that it is flush with the slab. (Refer to Figure 1).

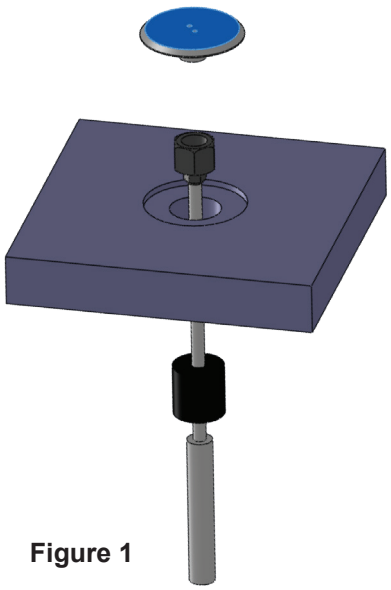


Figure 1

Then use a 1" masonry bit to bore through the remainder of the slab until sub-slab is reached. A 3" deep hole in the sub-slab is required so that the entire length of the screen can be exposed to the sub-slab.

Set sub-slab unit in hole. Grout the unit in with a quick-drying Portland Cement – which expands upon drying (to ensure a tight seal). Allow cement to cure for at least 24 hours prior to sampling.

SUB-SLAB GAS VAPOR PROBE KIT

52954	Sub-Slab Gas Vapor Probe Kit

SUB-SLAB GVP KIT ACCESSORIES

56958	Tamper-Resistant Top Cap

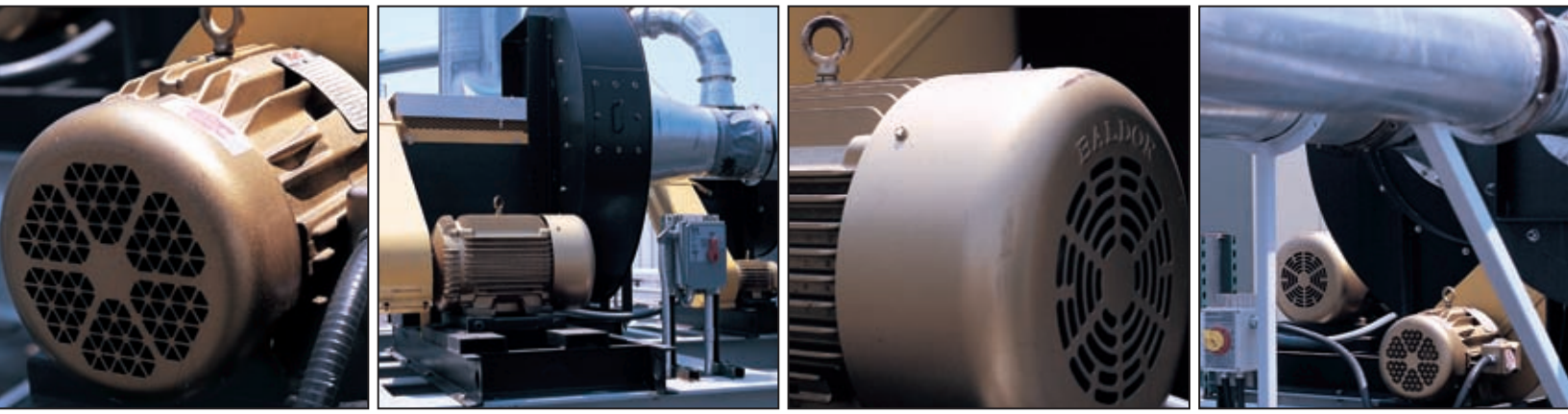
SUB-SLAB GVP KIT REPLACEMENT PARTS

52952	Sub-Slab Vapor Shaft Tube
52953	Sub-Slab Rubber Plug
13460	Connector SS-400-7-4
13462	Plug HH-1/4 NPT
13463	Hose-B SS-4-AC-1-4
21008	3" Implant with 1/4in SS Compression
22011	Stainless Steel Ball Adapter
208.63	Spanner Screw Driver

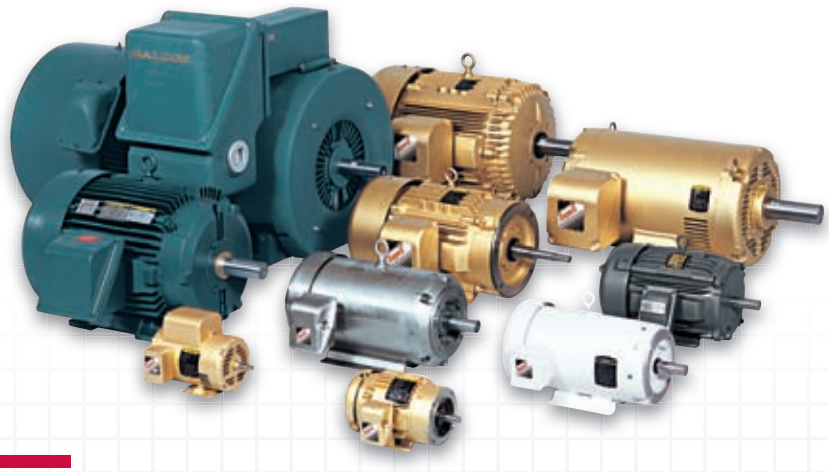
Appendix A-4

SSDS Fan and Motor – Installation and Operating Instructions

BALDOR® • RELIANCE

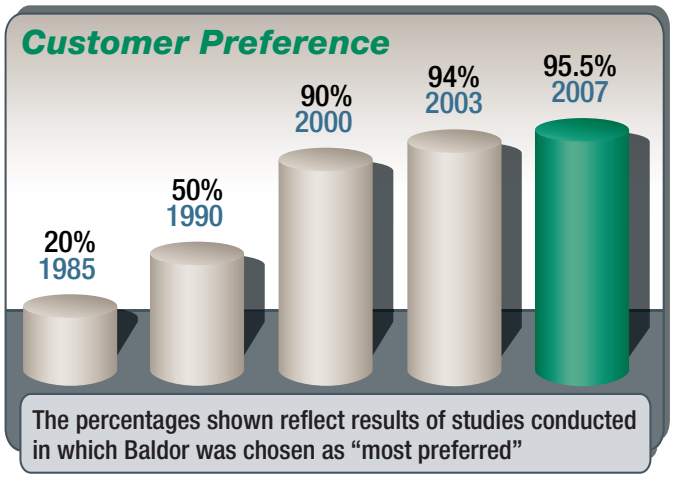


Super-E® Premium Efficient Motors



BALDOR®

Why Baldor?



For nearly 100 years, Baldor has strived to provide customers with the best value and reliability in industrial electric motors. That dedication shows in customer preference for Baldor•Reliance motors. To be considered as the most preferred...

Baldor offers the industry's broadest line of stock products. Save valuable time with just one call to Baldor. We offer more than 10,000 stock motors, drives and gearboxes.

Energy-efficiency leader. We began lowering the energy consumption of our motors in the 1920s, long before others were even talking about it. Today, our expansive line of Super-E® premium-efficient motors ranges from 1 through 15,000 Hp. Baldor's Super-E® line offers customers the highest overall efficiency levels in the industry.

Baldor products are available at more locations than any other brand. Our 35 district offices across North America and offices around the world, offer immediate availability of Baldor products to thousands of customers.

Continuous innovation to improve reliability. Baldor leads the motor industry in applying new technologies to improve motor reliability. Recent improvements to the line of Severe Duty motors are further proof that Baldor is the leader in motors for process industry applications. These improvements are explained in detail in the following pages.

Industry's shortest lead times/Flexible manufacturing. Baldor has the industry's shortest lead times on custom motors – just ten working days. Our unique LEAN FLEX FLOW™ manufacturing process lets us produce any order in any quantity, quickly and efficiently.

Industry's best information. Only Baldor offers customers so many choices for product information with a wide variety of catalogs and product brochures, the Baldor Web site at www.baldor.com, or you may talk to a Baldor customer service person at one of our sales offices.

Table of Contents

The Baldor Super-E®

In the mid-70s, a southeastern tire manufacturing plant asked Baldor to increase their plant's operating efficiencies. After analyzing the efficiencies of the plant's 75 Hp motors, Baldor engineers determined that considerable energy savings could be gained from a motor design focused on "active materials." By adding more copper to the windings, upgrading the laminations to a premium-grade steel, designing precision air gaps between the rotor and stator, and reducing fan and other losses in the motor, Baldor was able to supply the plant with the premium efficient motors it needed. This was the birth of the Baldor Super-E®.

Over 1,000 Stock Motor Ratings

Today's line of Baldor Super-E motors offers customers some from the highest levels of efficiencies, in ratings of 1 to 15,000 horsepower. Baldor has ratings available immediately from stock, with non-stock motors with the industry's shortest load times. All Super-E motors (except Explosion-Proof) are also "Inverter-Ready".

The Right Premium Efficient Motor for your Application

Whether it's a premium efficient motor for harsh, outdoor conditions at a petro-chemical plant, or for continuous duty in a distribution center, Baldor offers customers a variety of choices.

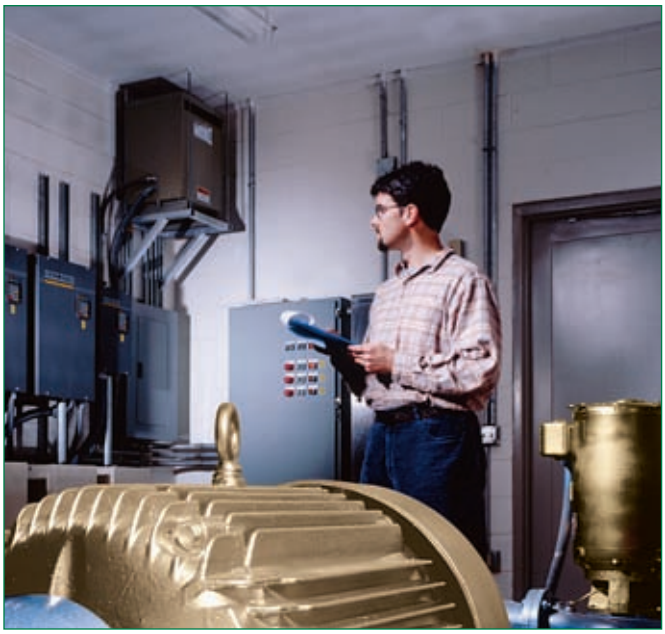
Super-E Totally Enclosed Fan Cooled (TEFC) and Open Drip Proof (ODP) are reliable motors that have kept plants operating efficiently since their introduction in 1983. Explosion-Proof, Close Coupled Pump and Automotive Approved Super-E's deliver premium efficiency for special applications.

In applications requiring added protection from corrosion caused by severe environmental operating conditions, Baldor•Reliance Super-E Severe Duty motors are available in TEFC ratings from 1 through 2250 Hp. Cast-iron construction, epoxy primer and finish paint inside and out, gaskets on all joints and many other features provide added protection where and when you need it most.

For the ultimate in protection from severe environments – where you need added insurance against downtime – Baldor offers IEEE 841 motors. Delivering reliable, rugged performance with the industry's highest energy efficiencies, these motors exceed IEEE 841 - 2001 standards for severe duty TEFC induction motors. Inpro/Seal® bearing isolators at both the drive end and fan end. Baldor IEEE 841 motors are available immediately off the shelf, in 1 - 250 Hp ratings, with special designs available as custom motors.

Leadership in Premium Efficiency

Called a "key breakthrough" by the Consortium for Energy Efficiency, the CEE in 1998 recognized Baldor's Super-E as the first premium efficient motor line to meet their stringent efficiency criteria, citing "For the first time, one manufacturer will carry all qualifying products."



A Baldor Super-E motor and Inverter Control provide premium energy efficiency and improved process control to a municipal water treatment facility.

Minimum Efficiency Performance Standards (MEPS) for electric motors are becoming commonplace throughout the world. The first of these was the Energy Policy Act of 1992 (EPAct) that mandated efficiency levels for 1-200 Hp general purpose motors for sale in the U.S. after October 1997. The Energy Independence and Security Act of 2007 (EISA) builds upon EPAct and raises the efficiency level for these motors to NEMA Premium® efficiency and adds other configuration and 201-500 Hp ratings for MEPS compliance. Baldor•Reliance Super-E motors manufactured today meet or exceed EISA requirements.

As countries and regions across the world establish minimum efficiency levels for motors, more companies are turning to the Baldor•Reliance Super-E. This includes plant and processing applications, as well as OEM products for shipment overseas. Super-E motors meet or exceed the efficiency levels defined by NEMA Premium®, EPAct in the U.S., NRC in Canada, and CEMEP EFF1 in Europe, and the new IE3 level of IEC 60034-30.

A wide selection of premium efficient motors, available from stock, manufactured and sold by a company committed to building better products for industries worldwide. No wonder, since the 1920s, Baldor•Reliance is recognized as the leader in energy efficient industrial motors and drives.

Green catalog numbers in this brochure denote motors that meet or exceed NEMA Premium® Efficiency.

ENERGY STAR PARTNER

NEMA Premium®

Going Beyond the Industry Standard in Premium Efficient Motors

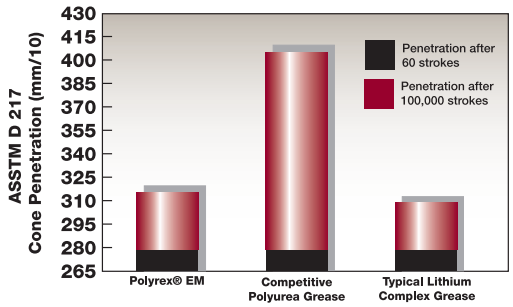
Baldor's Super-E® motors are another example of our commitment to provide reliable performance, while exceeding customer expectations.

Standard on All Baldor Motors: Exxon Polyrex® EM Polyurea Grease

It's a fact: Bearing failure is the #1 mechanical reason for motor failure. So the better the grease protecting those bearings, the better and longer the motor performs.

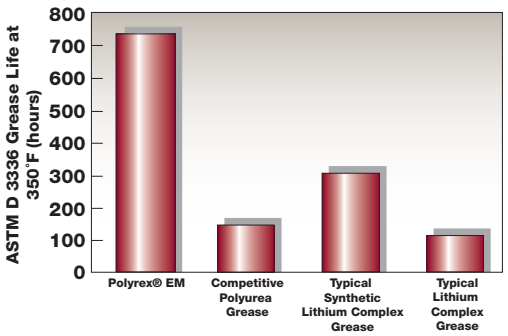
Today, that better grease is Exxon's new Polyrex® EM polyurea grease – now standard on all Baldor•Reliance motors. It provides lubrication life of more than four times greater than other polyurea greases in tests up to 350°F. It exhibits greater durability when subjected to mechanical shearing forces. Furthermore, a specially formulated additive in the grease resists washout, rust and corrosion even when subjected to salt water conditions.

Excellent Shear Stability



As illustrated here, the proprietary polyurea thickener system in Polyrex EM exhibits excellent durability and stability when subjected to a mechanical shearing force. Mechanical shear stability is a measurement of the greases thickener system. Good mechanical shear stability is important in roller bearing applications where excessive grease softening may lead to grease leakage or purging from the bearing.
Source: Exxon Mobil Product Data Sheet DG-3C, 6/15/99.

Outstanding High-Temperature Lubrication Life



In the severe ASTM D 3336 High-Temperature Grease Life Test, Polyrex EM dramatically out performed a competitive polyurea grease and conventional lithium-complex greases.

Source: Exxon Mobil Product Data Sheet DG-3C, 6/15/99.

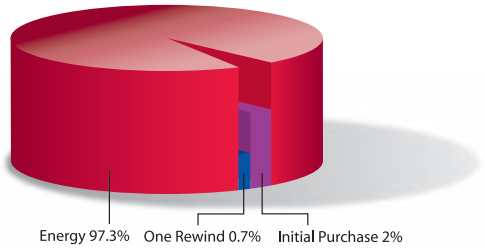
Making Energy Efficiency Work For You

Why is Energy Efficiency Important?

Electric motor-driven systems used in industrial processes consume 63% of all electricity used in U.S. industrial sector according to a U.S. Department of Energy report published in 1998. A 2002 report shows that companies that practiced DOE "best practices" actually averaged 33 percent savings if they were to apply motor and motor system efficiency upgrades, including the use of adjustable speed drives. The potential positive impacts on companies' bottom lines and the environment are significant.

Purchase Price is Only a Small Piece of the Pie

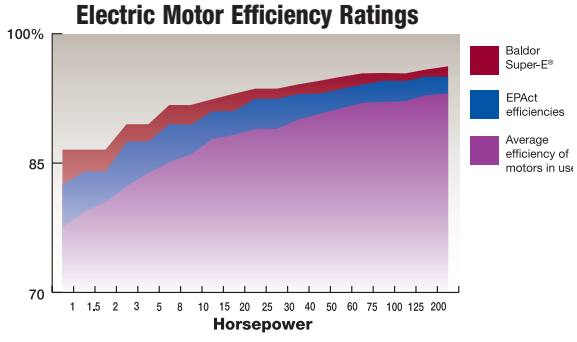
The pie chart to the right shows the typical life cycle cost of a 100 Hp motor operating in continuous duty over a 20-year life. As you can see, the original purchase price is almost insignificant compared to what it will cost to power the motor during its useful life.



How Baldor Super-E® Efficiencies Compare to Industry Standards

Baldor's line of Super-E motors offers customers the highest level of overall efficiencies available from any motor manufacturer, meeting or exceeding NEMA Premium® efficiency.

Electric Motor Efficiency Ratings

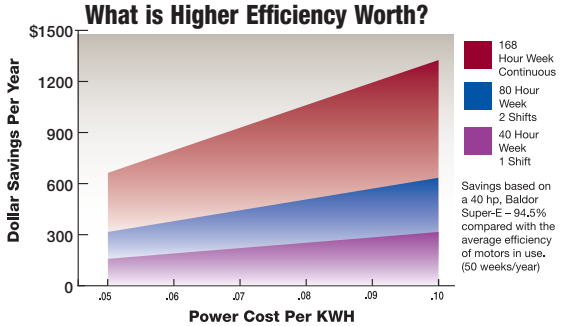


BE$T™ Baldor Energy Savings Tool Makes Calculating Payback Easy

In order to make payback calculations easier for customers, Baldor developed BE$T, Baldor Energy Savings Tool. The software helps calculate energy cost and energy savings for motors, as well as payback time frames. A popular feature of BE$T is that it allows users to make head-to-head comparisons of up to three motors, giving customers the information to make an informed decision through comparative analysis.

BE$T, Baldor Energy Savings Tool is available as a download through Baldor's award-winning Web site (www.baldor.com/support/software_BEST.asp,) as well as a stand-alone CD-ROM, available from your Baldor District Office.

What is Higher Efficiency Worth?



Super-E® Premium Efficiency Motor Construction

The family of Baldor • Reliance Super-E TEFC (Totally-Enclosed Fan-Cooled) motors shares a number of electrical and mechanical features that add up to outstanding value. "EM" motors are general-purpose premium efficient motors. For more severe environmental applications, our "ECP/XEX" Severe Duty motors provide added weather and chemical protection. For extreme applications, where downtime is critical, Baldor "841XL" motors are ideal; these motors exceed IEEE 841-2001 specifications.

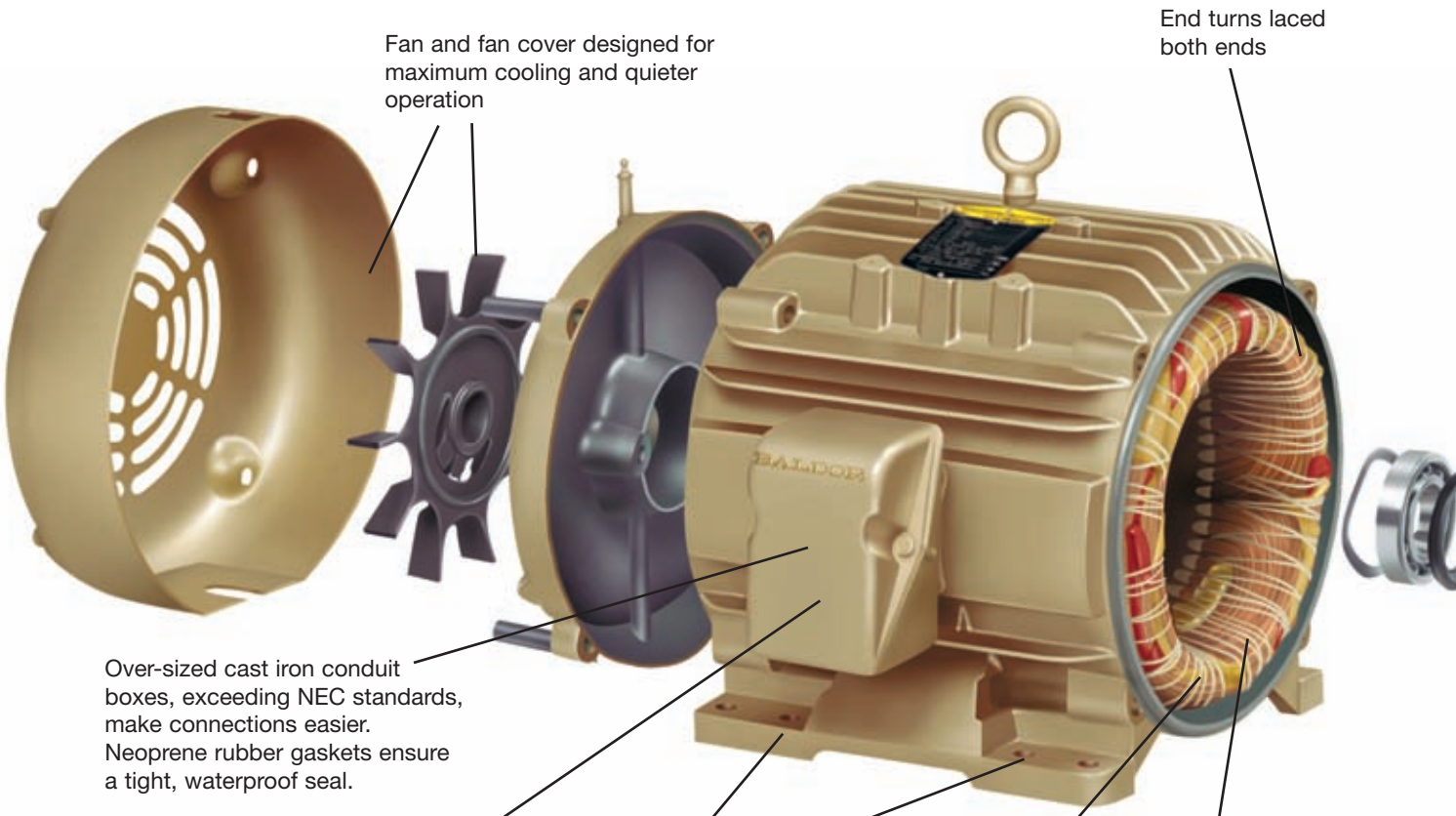
The chart below lists standard features ("S") in Baldor's TEFC Premium Efficient motors. Horsepower ranges indicate where certain features are standard in stock products. Additional features optional ("O") on custom motors, or through Baldor's Mod-Express.

TEFC Premium Efficiency Motor Family

Electrical Features	**EM / XE**	**ECP/XEX**	**841XL**
Hp Range - Stock	1-1000	1-1000	1-250
Class F insulation with Class B rise	S	S	S
1.15 Service factor	S	S	S
200°C Inverter Spike Resistant insulation system	S	S	S
Phase insulation	S	S	S
Corona inception testing - meets NEMA Part 31.4.4.2	S	S	S
Varnish dip & bake with 100% solids	S	S	S
No silicone lead wire		S	S
Documented final motor tests - data shipped with motor	O	O	S
Mechanical Features			
NEMA Frame sizes	143T - 449T	143T - 449T	143T - 449T
Steel Band Frame Die cast aluminum endplates, steel fan cover	S 143T - 215T		
Cast iron frame - cast iron endplates & fan cover (steel fan cover standard on EM/XE 140-280T)	O 143T - 286T S 324T - Up	S	S
Die cast aluminum conduit box	S thru 360T		
Cast Iron conduit box	S 400T - up	S	S
Threaded inlet hole in conduit box		S	S
Neoprene conduit box lid gasket & lead separator gasket		S	S
Seal endplate to frame joints		S	S
V-ring shaft seals - DE & ODE (except some 440 frame)	S 250T - up DE only	S	
Inpro/Seal® VBX or VBXX bearing isolators - DE and ODE			S
Hardware - zinc plated	S	S	S
Motor unfiltered vibration at rated voltage and frequency <0.15 in/sec peak velocity	S	S	
Motor unfiltered vibration at rated voltage and frequency <0.08 in/sec peak velocity			S
Test vibration on DE & ODE and document - ship with motor			S
Low bearing temperature specs (IEEE 841)			S
Foot flatness to < NEMA tolerances (0.005"/ft.)			S
Shaft runout < NEMA			S
Sound power level < 90 dBA			S
Grease inlet fitting - grease fitting	S		
Grease inlet with tube extension & grease fitting		S	S
Grease outlet with screw-in plug	S		
Grease outlet with automatic relief fitting	S 250T - up		
Grease outlet with tube extension & automatic relief fitting		S	S
Non-metallic external cooling fan	S	S	S
Casting coated with water base primer	S		
Castings coated with 2-part epoxy primer and epoxy finish coat		S	S
Finish paint with gold enamel	S		
Finish paint with 2-part dark gray epoxy		S	S
ASTM B117-90 96-hour salt spray test compliance		S	S
Laser etched aluminum nameplate with NEMA data	S		
Embossed Stainless steel nameplate with NEMA data		S	S
Stainless steel nameplate with bearing and grease data		S	S
Limited Warranty	3 year	3 year	5 year

Note: Contact your Baldor District Office for certified data, dimensions and features of a specific motor.

Baldor Super-E®: Premium efficiency inside and out

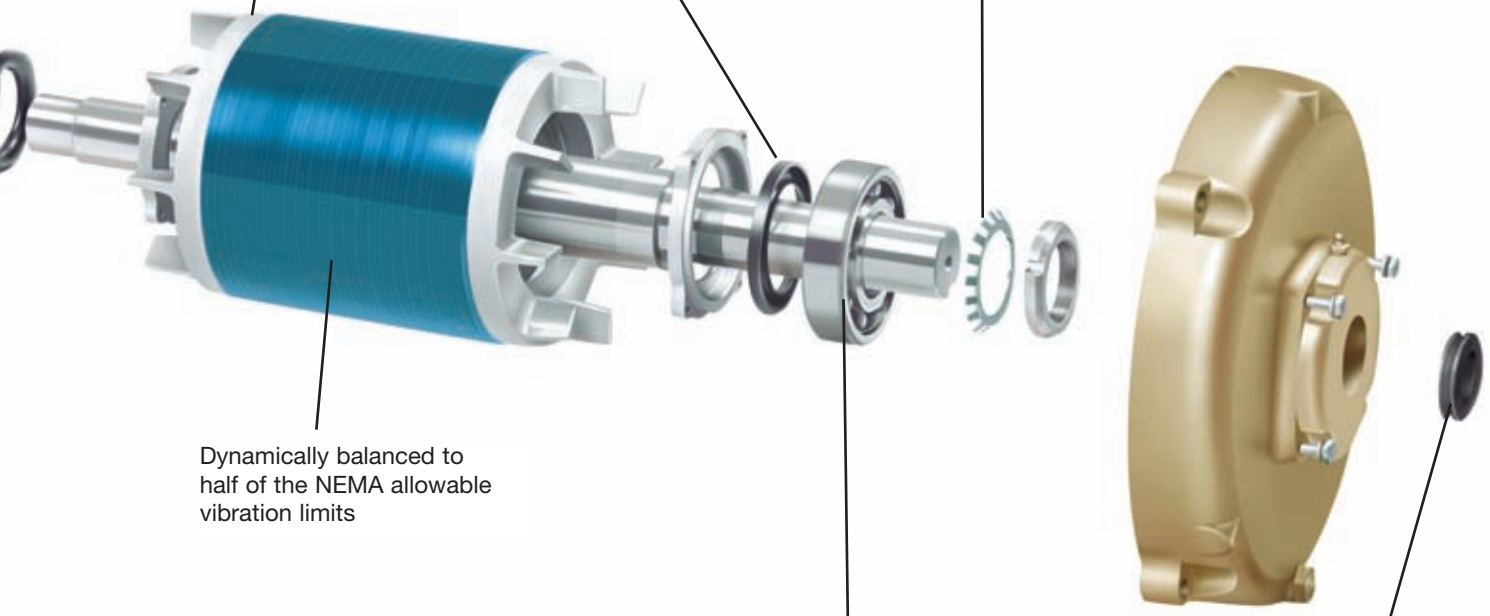


NEMA Premium

High-pressure die cast aluminum rotor through 449T frames coated to prevent corrosion

Patented Lube-Lok retainer grease seal on both ends, 250T frame and up

Locked bearing construction reduces endplay



Dynamically balanced to half of the NEMA allowable vibration limits

Baldor was the first motor manufacturer to use Exxon Polyrex® EM grease. Polyrex® EM protects motor bearings better, providing improved lubrication life, greater shear stability, and superior resistance to washout, rust and corrosion.

Neoprene v-ring rubber shaft slinger on pulley end of motor prevents contaminants from entering

Severe Duty Super-E® ECP/XEX NEMA Premium® Efficient Motors

Designed to meet the demanding application requirements typically found in severe duty processing environments. Baldor•Reliance Super-E, ECP motors have XEX features including all cast iron frame construction with oversized and rotatable cast iron conduit box. All bearings use the exclusive Positive Lubrication System (PLS) which channels grease directly into the bearing track. The Class F premium "Spike Resistant" insulation system meets the requirements of NEMA MG 1 Part 31.4.4.2 for use on variable frequency control. All internal surfaces are epoxy coated for corrosion protection.

Super-E® ECP/XEX TEFC - Totally Enclosed Fan Cooled - Foot Mounted, 460 Volts, Three Phase, 1-40 Hp

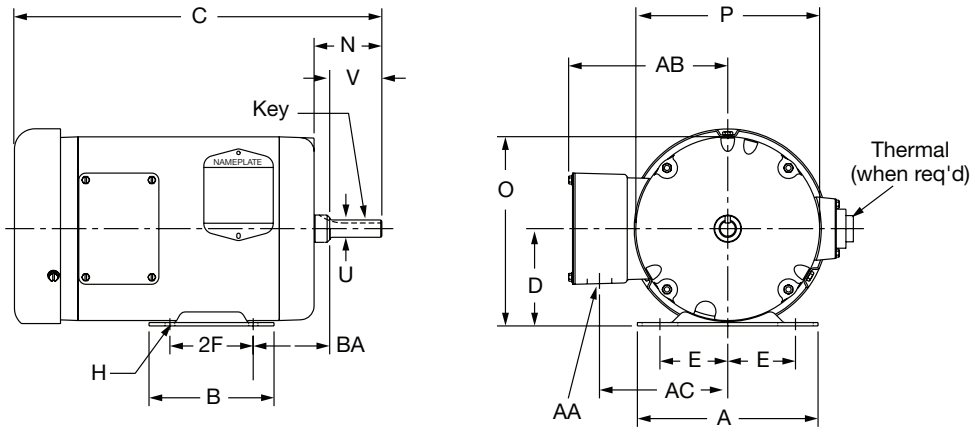
Hp	kW	RPM	Frame	Catalog No.	Amps		F.L. Torque Lb. Ft.	Efficiency %			Power Factor %			Bearings ODE/DE	"C" Dim.	Conn. Diag. No.
					F.L.	L.R.		1/2	3/4	F.L.	1/2	3/4	F.L.			
	0.75	3600	143T	ECP3580T-4	1.4	12.1	1.5	80.5	83.6	84	65	77	84	6205	12.88	CD0006
	0.75	3600	143T ▮	ENCP3580T-4	1.3	11.2	1.5	80.5	83.9	84.0	73	83	88	6205	11.37	CD0006
1	0.75	1800	143T	ECP3581T-4	1.5	14.0	3	83.8	86.2	87.5	58	72	78	6205	12.88	CD0006
	0.75	1800	143T ▮	ENCP3581T-4	1.5	15	3.0	84.4	87.0	87.5	48	60	70	6205	11.37	CD0006
	0.75	1200	145T	ECP3582T-4	1.8	9.6	4.5	82.3	84	82.5	42	55	63	6205	12.88	CD0006
	0.75	900	L182T	ECP3687T-4	1.75	9.2	6	80.2	83.1	82.5	43	56	64	6205/6206	17.12	416820-24
	1.1	3600	143T	ECP3583T-4	2	20.1	2.3	81.3	84.3	85.5	68	78	83	6205	12.88	CD0006
1 1/2	1.1	1800	145T	ECP3584T-4	2.1	19.7	4.5	86.7	88.6	88.5	55	68	76	6205	12.88	CD0006
	1.1	1200	182T	ECP3667T-4	2.4	20	6.8	84.2	86.9	87.5	47	59	67	6205/6206	15.62	416820-24
	1.1	900	L184T	ECP3668T-4	2.4	13.4	9	83.5	85.3	84	48	60	68	6205/6206	17.12	416820-24
	1.5	3600	145T	ECP3586T-4	2.5	30	3	83.8	86.2	86.5	70	80	85	6205	12.88	CD0006
2	1.5	1800	145T	ECP3587T-4	2.7	24.7	5.95	87.1	86.6	88.5	59	71	79	6205	12.88	CD0006
	1.5	1200	L184T	ECP3664T-4	2.8	18	9	86.4	88.3	88.5	49	62	70	6205/6206	17.12	416820-24
	1.5	900	L213T	ECP3772T-4	3.2	16.8	12.2	85.3	86.8	86.4	48	61	69	6206/6207	20.19	416820-24
	2.2	3600	182T	ECP3660T-4	3.6	30	4.5	87.7	88.8	88.5	78	86	88	6205/6206	15.62	416820-24
3	2.2	1800	182T	ECP3661T-4	4.2	32	9	88.1	89.5	89.5	55	68	76	6205/6206	15.62	416820-24
	2.2	1200	213T	ECP3764T-4	4.2	31	13.4	88.4	89.7	89.5	55	68	75	6206/6207	19.31	416820-24
	2.2	900	L215T	ECP3775T-4	4.7	25	18.3	85.4	86.3	85.5	51	63	70	6206/6207	20.19	416820-24
	3.7	3600	184T	ECP3663T-4	6	44	7.5	89.2	89.6	88.5	74	84	88	6205/6206	15.62	416820-24
5	3.7	1800	L184T	ECP3665T-4	6.6	46	15	89.4	90.1	89.5	62	74	80	6205/6206	17.12	416820-24
	3.7	1200	L215T	ECP3768T-4	6.8	46	22.5	89.7	90.2	89.5	60	71	77	6206/6207	20.19	416820-24
	3.7	900	254T	ECP2280T-4	7.3	46	29.8	88.2	89.6	89.5	53	65	72	6309	24.56	416820-24
	5.6	3600	213T	ECP3769T-4	8.6	62	11.2	90.6	90.9	90.2	81	87	90	6206/6207	19.31	416820-24
7.5	5.6	1800	L213T	ECP3770T-4	9.4	64	22.3	91.7	92.2	91.7	64	76	81	6206/6207	20.19	416820-24
	5.6	1200	254T	ECP2276T-4	9.9	64	33.5	90.7	91.4	91	61	72	78	6309	24.56	416820-25
	5.6	900	256T	ECP2401T-4	10.5	62	44.8	89.5	90.5	90.2	57	68	74	6309	24.56	416820-24
	7.5	3600	215T	ECP3771T-4	11.1	81	15	91.6	91.9	91	87	92	93	6206/6207	19.31	416820-24
10	7.5	1800	L215T	ECP3774T-4	12.3	81	30	92.3	92.4	91.7	68	78	83	6206/6207	20.19	416820-24
	7.5	1200	256T	ECP2332T-4	12.5	78	44.8	91.7	91.8	91	70	79	82	6309	24.56	416820-25
	7.5	900	284T	ECP2402T-4	13.7	81	59.4	89.6	90.7	91	60	70	76	6310	27.44	416820-24
	11.2	3600	254T	ECP2394T-4	16.8	114	22.3	92.8	93.1	91.7	85	90	91	6309	24.56	416820-25
15	11.2	1800	254T	ECP2333T-4	18.1	116	44.6	92.3	92.8	92.4	75	82	84	6309	24.56	416820-25
	11.2	1200	284T	ECP4100T-4	18.7	113	66.7	91.9	92.7	92.4	69	78	81	6310	27.44	416820-25
	11.2	900	286T	ECP2395T-4	20	109	89.4	90.9	91.3	90.7	65	74	78	6310	27.44	416820-25
	14.9	3600	256T	ECP4106T-4	22.3	145	29.8	92.3	92.4	91.7	87	91	82	6309	24.56	416820-25
20	14.9	1800	256T	ECP2334T-4	24	145	59.6	93.5	93.6	93	74	81	84	6309	24.56	416820-25
	14.9	1200	286T	ECP4102T-4	24.8	143	89.2	92.5	92.9	92.4	71	79	82	6310	27.44	416820-25
	14.9	900	324T	ECP4112T-4	26.5	140	119	92	92.3	91.6	61	72	77	6311	30.44	416820-24
	18.6	3600	284TS	ECP4107T-4	28.1	182	37	93.5	93.7	93	84	89	89	6310	26.06	416820-25
25	18.6	1800	284T	ECP4103T-4	29.7	182	74.1	94.1	94.2	93.6	77	83	84	6310	27.44	416820-25
	18.6	1200	324T	ECP4111T-4	30.9	182	111	92.8	93.3	93	68	77	81	6311	30.44	416820-25
	22.4	3600	286TS	ECP4108T-4	33.9	214	44.5	93.9	94.1	93	87	90	89	6310	26.06	416820-25
30	22.4	1800	286T	ECP4104T-4	36.1	217	89.1	94.1	94.2	93.6	74	81	83	6310	27.44	416820-25
	22.4	1200	326T	ECP4117T-4	36.4	217	133	93.6	94	93.6	70	79	82	6311	30.44	416820-25
	29.8	3600	324TS	ECP4109T-4	44.3	278	59	94.2	94.5	94.1	80	87	90	6311	28.94	416820-25
40	29.8	1800	324T	ECP4110T-4	47.7	287	118	94.6	94.7	94.1	73	80	83	6311	30.44	416820-25
	29.8	1200	364T	ECP4308T-4	49	290	177	93.6	94.3	94.1	69	77	81	6313	33.44	416820-25

NOTES: ▮ TENV enclosure. See page 54 for Layout drawing. See page 75 for Connection Diagrams.
Efficiencies shown are nominal. Data subject to change without notice. Contact Baldor for certified data.

Shaded ratings are cast iron frames.

Dimensions

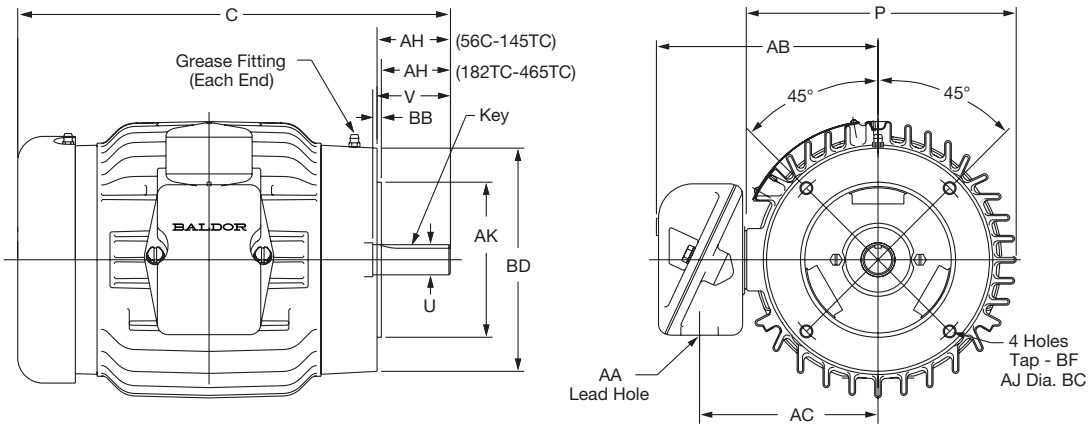
Three Phase Steel Band Construction Motors
Totally Enclosed Fan-Cooled - NEMA 56 through 215T



NEMA Frame	A	B	D	E	2F	H	Key	N	O	P	U	V	AA	AB	AC	BA
56	6.50	4.50	3.50	2.44	3.00	0.34 Slot	0.19	2.44	6.81	6.62	0.625	1.88	0.88	5.73	4.62	2.75
143T 145T	6.50	5.94	3.50	2.75	4.00 5.00	0.34	0.19	2.50	6.81	6.62	0.875	2.25	0.88	5.73	4.62	2.25
182T 184T	8.63	6.50	4.50	3.75	4.50 5.50	0.41	0.25	3.56	8.44	7.88	1.125	2.75	1.09	6.87	5.76	2.75
213T 215T	9.50	8.00	5.25	4.25	5.50 7.00	0.41	0.31	3.88	10.03	9.57	1.375	3.38	1.38	8.05	6.79	3.50

NOTE: Drawings shown are for reference only. Please contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or website at www.baldor.com

Three Phase Cast Iron Construction Motors
Totally Enclosed Fan-Cooled - NEMA 56C through 215TC - C-Face Less Base

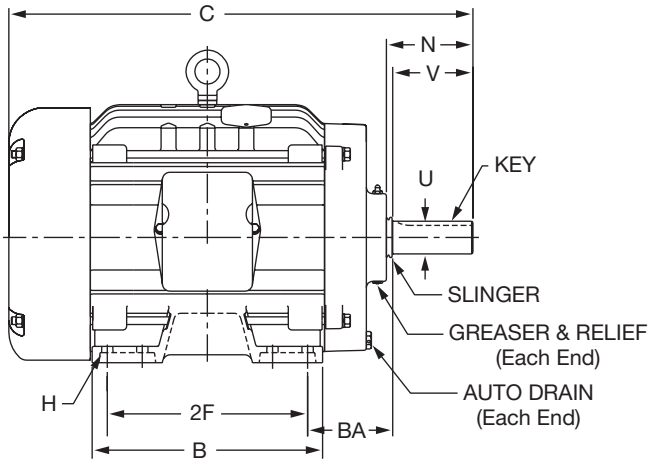


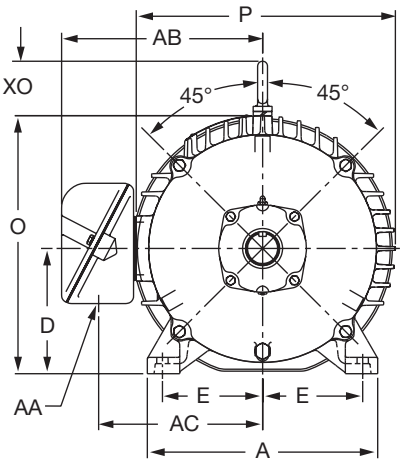
NEMA Frame	Key	P	U	V	AA	AB	AC	AH	AJ	AK	BB	BD	Tap BF
56C	0.188	8.00	0.625	1.88	1.06	6.38	5.00	2.06	5.88	4.50	0.13	6.50	3/8-16
Cast Iron Construction													
143TC 145TC	0.19	8.00	0.875	1.87	1.09	6.43	5.18	2.12	5.88	4.50	0.12	6.50	0.38-16
182TC 184TC	0.25	10.12	1.125	2.75	1.09	7.18	5.93	2.62	7.25	8.50	0.25	9.00	0.50-13
213TC 215TC	0.31	12.18	1.375	3.13	1.38	9.22	7.38	3.13	7.25	8.50	0.25	9.06	0.50-13

NOTE: Drawings shown are for reference only. Please contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-Rom or website at www.baldor.com

Dimensions

Three Phase Cast Iron Construction Motors
Totally Enclosed Fan-Cooled - NEMA 143T through 405T



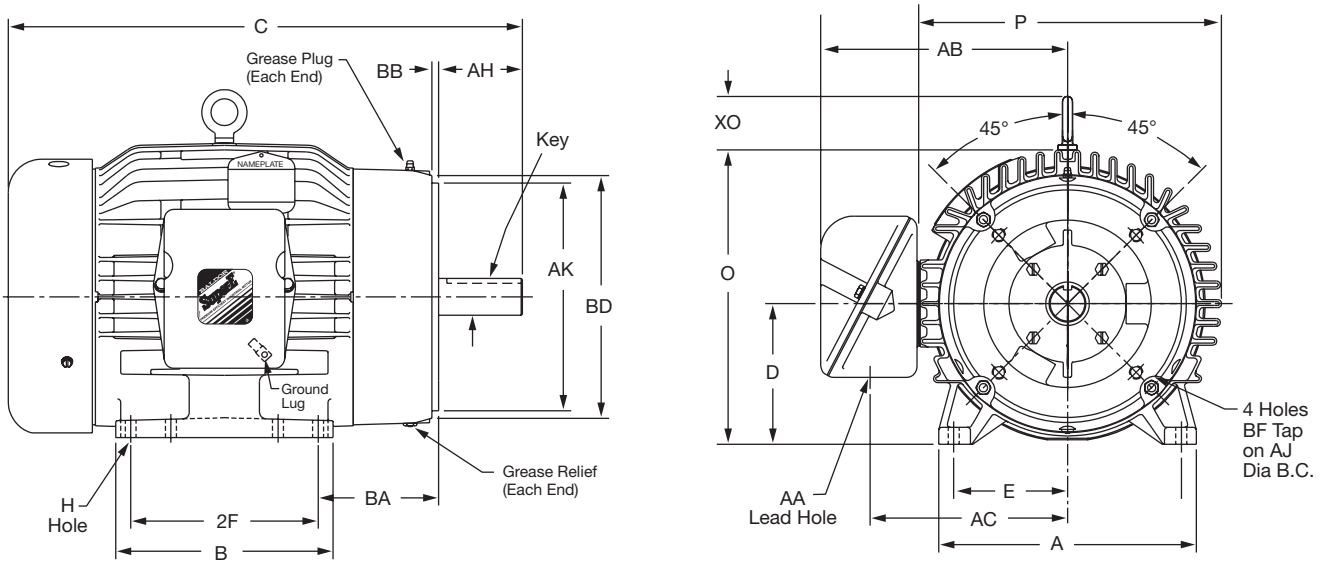


NEMA Frame	A	B	D	E	2F	H	Key	N	O	P	U	V	AA	AB	AC	BA
143T 145T	6.50	5.88	3.50	2.75	4.00 5.00	0.38	0.19	2.50	7.50	8.00	0.875	2.25	1.09	6.43	5.18	2.25
182T 184T	8.62	6.50	4.50	3.75	4.50 5.50	0.41	0.25	2.81	9.23	9.46	1.125	2.75	1.09	7.18	5.93	2.75
213T 215T	9.62	8.12	5.25	4.25	5.50 7.00	0.41	0.31	3.88	10.99	11.50	1.375	3.38	1.38	9.22	7.38	3.50
254T 256T	11.50	11.50	6.25	5.00	8.25 10.00	0.53	0.38	4.32	12.88	12.94	1.625	4.00	1.38	10.04	8.19	4.25
284T 286T	12.75	12.84	7.00	5.50	9.50 11.00	0.53	0.50	4.75	13.83	13.63	1.625	4.63	2.00	12.20	9.66	4.75
284TS 286TS	12.75	12.84	7.00	5.50	9.50 11.00	0.53	0.38	3.37	13.83	13.63	1.625	3.25	2.00	12.20	9.66	4.75
324T 326T	14.50	14.00	8.00	6.25	10.50 12.00	0.66	0.50	5.56	15.44	15.92	2.125	5.25	2.50	13.74	11.19	5.25
324TS 326TS	14.50	14.00	8.00	6.25	10.50 12.00	0.66	0.50	4.06	15.44	15.92	1.875	3.75	2.50	13.74	11.19	5.25
364T 365T	16.50	14.50	9.00	7.00	11.25 12.25	0.66	0.62	6.13	18.38	19.25	2.375	5.88	3.62	14.95	12.40	5.88
364TS 365TS	16.50	14.50	9.00	7.00	11.25 12.25	0.66	0.50	4.00	18.38	19.25	1.875	3.75	3.62	14.95	12.40	5.88
404T 405T	18.88	16.63	10.00	8.00	12.25 13.75	0.81	0.75	7.50	19.38	19.81	2.875	7.25	3.63	17.85	14.18	6.63

NOTE: Drawings shown are for reference only. Please contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or website at www.baldor.com

Dimensions

Three Phase Cast Iron Construction Motors
Totally Enclosed Fan-Cooled - NEMA 143TC through 365TC - C-Face With Base

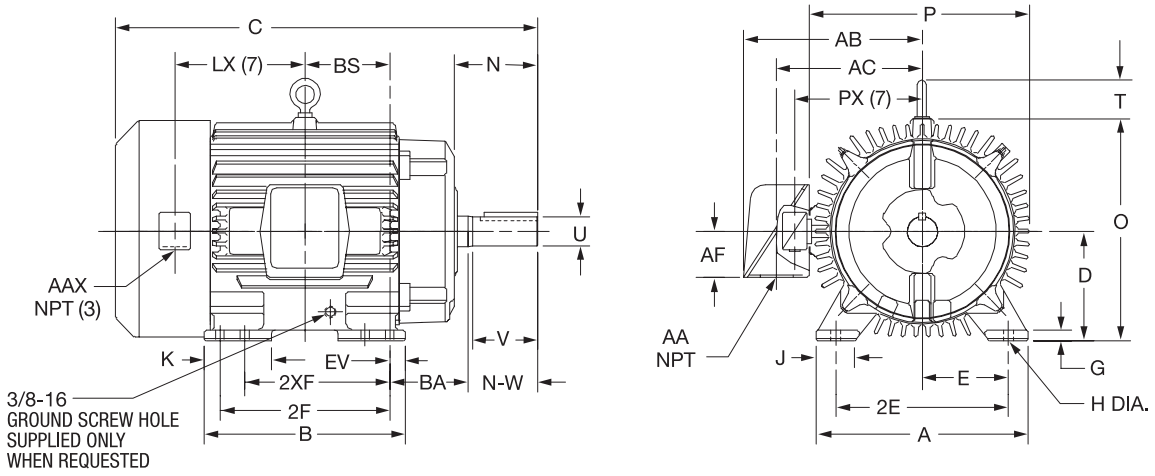


NEMA Frame	A	B	D	E	2F	H	Key	O	P	U	V	AA	AB	AC	AH	AJ	AK	BB	BD	Tap BF	BA
143TC 145TC	6.50	5.88	3.50	2.75	4.00 5.00	0.38	0.19	7.51	8.00	0.875	2.13	1.09	6.43	5.18	2.25	5.88	4.50	0.13	6.47	0.38-16	2.75
182TC 184TC	8.62	6.50	4.50	3.75	4.50 5.50	0.41	0.25	9.23	9.46	1.125	2.62	1.09	7.18	5.93	2.75	7.25	8.50	0.25	8.87	0.50-13	3.50
213TC 215TC	9.62	8.12	5.25	4.25	5.50 7.00	0.41	0.31	10.99	11.50	1.375	3.38	1.38	9.21	7.37	3.13	7.25	8.50	0.25	9.06	0.50-13	4.25
254TC 256TC	11.50	11.50	6.25	5.00	8.25 10.00	0.53	0.38	12.18	11.62	1.625	4.00	1.38	9.4	7.56	3.75	7.25	8.50	0.25	9.09	0.50-13	4.75
284TC 286TC	12.75	12.84	7.00	5.50	9.50 11.00	0.53	0.50	13.85	13.63	1.875	4.63	2.00	12.20	9.66	4.38	9.00	10.50	0.25	11.21	0.50-13	4.75
324TC 326TC	14.50	14.00	8.00	6.25	10.50 12.00	0.66	0.50	15.44	14.78	2.125	5.00	2.50	13.74	11.19	4.75	11.00	12.50	0.25	13.05	0.62-11	5.25
364TC 365TC	16.50	14.50	9.00	7.00	11.25 12.25	0.66	0.62	18.38	19.25	2.375	5.88	3.62	14.95	12.40	5.63	11.00	12.50	0.25	12.90	0.63-11	5.88
404TC 405TC	18.88	16.63	10.00	8.00	12.25 13.75	0.81	0.75	19.38	19.81	2.875	7.25	3.63	17.85	14.18	7.00	11.00	12.50	0.25	12.90	0.63-11	6.62

NOTE: Drawings shown are for reference only.
Please contact Baldor for a detailed dimensional drawing of the specific motor you require.
Drawings may also be available from our CD-ROM or website at www.baldor.com

Dimensions

ECP - Cast Iron Construction
Totally Enclosed Fan Cooled - NEMA 143T-449T - Foot Mounted

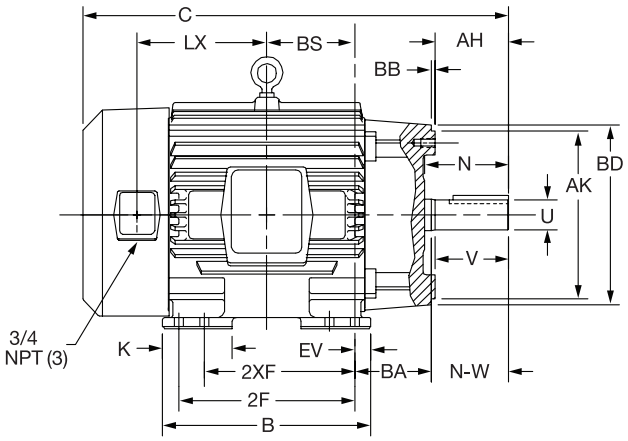


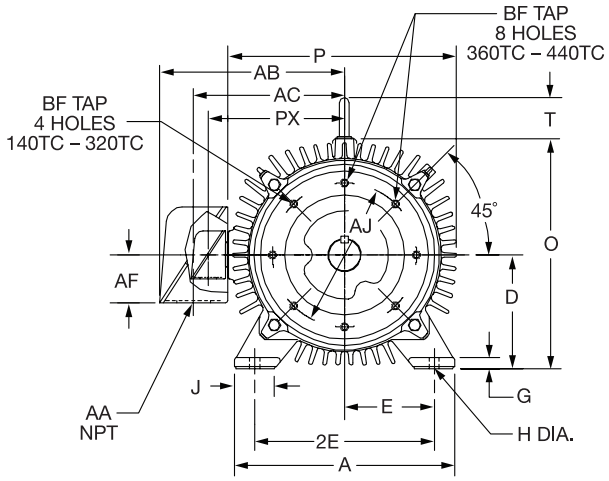
Frame Size (1)	A	D(2)	E	G	H	O	P	T	Cast Iron Conduit Box				BA	C	BS	B	2F	2XF (2)	Shaft and Key						Wgt. lbs.
									AA	AB	AC	AF							N	N-W	U	V	Sq.	Lgth.	
143T 145T	6.50	3.50	2.75	—	0.38	7.48	8.00	1.88	0.75	6.38	5.00	—	2.25	12.88	—	5.88	4.00 5.00	—	2.50	2.25	0.875	2.25	0.19	1.38	58 65
182T L182T	9.00	4.50	3.75	0.44	0.44	9.88	9.50	2.00	1.00	8.44	6.69	2.12	2.75	15.62 17.12	2.75 3.50	7.00 8.50	—	4.50	3.00	2.75	1.130	2.50	0.25	1.75	86 116
184T L184T	9.00	4.50	3.75	0.44	0.44	9.88	9.50	2.00	1.00	8.44	6.69	2.12	2.75	15.62 17.12	2.75 3.50	7.00 8.50	5.50	—	3.00	2.75	1.130	2.50	0.25	1.75	91 121
213T L213T	10.50	5.25	4.25	0.44	0.44	11.25	11.00	2.00	1.00	9.31	7.56	2.12	3.50	19.31 20.19	3.50 3.94	8.50 9.12	—	5.50	3.62	3.38	1.375	3.12	0.312	2.38	135 175
215T L215T	10.50	5.25	4.25	0.44	0.44	11.25	11.00	2.00	1.00	9.31	7.56	2.12	3.50	19.31 20.19	3.50 3.94	8.50 9.12	7.00	—	3.62	3.38	1.375	3.12	0.312	2.38	145 185
254T 256T	12.50	6.25	5.00	0.75	0.56	13.25	13.25	2.44	1.25	10.81	8.81	2.50	4.25	24.56	5.00	12.00	— 10.00	8.25 —	4.12	4.00	1.625	3.75	0.375	2.88	335 345
284T 284TS	13.75	7.00	5.50	0.75	0.56	14.75	14.88	2.44	1.50	12.62	10.19	3.00	4.75	27.44 26.06	5.50	13.00	—	9.50	5.00 3.62	4.62 3.25	1.875 1.625	4.38 3.00	0.500 0.375	3.25 1.88	475
286T 286TS	13.75	7.00	5.50	0.75	0.56	14.75	14.88	2.44	1.50	12.62	10.19	3.00	4.75	27.44 26.06	5.50	13.00	11.00	—	5.00 3.62	4.62 3.25	1.875 1.625	4.38 3.00	0.500 0.375	3.25 1.88	490
324T 324TS	15.50	8.00	6.25	0.88	0.69	16.69	17.00	2.44	2.00	15.44	11.69	3.62	5.25	30.44 28.94	6.00	14.75	—	10.50	5.62 4.12	5.25 3.75	2.125 1.875	5.00 3.50	0.500	3.88 2.00	590
326T 326TS	15.50	8.00	6.25	0.88	0.69	16.69	17.00	2.44	2.00	15.44	11.69	3.62	5.25	30.44 28.94	6.00	14.75	12.00	—	5.62 4.12	5.25 3.75	2.125 1.875	5.00 3.50	0.500	3.88 2.00	630
364T 364TS	17.00	9.00	7.00	0.88	0.69	18.50	19.50	2.94	3.00	18.00	13.81	4.12	5.88	33.44 31.31	6.12	15.00	—	11.25	6.25 4.12	5.88 3.75	2.375 1.875	5.62 3.50	0.625 0.500	4.25 2.00	865 859
365T 365TS	17.00	9.00	7.00	0.88	0.69	18.50	19.50	2.94	3.00	18.00	13.81	4.12	5.88	33.44 31.31	6.12	15.00	12.25	—	6.25 4.12	5.88 3.75	2.375 1.875	5.62 3.50	0.625 0.500	4.25 2.00	890 884
404T 404TS	19.00	10.00	8.00	1.12	0.81	21.31	22.50	2.94	3.00	19.25	15.06	4.12	6.62	38.31 35.31	6.88	16.00	—	12.25	7.50 4.50	7.25 4.25	2.875 2.125	7.00 4.00	0.750 0.500	5.62 2.75	1,220 1,211
405T 405TS	19.00	10.00	8.00	1.12	0.81	21.31	22.50	2.94	3.00	19.25	15.06	4.12	6.62	38.31 35.31	6.88	16.00	13.75	—	7.50 4.50	7.25 4.25	2.875 2.125	7.00 4.00	0.750 0.500	5.62 2.75	1,260 1,251
444T 444TS	21.00	11.00	9.00	1.12	0.81	23.38	25.25	3.25	3.00	22.19	17.44	6.00	7.50	44.62 40.88	8.25	19.00	—	14.50	8.94 5.19	8.50 4.75	3.375 2.375	8.25 4.50	0.875 0.625	6.88 3.00	1,670 1,654
445T 445TS	21.00	11.00	9.00	1.12	0.81	23.38	25.25	3.25	3.00	22.19	17.44	6.00	7.50	44.62 40.88	8.25	19.00	16.50	—	8.94 5.19	8.50 4.75	3.375 2.375	8.25 4.50	0.875 0.625	6.88 3.00	1,860 1,844
447T 447TS	22.00	11.00	9.00	1.25	0.81	23.62	26.00	0.75	4.00	23.87	18.62	7.00	7.81	48.40 44.65	10.00	22.50	20.00	—	8.19 4.44	8.19 4.44	3.375 2.375	8.19 4.44	0.875 0.625	6.88 3.00	2,275
449T 449TS	22.00	11.00	9.00	1.25	0.81	23.62	26.00	0.75	4.00	23.87	18.62	7.00	7.81	53.40 49.60	12.50	27.50	25.00	—	8.19 4.44	8.19 4.44	3.375 2.375	8.19 4.44	0.875 0.625	6.88 3.00	2,650

NOTE: (1) Frame sizes with the "L" designation are not suitable for conversion to F-2 mounting.
(2) Frames 143T through 445T have eight (8) mounting holes for dual mounting. (3) Auxiliary conduit box supplied when specified.
Dimensions are in Inches. Drawings shown are for reference only. Please contact Baldor for a detailed dimensional drawing of the specific motor you require.
Drawings may also be available from our website at www.Baldor.com.

Dimensions

CP/ECP - Cast Iron Construction
Totally Enclosed Fan Cooled - NEMA 143TC-326TC - C-Face, Foot Mounted



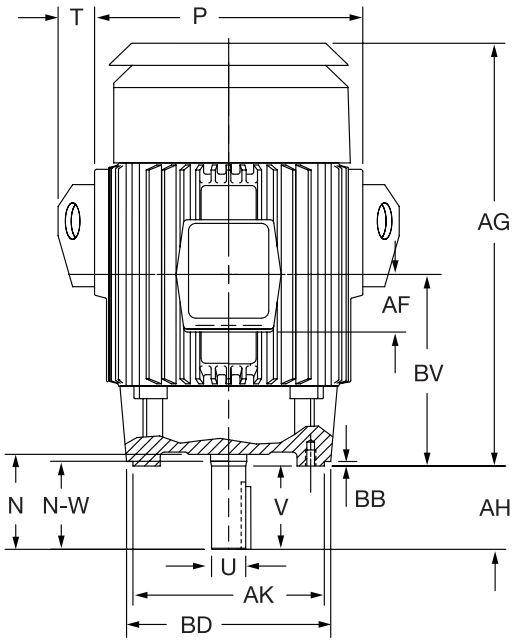


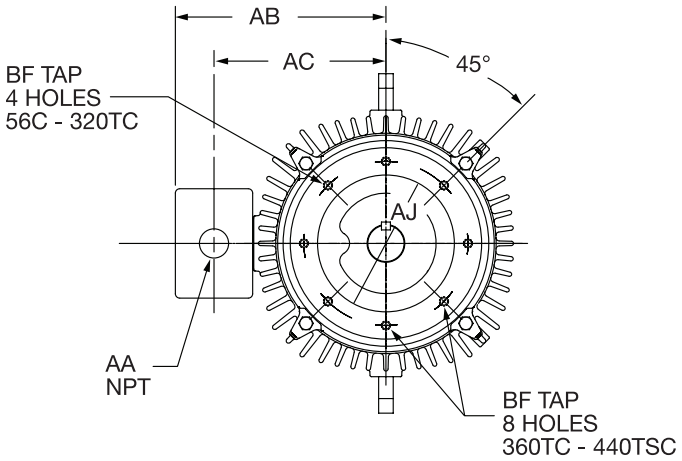
Frame Size (1)	A	D	E	H	O	P	T	BA	Cast Iron Conduit Box				BB	BD	BF	Min Tap Depth	AJ	AK	C	BS	B	2F	2XF (2)	Shaft and Key						Wgt. Lbs.
									AA	AB	AC	AF												N	N-W	U	V	Sq.	Lgth	
143TC 145TC	6.50	3.50	2.75	0.38	7.48	8.00	2.00	2.75	0.75	6.38	5.31	—	0.13	6.47	3/8-16	0.62	5.88	4.50	13.38	2.50	5.88	4.00 5.00	—	2.50	2.25	0.875	2.25	0.190	1.38	58 65
182TC 184TC L184TC	9.00	4.50	3.75	0.44	9.88	9.50	2.00	3.50	1.00	8.44	6.69	2.12	0.25	9.00	1/2-13	0.75	7.25	8.50	16.38 16.38 17.88	2.75 2.75 3.50	7.00 7.00 8.50	— 5.50 5.50	4.50 — —	3.00	2.75	1.125	2.50	0.250	1.75	95 100 130
213TC 215TC L215TC	10.50	5.25	4.25	0.44	11.25	11.00	2.00	4.25	1.00	9.31	7.56	2.12	0.25	9.00	1/2-13	0.75	7.25	8.50	20.06 20.06 20.94	3.50 3.50 3.94	8.50 8.50 9.12	— 7.00 7.00	5.50 — —	3.62	3.38	1.375	3.12	0.312	2.38	145 155 195
254TC 256TC	12.50	6.25	5.00	0.56	13.25	13.25	2.44	4.75	1.25	10.81	8.81	2.50	0.25	9.00	1/2-13	0.75	7.25	8.50	25.06	5.00	12.00	— 10.00	8.25 —	4.06	4.00	1.625	3.75	0.375	2.88	345 355
284TC 286TC	13.75	7.00	5.50	0.56	14.75	14.88	2.44	4.75	1.50	12.62	10.19	3.00	0.25	11.25	1/2-13	0.75	9.00	10.50	27.44	5.50	13.00	— 11.00	9.50 —	5.00	4.62	1.875	4.38	0.500	3.25	485 500
324TC 326TC	15.50	8.00	6.25	0.69	16.69	17.00	2.44	5.25	2.00	15.44	11.69	3.62	0.25	13.12	5/8-11	0.94	11.00	12.50	30.44	6.00	14.75	— 12.00	10.50 —	5.62	5.25	2.125	5.00	0.500	3.88	605 645

NOTE: (1) Frame sizes with the "L" designation are not suitable for conversion to F-2 mounting.
(2) All frames have eight (8) mounting holes for dual mounting.
(3) Auxiliary conduit box supplied when specified.
Dimensions are in Inches. Drawings shown are for reference only.
Please contact Baldor for a detailed dimensional drawing of the specific motor you require.
Drawings may also be available from our website at www.Baldor.com.

Dimensions

ECP - Cast Iron Construction Motors
Totally Enclosed Fan Cooled - NEMA 56C-324TC - C-Face, Footless



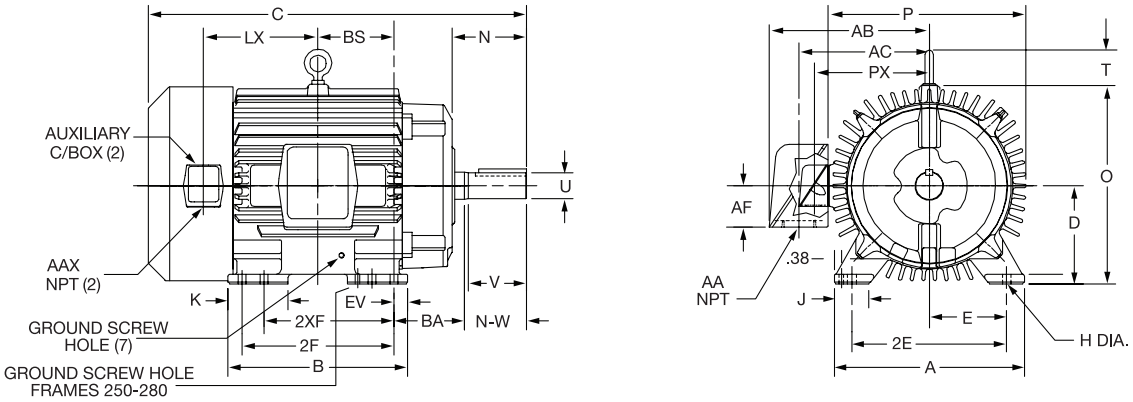


Frame Size	P	Cast Iron Conduit Box				AJ	AK	BB	BD	BF	Min Tap Depth	T	C	AG	AH	BV	Shaft and Key						Wgt. Lbs.
		AA	AB	AC	AF												N	N-W	U	V	Lgth	Sq.	
56C	8.02	0.75	6.47	5	—	5.88	4.50	0.13	6.48	3/8-16	0.75	—	12.69	—	2.06	—	1.88	1.88	0.625	1.88	1.38	0.190	53
143TC 145TC	8.02	0.75	6.47	5.00	—	5.88	4.50	0.13	6.48	3/8-16	0.75	—	13.92	—	2.12	—	2.25	2.25	0.875	2.25	1.38	0.190	62
182TC 184TC	10.50	1.00	8.44	6.69	2.12	7.25	8.50	0.25	8.75	1/2-13	0.75	1.44	—	15.49	2.62	6.44	2.94	2.75	1.125	2.50	1.75	0.250	126
213TC 215TC	11.00	1.00	9.31	7.31	2.12	7.25	8.50	0.25	9.00	1/2-13	0.75	1.44	—	18.44	3.12	7.69	3.62	3.38	1.375	3.12	2.38	0.312	190
254TC 256TC	14.00	1.25	10.81	8.81	2.50	7.25	8.50	0.25	9.00	1/2-13	0.75	2.25	—	23.22	3.75	10.00	4.06	4.00	1.625	3.75	2.88	0.375	350
284TC 286TC	15.50	1.50	12.62	10.19	3.00	9.00	10.50	0.25	11.25	1/2-13	0.75	2.25	—	24.97	4.38	10.50	5.00	4.62	1.875	4.38	3.25	0.500	475 490
324TC	17.38	2.00	15.44	11.69	3.62	11.00	12.50	0.25	13.12	5/8-11	0.94	2.25	—	27.35	5.00	11.50	5.62	5.25	2.125	5.00	3.88	0.500	605

NOTE: Dimensions are in Inches
Drawings shown are for reference only.
Please contact Baldor for a detailed dimensional drawing of the specific motor you require.
Drawings may also be available from our website at www.Baldor.com.

Dimensions

841XL and 661XL - Three Phase - Cast Iron Construction Motors
Totally Enclosed Fan Cooled - NEMA 143T-449T - Foot Mounted

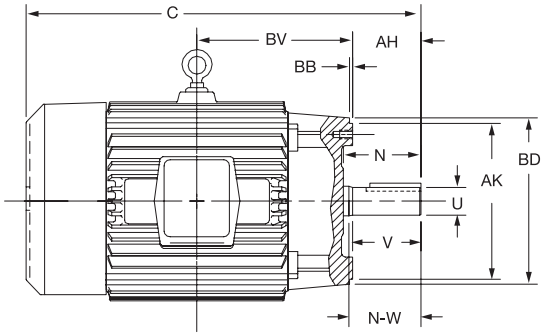


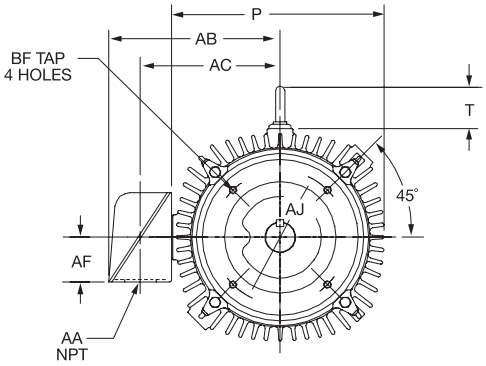
Frame Size (1)	A	D(2)	E	H	O	P	T	BA	Cast Iron Conduit Box				Aux C/box (2)			C	BS	B	2F	2XF (3)	Shaft and Key						Weight Lbs.
									AA	AB	AC	AF	AAX	LX	PX						N	N-W	U	V	Sq.	Lgth	
143T 145T	6.50	3.50	2.75	0.38	7.48	8.00	2.00	2.25	0.75	6.38	5.31	—	—	—	—	12.88	2.50	5.88	4.00 5.00	—	2.50	2.25	0.88	2.25	0.19	1.38	58 65
182T L182T	9.00	4.50	3.75	0.44	9.88	9.50	2.00	2.75	1.00	8.44	6.69	2.12	0.75	4.00 4.75	7.06	15.62 17.12	2.75 3.50	7.00 8.50	—	4.50	3.00	2.75	1.13	2.50	0.25	1.75	86 91
184T L184T	9.00	4.50	3.75	0.44	9.88	9.50	2.00	2.75	1.00	8.44	6.69	2.12	0.75	4.00 4.75	7.06	15.62 17.12	2.75 3.50	7.00 8.50	5.50	—	3.00	2.75	1.13	2.50	0.25	1.75	116 121
213T L213T	10.50	5.25	4.25	0.44	11.25	11.00	2.00	3.50	1.25	9.81	7.81	2.50	0.75	5.12 5.56	7.72	19.31 20.19	3.50 3.94	8.50 9.12	—	5.50	3.62	3.38	1.38	3.12	0.31	2.38	135 145
215T L215T	10.50	5.25	4.25	0.44	11.25	11.00	2.00	3.50	1.25	9.81	7.81	2.50	0.75	5.12 5.56	7.72	19.31 20.19	3.50 3.94	8.50 9.12	7.00	—	3.62	3.38	1.38	3.12	0.31	2.38	175 185
254T 256T	12.50	6.25	5.00	0.56	13.25	13.25	2.44	4.25	1.25	10.81	8.81	2.50	0.75	7.06	9.31	24.56	5.00	12.00	— 10.00	8.25 —	4.12	4.00	1.63	3.75	0.38	2.88	335 345
284T 284TS	13.75	7.00	5.50	0.56	14.75	14.88	2.44	4.75	1.50	12.62	10.19	3.00	0.75	7.63	10.50	27.44 26.06	5.50	13.00	—	9.50	5.00 3.62	4.62 3.25	1.88 1.63	4.38 3.00	0.50 0.38	3.25 1.88	475
286T 286TS	13.75	7.00	5.50	0.56	14.75	14.88	2.44	4.75	1.50	12.62	10.19	3.00	0.75	7.63	10.50	27.44 26.06	5.50	13.00	11.00	—	5.00 3.62	4.62 3.25	1.88 1.63	4.38 3.00	0.50 0.38	3.25 1.88	490 490
324T 324TS	15.50	8.00	6.25	0.69	16.69	17.00	2.44	5.25	2.00	15.44	11.69	3.62	0.75	8.75	10.50	30.44 28.94	6.00	14.75	—	10.50	5.62 4.12	5.25 3.75	2.13 1.88	5.00 3.50	0.50	3.88 2.00	590
326T 326TS	15.50	8.00	6.25	0.69	16.69	17.00	2.44	5.25	2.00	15.44	11.69	3.62	0.75	8.75	10.50	30.44 28.94	6.00	14.75	12.00	—	5.62 4.12	5.25 3.75	2.13 1.88	5.00 3.50	0.50	3.88 2.00	630
364T 364TS	17.00	9.00	7.00	0.69	18.50	19.50	2.94	5.88	3.00	18.00	13.81	4.12	0.75	9.12	11.62	33.44 31.31	6.12	15.00	—	11.25	6.25 4.12	5.88 3.75	2.38 1.88	5.62 3.50	0.63 0.50	4.25 2.00	865 859
365T 365TS	17.00	9.00	7.00	0.69	18.50	19.50	2.94	5.88	3.00	18.00	13.81	4.12	0.75	9.12	11.62	33.44 31.31	6.12	15.00	12.25	—	6.25 4.12	5.88 3.75	2.38 1.88	5.62 3.50	0.63 0.50	4.25 2.00	890 884
404T 404TS	19.00	10.00	8.00	0.81	21.31	22.50	2.94	6.62	3.00	19.25	15.06	4.12	0.75	9.62	14.44	35.31	6.88	16.00	—	12.25	7.50 4.50	7.25 4.25	2.88 2.13	7.00 4.00	0.75 0.50	5.62 2.75	1220 1211
405T 405TS	19.00	10.00	8.00	0.81	21.31	22.50	2.94	6.62	3.00	19.25	15.06	4.12	0.75	9.62	14.44	38.31 35.31	6.88	16.00	13.75	—	7.50 4.50	7.25 4.25	2.88 2.13	7.00 4.00	0.75 0.50	5.62 2.75	1260 1251
444T 444TS	21.00	11.00	9.00	0.81	23.38	25.25	3.25	7.50	3.00	22.19	17.44	6.00	0.75	11.12	15.25	44.62 40.88	8.25	19.00	—	14.50	8.94 5.19	8.50 4.75	3.38 2.38	8.25 4.50	0.88 0.63	6.88 3.00	1670 1654
445T 445TS	21.00	11.00	9.00	0.81	23.38	25.25	3.25	7.50	3.00	22.19	17.44	6.00	0.75	11.12	15.25	44.62 40.88	8.25	19.00	16.50	—	8.94 5.19	8.50 4.75	3.38 2.38	8.25 4.50	0.88 0.63	6.88 3.00	1860 1844
447T 447TS	22.00	11.00	9.00	0.81	23.62	26.00	0.75	7.50	3.00	23.87	18.62	7.00	0.75	12.88	15.50	48.13 44.37	10.00	22.50	20.00	—	8.50 4.75	8.50 4.75	3.38 2.38	8.82 4.50	0.88 0.63	6.88 3.00	2275
449T 449TS	22.00	11.00	9.00	0.81	23.62	26.00	0.75	7.50	3.00	23.87	18.62	7.00	0.75	15.38	15.50	53.13 49.37	12.50	27.50	25.00	—	8.50 4.75	8.50 4.75	3.38 2.375	8.25 4.50	0.88 0.625	6.88 3.00	2650

NOTE: (1) Frame sizes with the "L" designation are not suitable for conversion to F-2 mounting.
(2) Auxiliary terminal box supplied only when specified.
(3) Frames 143T through 445T have eight (8) mounting holes for dual mounting.
Dimensions are in Inches Drawings shown are for reference only. Please contact Baldor for a detailed dimensional drawing of the specific motor you require.
Drawings may also be available from our website at www.Baldor.com.

Dimensions

841XL - Three Phase - Cast Iron Construction Motors
Totally Enclosed Fan Cooled - NEMA 143TC-365TC - C-Face, Footless

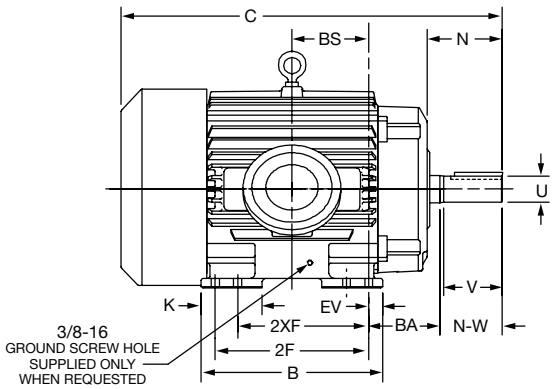


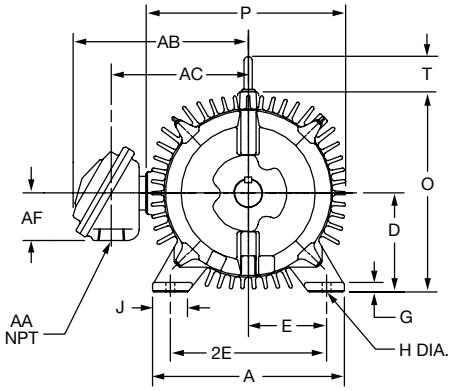


Frame Size	P	Cast Iron Conduit Box				AJ	AK	BB	BD	BF	Min Tap Depth	T	C	BV	AH	Shaft and Key						Wgt. Lbs.
		AA	AB	AC	AF											N	N-W	U	V	Sq.	Lgth	
143TC 145TC	7.48	0.75	6.38	5.31	—	5.88	4.50	0.13	6.47	3/8-16	0.62	2.00	14.56	—	2.12	2.50	2.25	0.875	2.25	0.190	1.38	58 65
182TC 184TC	9.50	1.00	8.44	6.69	2.12	7.25	8.50	0.25	9.00	1/2-13	0.75	2.00	17.88	7.13	2.62	3.00	2.75	1.125	2.50	0.250	1.75	126
213TC 215TC	11.00	1.25	9.81	7.81	2.50	7.25	8.50	0.25	9.00	1/2-13	0.75	2.00	20.94	8.45	3.12	3.62	3.38	1.375	3.12	0.312	2.38	190
254TC 256TC	13.25	1.25	10.81	8.81	2.50	7.25	8.50	0.25	9.00	1/2-13	0.75	2.44	25.06	10.00	3.75	4.06	4.00	1.625	3.75	0.375	2.88	335 345

NOTE: Drawings shown are for reference only. Contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or at www.baldor.com.

Explosion Proof - ECP/XEX - Cast Iron Construction Motors
Totally Enclosed Fan Cooled - NEMA L182T-445T - Foot Mounted



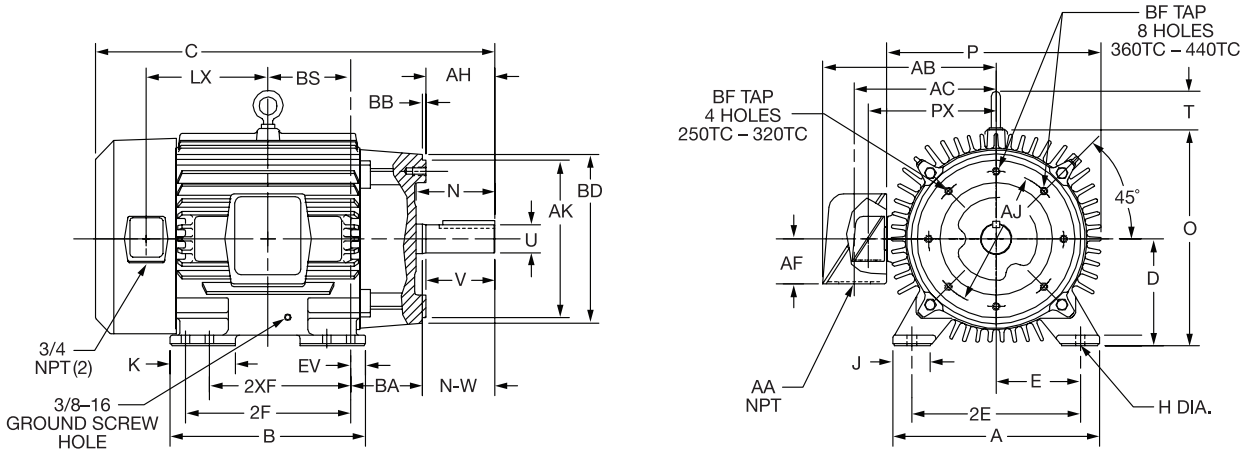


Frame Size	A	B	C	D	E	2F	H	KEY	N	O	P	U	V	AA	AB	AC	AF	BA	Wgt. Lbs.(5)
L182T L184T	9	8.5	17.12	4.5	3.75	4.5 5.5	0.44	0.188	2.81	9.88	9.25	1.125	2.5	1	9.5	6.94	2.5	2.75	110 115
213T 215T	10.5	8.5	19.25	5.25	4.25	5.5 7.0	0.44	0.25	3.44	11.25	10.5	1.375	3.12	1	10.5	7.81	2.5	3.5	130 140
L213T L215T	10.5	9.12	20.12	5.25	4.25	5.5 7.0	0.44	0.25	3.44	11.25	10.5	1.375	3.12	1	10.5	7.81	2.5	3.5	170 180
254T 256T	12.5	12	24.56	6.25	5	8.25 10	0.56	0.375	4.06	13.25	13.25	1.625	3.75	1.25	12.38	9.69	3.38	4.25	335 345
284T 286T	13.75	13	27.44	7	5.5	9.5 11	0.56	0.5	4.69	14.75	14.88	1.875	4.38	1.5	13.25	10.56	3.38	4.75	495 510
324T 326T	15.5	14.75	30.44	8	6.25	10.5 12	0.69	0.5	5.62	16.69	17	2.125	5	2	17.06	12.5	4.25	5.25	610 650
364T 365T	17	15	33.44	9	7	11.25 12.25	0.69	0.625	6	18.5	19.5	2.375	5.62	3	18.81	14.25	4.25	5.88	910 950
404T 405T	19	16	38.31	10	8	12.25 13.75	0.81	0.75	7.5	21.31	22.5	2.875	7	3	20.5	15.88	4.25	6.62	1300 1335
444T 445T	21	19	44.62	11	9	14.5 16.5	0.81	0.875	8.94	23.38	25.25	3.375	8.25	3	26.25	20.38	6	7.5	1770 1960

NOTE: Drawings shown are for reference only. Contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or at www.baldor.com.

Dimensions

841XL - Three Phase - Cast Iron Construction Motors
Totally Enclosed Fan Cooled - NEMA 143TC-365TC - C-Face, Foot Mounted

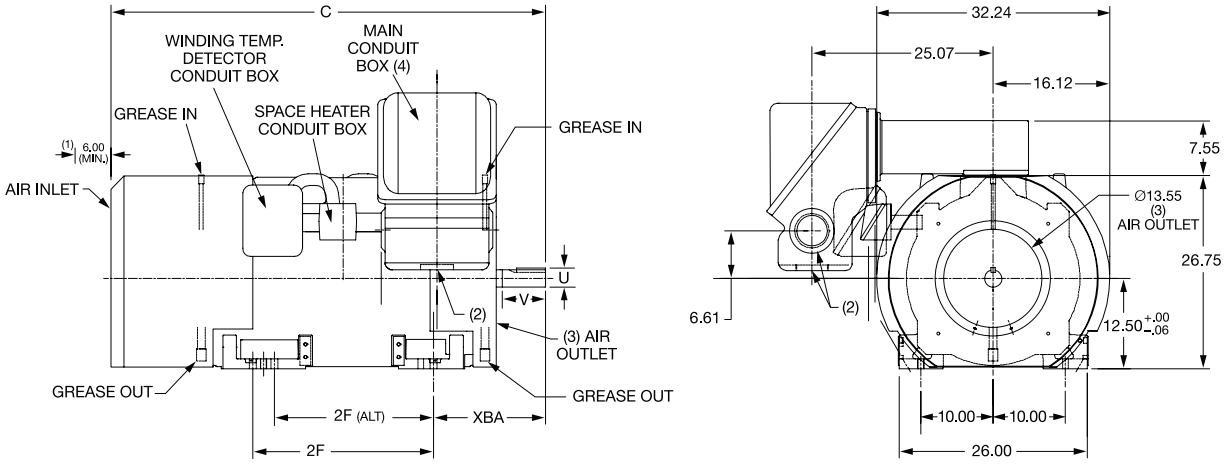


Frame Size (1)	A	D	E	H	O	P	T	BA	Cast Iron Conduit Box				Aux C/box (2)			BB	BD	BF	Min Tap Depth	AJ	AK	C	BS	B	2F (3)	2XF	Shaft and Key						Wgt. Lbs.
									AA	AB	AC	AF	AAX	LX	PX												N	N-W	U	V	Sq.	Lgth	
143TC 145TC	6.50	3.50	2.75	.38	7.48	8.00	2.00	2.75	.75	6.38	5.31	—	—	—	—	.13	6.47	3/8-16	.62	5.88	4.50	13.38	2.50	5.88	4.00 5.00	—	2.50	2.25	.875	2.25	.190	1.38	58 65
182TC L182TC	9.00	4.50	3.75	.44	9.88	9.50	2.00	3.50	1.00	8.44	6.69	2.12	.75	4.00 4.75	7.06	.25	9.00	1/2-13	.75	7.25	8.50	16.38 17.88	2.75 3.50	7.00 8.50	—	4.50	3.00	2.75	1.125	2.50	.250	1.75	95 125
184TC L184TC	9.00	4.50	3.75	.44	9.88	9.50	2.00	3.50	1.00	8.44	6.69	2.12	.75	4.00 4.75	7.06	.25	9.00	1/2-13	.75	7.25	8.50	16.38 17.88	2.75 3.50	7.00 8.50	5.50	—	3.00	2.75	1.125	2.50	.250	1.75	100 130
213TC L213TC	1.50	5.25	4.25	.44	11.25	11.00	2.00	4.25	1.25	9.81	7.81	2.50	.75	5.12 5.56	7.72	.25	9.00	1/2-13	.75	7.25	8.50	2.06 2.94	3.50 3.94	8.50 9.12	—	5.50	3.62	3.38	1.375	3.12	.312	2.38	145 185
215TC L215TC	1.50	5.25	4.25	.44	11.25	11.00	2.00	4.25	1.25	9.81	7.81	2.50	.75	5.12 5.56	7.72	.25	9.00	1/2-13	.75	7.25	8.50	2.06 2.94	3.50 3.94	8.50 9.12	7.00	—	3.62	3.38	1.375	3.12	.312	2.38	155 195
254TC 256TC	12.50	6.25	5.00	.56	13.25	13.25	2.44	4.75	1.25	1.81	8.81	2.50	.75	7.06	9.31	.25	9.00	1/2-13	.75	7.25	8.50	25.06	5.00	12.00	— 1.00	8.25 —	4.06	4.00	1.625	3.75	.375	2.88	345 355
284TC 284TSC	13.75	7.00	5.50	.56	14.75	14.88	2.44	4.75	1.50	12.62	1.19	3.00	.75	7.63	1.50	.25	11.25	1/2-13	.75	9.00	1.50	27.44 26.06	5.50	13.00	—	9.50	5.00 3.62	4.62 3.25	1.875 1.625	4.38 3.00	.500 .375	3.25 1.88	485
286TC 286TSC	13.75	7.00	5.50	.56	14.75	14.88	2.44	4.75	1.50	12.62	1.19	3.00	.75	7.63	1.50	.25	11.25	1/2-13	.75	9.00	1.50	27.44 26.06	5.50	13.00	11.00	—	5.00 3.62	4.62 3.25	1.875 1.625	4.38 3.00	.500 .375	3.25 1.88	500
324TC 324TSC	15.50	8.00	6.25	.69	16.69	17.00	2.44	5.25	2.00	15.44	11.69	3.62	.75	8.75	1.50	.25	13.12	5/8-11	.94	11.00	12.50	3.44 28.94	6.00	14.75	—	1.50	5.62 4.12	5.25 3.75	2.125 1.875	5.00 3.50	.500	3.88 2.00	605
326TC 326TSC	15.50	8.00	6.25	.69	16.69	17.00	2.44	5.25	2.00	15.44	11.69	3.62	.75	8.75	1.50	.25	13.12	5/8-11	.94	11.00	12.50	3.44 28.94	6.00	14.75	12.00	—	5.62 4.12	5.25 3.75	2.125 1.875	5.00 3.50	.500	3.88 2.00	645
364TC 364TSC	17.00	9.00	7.00	.69	18.50	19.50	2.94	5.88	3.00	18.00	13.81	4.12	.75	9.12	11.62	.25	13.00	5/8-11	.94	11.00	12.50	33.44 31.31	6.12	15.00	—	11.25	6.25 4.12	5.88 3.75	2.375 1.875	5.62 3.50	.625 .500	4.25 2.00	880 874
365TC 365TSC	17.00	9.00	7.00	.69	18.50	19.50	2.94	5.88	3.00	18.00	13.81	4.12	.75	9.12	11.62	.25	13.00	5/8-11	.94	11.00	12.50	33.44 31.31	6.12	15.00	12.25	—	6.25 4.12	5.88 3.75	2.375 1.875	5.62 3.50	.625 .500	4.25 2.00	905 899

NOTE: (1) Frame sizes with the "L" designation are not suitable for conversion to F-2 mounting.
(2) Auxiliary terminal box supplied only when specified.
(3) All frames have eight (8) mounting holes for dual mounting.
Dimensions are in Inches. Drawings shown are for reference only.
Please contact Baldor for a detailed dimensional drawing of the specific motor you require.
Drawings may also be available from our website at www.Baldor.com.

Dimensions

Super-E Liberator Large AC - Cast Iron Construction Motors
Totally Enclosed Fan Cooled - G30 Sizes

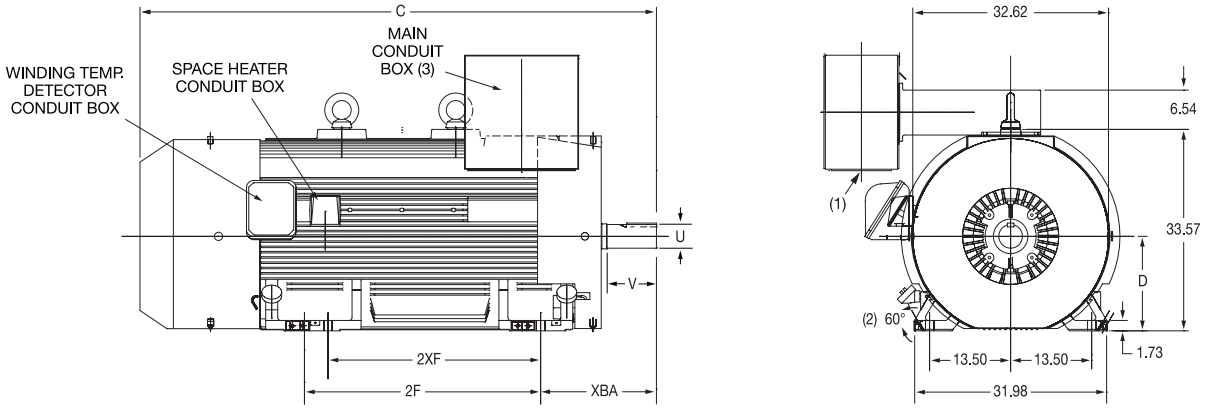


NOTES:
(1) – WALL OR OBSTRUCTION MUST NOT ENCROACH ON AIR INLET SPACE.
(2) – 4.0" N.P.T. FOR MOTOR POWER LEADS, 3 TOTAL.
(3) – AIR OUTLET OBSTRUCTION MUST NOT ENCROACH UPON AIR OUTLET SPACE.
(4) – CONDUIT BOX LOCATED ON OPPOSITE SIDE WHEN F-2 MOUNTING IS SPECIFIED.
ADDITIONAL DIMENSION INFORMATION AVAILABLE ON M/N SPECIFIC DIMENSION SHEETS.

Frame	RPM (Max)	Bearing Type	C	2F	X2F	U (+.000 /-.001)	V	XBA	D
G5008S	3600	Ball	60.14	25	22	2.375	6.00	15.5	12.5
G5008S	1800	Ball	60.14	25	22	4.125	6.00	15.5	12.5
G5008L	1800	Ball convertible to Roller	64.14	25	22	4.125	10.00	19.5	12.5
G5008L	1200	Roller convertible to Ball	64.14	25	22	4.500	10.00	19.5	12.5
G5010S	3600	Ball	67.14	32	28	2.375	6.00	15.5	12.5
G5010S	1800	Ball	67.14	32	28	4.125	6.00	15.5	12.5
G5010L	1800	Ball convertible to Roller	71.14	32	28	4.125	10.00	19.5	12.5
G5010L	1200	Roller convertible to Ball	71.14	32	28	4.500	10.00	19.5	12.5
G5012S	1800	Ball	75.14	40	36	4.125	6.00	15.5	12.5
G5012L	1800	Ball convertible to Roller	79.14	40	36	4.125	10.00	19.5	12.5
G5012L	1200	Roller convertible to Ball	79.14	40	36	4.500	10.00	19.5	12.5

NOTE: Dimensions are in inches.

Super-E Liberator Large AC - Cast Iron Construction Motors
Totally Enclosed Fan Cooled - G40 Sizes



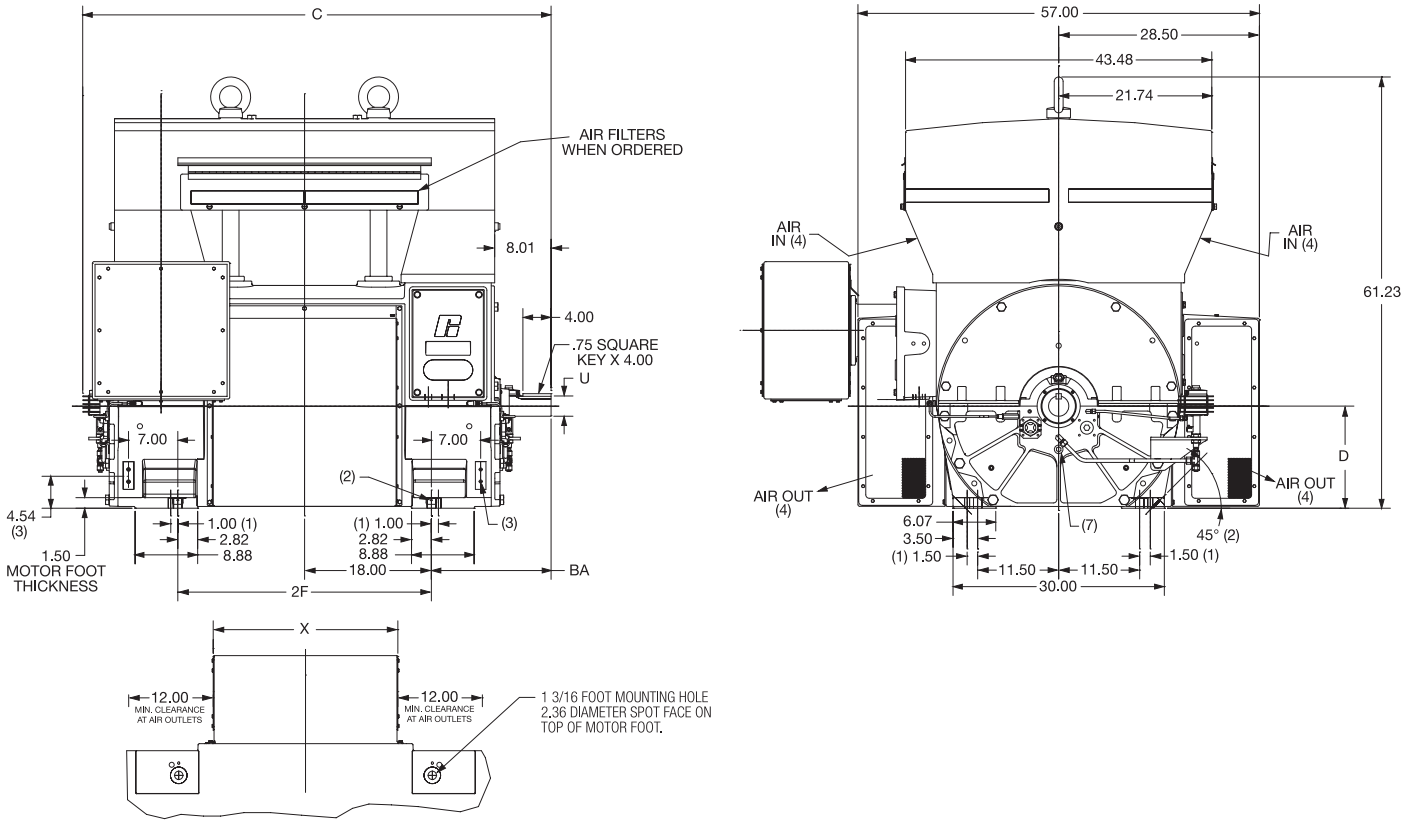
NOTES:
(1) – CONDUIT BOX LOCATED ON OPPOSITE SIDE WHEN F-2 MOUNTING IS SPECIFIED.
ADDITIONAL DIMENSION INFORMATION AVAILABLE ON M/N SPECIFIC DIMENSION SHEETS.

Frame	RPM (Max)	C	2F	X2F	U (+.000 /-.009)	V	XBA	D
5800	3600	83.31	39.37	35.43	2.3634	5.51	16.53	15.75
5800	1800	86.07	39.37	35.43	3.9384	8.27	19.29	15.75

NOTE: Dimensions are in inches.

Dimensions

Super-E® Liberator WPII - Weather Protected Type II Motors
Foot Mounted - 5800 Frame Sizes



NOTES:

1) 3/4-10 TAPPED VERTICAL JACKSCREW HOLE- ONE PER FOOT.
2) 7mm DOWEL PIN PILOT HOLE – ONE PER FOOT.
3) TWO S.S. GROUND PADS, EACH WITH TWO 1/2-13 TAPPED HOLES.
4) 12 INCH MINIMUM CLEARANCE REQUIRED TO ANY WALL OR OBSTRUCTION FOR AIR INLET SPACE.
5) DRAWING IS SCALED AND SHOWN WITH TERMINAL BOX IN THE NEMA F-1 LOCATION. MAIN TERMINAL BOX IS MIRRORED ON OPPOSITE SIDE OF MOTOR FOR F-2 LOCATION.
   DEPENDENT UPON CUSTOMER SPECIFICATIONS, OTHER MAIN TERMINAL BOXES SIZES OR ARRANGEMENTS MAY BE OFFERED AND PROVIDED.
   REFER TO TERMINAL BOX DIMENSION DRAWING 616171-26 FOR OTHER MAIN TERMINAL BOX SIZES AND DIMENSIONS.
   TABLE A ON THIS DRAWING IS AVAILABLE TO RECORD MAIN TERMINAL BOX DIMENSIONS.
6) OIL IN – BOTH ENDS
7) OIL DRAIN – BOTH ENDS
8) DRAWING IS SCALED AND SHOWN WITH OVERALL DIMENSION FOR STANDARD DESIGN.

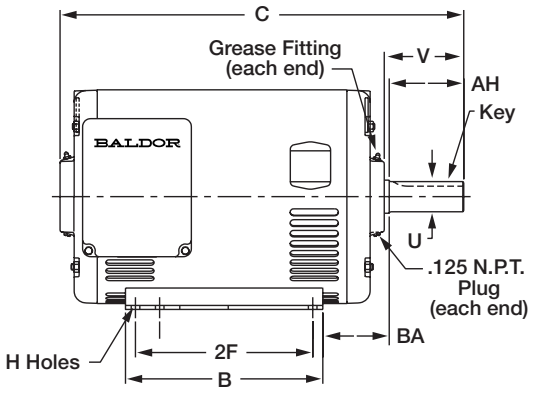
ALL DIMENSIONS ARE IN INCHES,

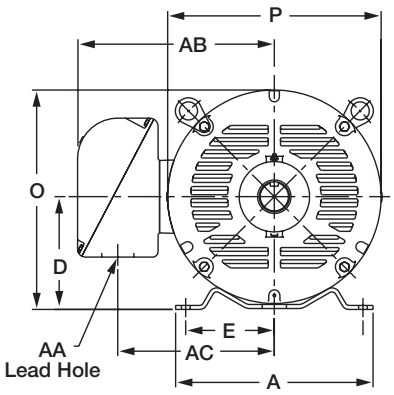
Frame	RPM (Max)	C	2F	U	D	BA	X
5808	1800	55.99	28.00	4.50	14.50	17.00	18.22
5808	3600	58.50	28.00	2.875	14.50	17.00	18.22
5810	1800	63.99	36.00	4.500	14.50	17.00	26.22
5810	3600	66.50	36.00	2.875	14.50	17.00	26.22
5812	1800	72.99	45.00	4.500	14.50	17.00	35.22

NOTE: Refer to 2F(ALT) mounting dimension for guidance in replacing 5007, 5009, 5011, 315J and 315G frame motors.
Dimensions are in inches.

Dimensions

Three Phase Motors
Open Drip-Proof - NEMA 56 through 449T



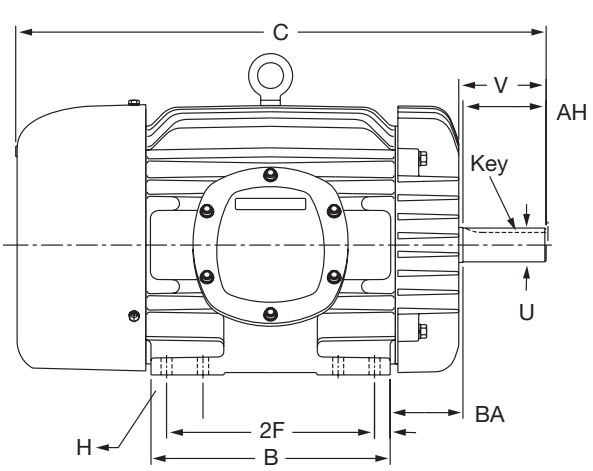


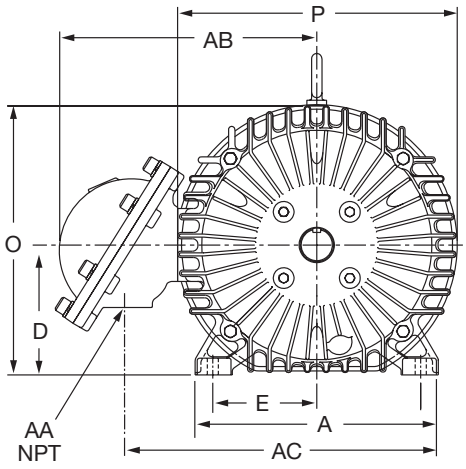
NEMA Frame	A	B	D	E	2F	H	Key	N	O	P	U	V	AA	AB	AC	BA
56	6.50	4.50	3.50	2.44	3.00	0.34	0.19	2.44	6.81	6.62	0.625	1.88	0.88	5.61	4.56	2.75
143T 145T	6.50	5.94	3.50	2.75	4.00 5.00	0.34	0.19	2.50	6.81	6.62	0.875	2.25	0.88	5.61	4.56	2.25
182T 184T	8.63	6.50	4.50	3.75	4.50 5.50	0.41	0.25	3.56	8.44	7.88	1.125	2.75	1.09	6.75	5.70	2.75
213T 215T	9.50	8.00	5.25	4.25	5.50 7.00	0.41	0.31	3.88	10.03	9.57	1.375	3.38	1.38	7.93	6.73	3.50
254T 256T	11.25	11.25	6.25	5.00	8.25 10.00	0.53	0.38	4.31	12.00	11.69	1.625	4.00	1.38	9.49	7.69	4.25
284T 286T	12.25	12.25	7.00	5.50	9.50 11.00	0.53	0.50	4.94	13.63	13.25	1.625	4.63	2.00	12.33	9.78	4.75
284TS 286TS	12.25	12.25	7.00	5.50	9.50 11.00	0.53	0.38	3.56	13.63	13.25	1.625	3.25	2.00	12.33	9.78	4.75
324T 326T	14.04	13.50	8.00	6.25	10.50 12.00	0.66	0.50	5.56	15.59	15.19	2.125	5.25	2.50	13.32	10.77	5.25
324TS 326TS	14.04	13.50	8.00	6.25	10.50 12.00	0.66	0.50	4.06	15.59	15.19	1.875	3.75	2.00	13.22	10.71	5.25
364T 365T	15.75	14.00	9.00	7.00	11.25 12.25	0.66	0.62	6.06	16.59	15.12	2.375	5.88	3.62	13.20	10.71	5.88
364TS 365TS	15.75	14.00	9.00	7.00	11.25 12.25	0.66	0.50	3.94	16.59	15.19	1.875	3.75	3.62	13.20	10.71	5.88
404T 405T	18.49	16.62	10.00	8.00	12.25 13.75	0.81	0.75	7.44	18.41	16.81	2.875	7.25	3.62	16.39	12.75	6.63
404TS 405TS	18.49	16.62	10.00	8.00	12.25 13.75	0.81	0.50	4.44	18.41	16.81	2.125	4.25	3.62	16.39	12.75	6.63
Cast Iron Construction																
364T 365T	17.56	15.13	9.00	7.00	11.25 12.25	0.65	0.63	6.06	18.80	18.35	2.375	5.88	3.63	15.02	12.46	5.88
404T 405T	19.50	16.63	10.00	8.00	12.25 13.75	0.81	0.75	7.50	20.14	20.28	2.875	7.25	3.63	18.40	14.68	6.62
404TS 405TS	19.50	16.63	10.00	8.00	12.25 13.75	0.81	0.50	4.50	20.14	20.28	2.125	4.25	3.63	18.40	14.68	6.62
444T 445T	21.50	19.50	11.00	9.00	14.50 16.50	0.81	0.88	8.87	22.18	22.55	3.375	8.50	3.62	19.06	14.62	7.50
444TS 445TS	21.50	19.50	11.00	9.00	14.50 16.50	0.81	0.63	5.13	22.18	22.55	2.375	4.75	3.62	19.06	14.62	7.50
447T 449T	21.50	28.00	11.00	9.00	15.00 25.00	0.81	0.875	8.87	22.43	22.84	3.375	8.50	4.00	20.67	15.76	7.50

NOTE: Drawings shown are for reference only. Contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or at www.baldor.com.

Dimensions

Three Phase Motors - Explosion Proof
Totally Enclosed Fan-Cooled - NEMA 143T through 365T



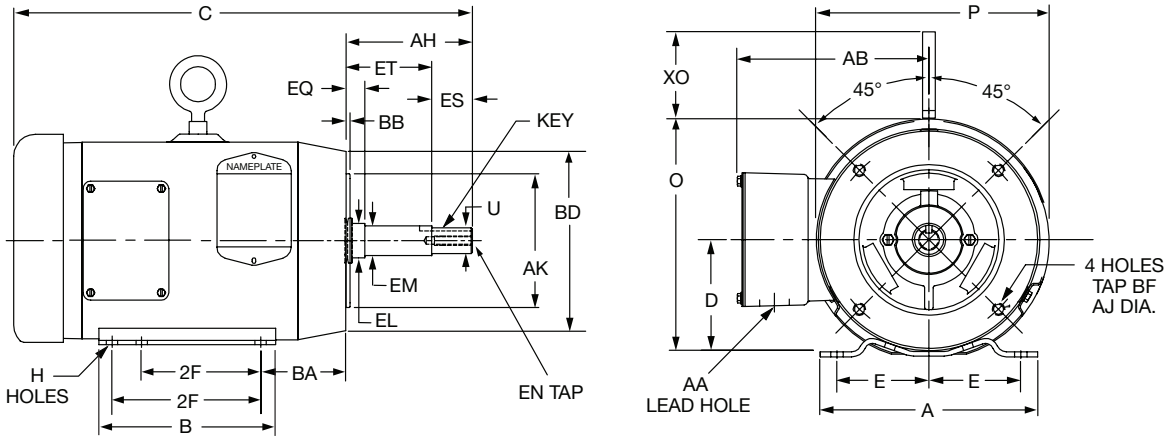


NEMA Frame	A	B	D	E	2F	H	Key	N	O	P	U	V	AA	AB	AC	BA
Steel Band Construction																
143T 145T	6.50	5.94	3.50	2.75	4.00 5.00	0.34	0.19	2.46	7.09	6.69	0.875	2.25	0.75	6.92	5.38	2.25
Cast Iron Construction																
143T 145T	6.50	8.47	3.50	2.75	4.00 5.00	0.37	0.19	2.38	7.84	8.56	0.875	2.25	0.75	8.07	6.59	2.25
182T 184T	8.63	8.00	4.50	3.75	4.50 5.50	0.41	0.25	3.26	9.56	10.09	1.125	2.75	0.75	8.56	6.53	2.75
213T 215T	9.75	8.00	5.25	4.25	5.50 7.00	0.41	0.31	3.47	10.75	11.00	1.375	3.38	0.75	9.66	7.62	3.50
254T 256T	11.50	11.50	6.25	5.00	8.25 10.00	0.53	0.38	4.20	12.94	13.38	1.625	4.00	1.25	11.21[1] 12.62[2]	8.57[1] 9.49[2]	4.25
284T 286T	12.76	12.75	7.00	5.50	9.50 11.00	0.53	0.50	4.88	14.74	15.54	1.875	4.63	1.25	14.33[1] 16.52[2]	10.69[1] 11.57[2]	4.75
324T 326T	14.50	14.00	8.00	6.25	10.50 12.00	0.66	0.50	5.44	16.68	17.40	2.125	5.25	1.50	15,21[1] 17.55[2]	11.60[1] 12.48[2]	5.25
364T 365T	16.50	14.50	9.00	7.00	11.25 12.25	0.66	0.62	6.13	18.44	19.13	2.375	5.88	3.00	19.85[2]	14.13[2]	5.88

NOTE: [1] Class I, Group C & D, Class II Group F & G
[2] Class I Group D, Class II Group F & G
Drawings shown are for reference only. Contact Baldor for a detailed dimensional drawing of the specific motor you require.
Drawings may also be available from our CD-ROM or at www.baldor.com.

Dimensions

Totally Enclosed Fan Cooled - Close-Coupled Pump
NEMA 143JM through 215JM



NEMA Frame	A	B	D	E	2F	H	KEY	O	P	U	AA	AB	AH	AJ	BF TAP	AK	BA	BB	BD	XO
Steel Band Construction																				
143JM	6.50	5.94	3.50	2.75	4.00	0.34	0.19	6.81	6.63	0.875	0.50	5.73	4.25	5.88	3/8-16	4.50	2.88	0.12	6.50	—
145JM	6.50	5.94	3.50	2.75	5.00	0.34	0.19	6.81	6.63	0.875	0.50	5.73	4.25	5.88	3/8-16	4.50	2.88	0.12	6.50	—
182JM	8.63	6.50	4.50	3.75	4.50	0.41	0.19	8.44	7.88	0.875	0.75	6.86	4.25	5.88	3/18-16	4.50	3.50	0.12	6.50	2.40
184JM	8.63	6.50	4.50	3.75	5.50	0.41	0.19	8.44	7.88	0.875	0.75	6.86	4.25	5.88	3/18-16	4.50	3.50	0.12	6.50	2.40
213JM	9.50	8.00	5.25	4.25	5.50	0.41	0.19	10.03	9.56	0.875	1.38	8.04	4.25	7.25	1/2-13	8.50	4.50	0.25	9.06	2.40
215JM	9.50	8.00	5.25	4.25	7.00	0.41	0.19	10.03	9.56	0.875	1.38	8.04	4.25	7.25	1/2-13	8.50	4.50	0.25	9.06	2.40
Cast Iron																				
254JM	11.50	11.50	6.25	5.00	8.25	0.53	0.25	12.88	12.94	1.250	1.38	10.04	5.25	7.25	1/2-13	8.50	4.75	0.25	9.09	2.72
256JM	11.50	11.50	6.25	5.00	10.00	0.53	0.25	12.88	12.94	1.250	1.38	10.04	5.25	7.25	1/2-13	8.50	4.75	0.25	9.09	2.72
284JM	12.75	12.84	7.00	5.50	9.50	0.53	0.25	14.44	15.29	1.250	2.00	13.11	5.25	11.00	5/8-11	12.50	4.75	0.25	13.05	2.72
286JM	12.75	12.84	7.00	5.50	11.00	0.53	0.25	14.44	15.29	1.250	2.00	13.11	5.25	11.00	5/8-11	12.50	4.75	0.25	13.05	2.72
324JM	14.50	14.00	8.00	6.25	10.50	0.66	0.25	16.25	17.85	1.250	2.50	14.61	5.25	11.00	5/8-11	12.50	5.25	0.25	13.40	3.22
326JM	14.50	14.00	8.00	6.25	12.00	0.66	0.25	16.25	17.85	1.250	2.50	14.61	5.25	11.00	5/8-11	12.50	5.25	0.25	13.40	3.22

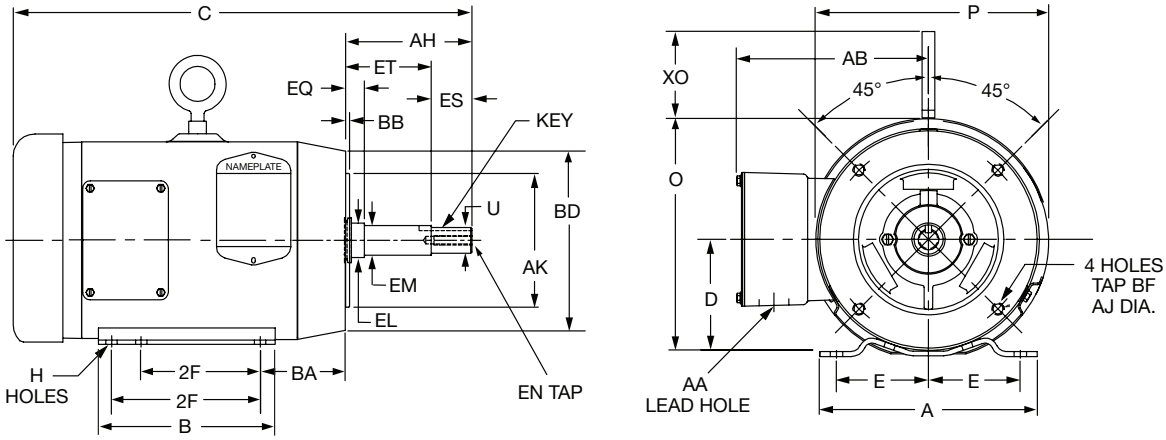
Washdown Closed-Coupled Pump Shaft Motors

NEMA Frame	EL	EM	EN	EQ	ES	ET
Steel Band Construction						
143JM	1.15	1.0	0.38-16 x 0.88	0.625	1.38	2.875
145JM	1.15	1.0	0.38-16 x 0.88	0.625	1.38	2.875
182JM	1.25	1.0	0.38-16 x 0.88	0.625	1.38	2.875
184JM	1.25	1.0	0.38-16 x 0.88	0.625	1.38	2.875
213JM	1.25	1.0	0.38-16 x 0.88	0.625	1.38	2.875
215JM	1.25	1.0	0.38-16 x 0.88	0.625	1.38	2.875
Cast Iron						
254JM	1.75	1.38	0.50-13x1.12	0.625	2.25	3.000
256JM	1.75	1.38	0.50-13x1.12	0.625	2.25	3.000
284JM	1.75	1.38	0.50-13x1.12	0.625	2.25	3.000
286JM	1.75	1.38	0.50-13x1.12	0.625	2.25	3.000
324JM	1.75	1.38	0.50-13x1.25	0.625	2.25	3.000
326JM	1.75	1.38	0.50-13x1.25	0.625	2.25	3.000

NOTE: Dimension for reference only. Contact a Baldor District Office or www.baldor.com for the detailed dimension drawing for your specific catalog number.

Dimensions

Totally Enclosed Fan Cooled - Close-Coupled Pump
NEMA 215JP through 326JP



NEMA Frame	A	B	D	E	2F	H	KEY	O	P	U	AA	AB	AH	AJ	BF TAP	AK	BA	BB	BD	XO
Steel Band Construction																				
215JP	9.50	8.00	5.25	4.25	7.00	0.41	0.19	10.03	9.56	0.875	1.38	8.04	8.125	7.25	1/2-13	8.50	4.50	0.25	9.06	2.40
Cast Iron																				
254JP	11.50	11.50	6.25	5.00	8.25	0.53	0.25	12.88	12.94	1.250	1.38	10.04	8.125	7.25	1/2-13	8.50	4.75	0.25	9.09	2.72
256JP	11.50	11.50	6.25	5.00	10.00	0.53	0.25	12.88	12.94	1.250	1.38	10.04	8.125	7.25	1/2-13	8.50	4.75	0.25	9.09	2.72
284JP	12.75	12.84	7.00	5.50	9.50	0.53	0.25	14.44	15.29	1.250	2.00	13.11	8.125	11.00	5/8-11	12.50	4.75	0.25	13.05	2.72
286JP	12.75	12.84	7.00	5.50	11.00	0.53	0.25	14.44	15.29	1.250	2.00	13.11	8.125	11.00	5/8-11	12.50	4.75	0.25	13.05	2.72
324JP	14.50	14.00	8.00	6.25	10.50	0.66	0.25	16.25	17.85	1.250	2.50	14.61	8.125	11.00	5/8-11	12.50	5.25	0.25	13.40	3.22
326JP	14.50	14.00	8.00	6.25	12.00	0.66	0.25	16.25	17.85	1.250	2.50	14.61	8.125	11.00	5/8-11	12.50	5.25	0.25	13.40	3.22

Washdown Closed-Coupled Pump Shaft Motors

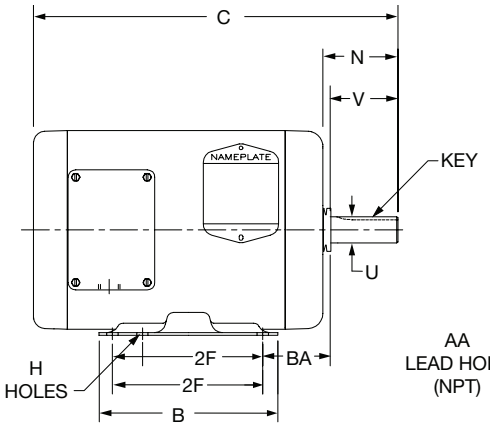
NEMA Frame	EL	EM	EN	EQ	ES	ET
Steel Band Construction						
215JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
Cast Iron						
254JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
256JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
284JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
286JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
324JP	1.75	1.38	0.50-13x1.25	2.375	2.25	5.875
326JP	1.75	1.38	0.50-13x1.25	2.375	2.25	5.875

NOTE: Dimension for reference only. Contact a Baldor District Office or www.baldor.com for the detailed dimension drawing for your specific catalog number.

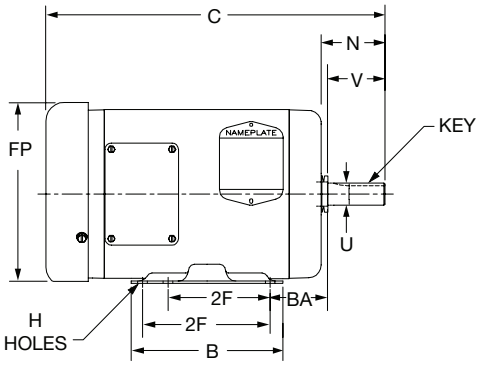
Dimensions

Washdown NEMA 56 through 256TC

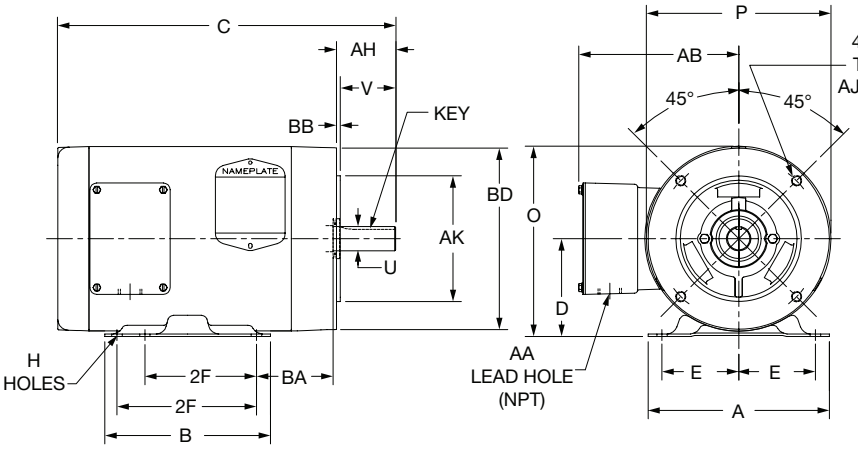
TENV Enclosure



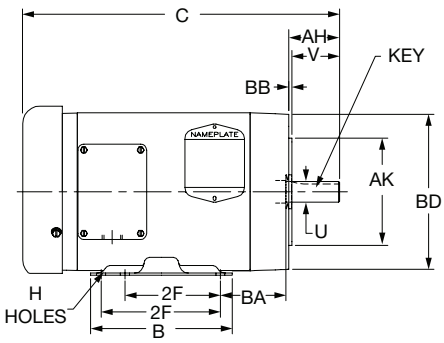
TEFC Enclosure



TENV Enclosure



TEFC Enclosure



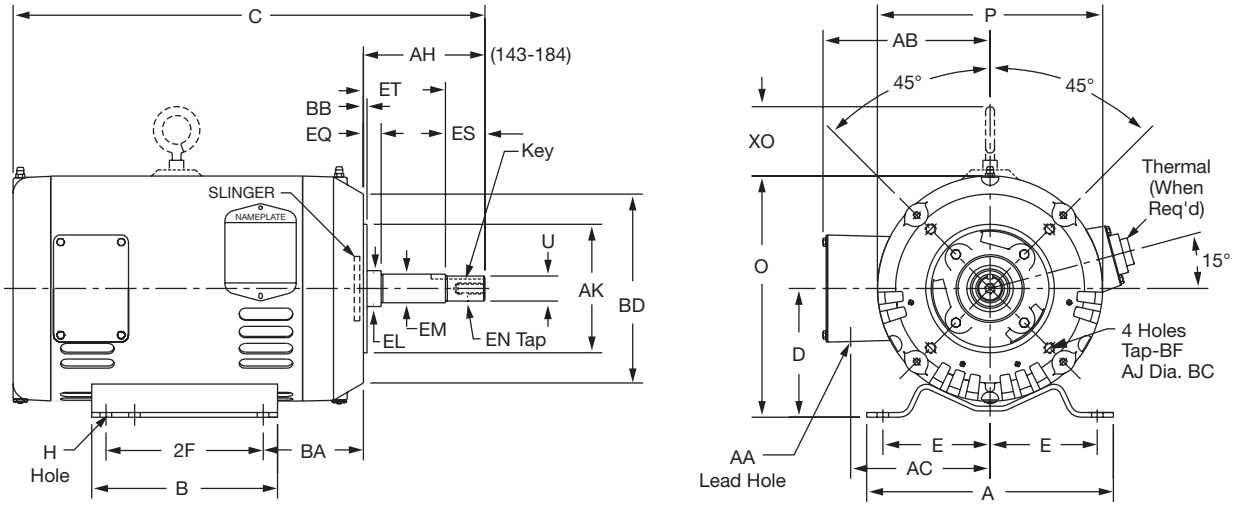
Catalog No. starting with "C" = C-face with base.
Catalog No. starting with "V" = C-face, no base.

NEMA Frame	A	B	D	E	2F	H	N	O	P	U	V	AA	AB	AH	AJ	BF TAP	AK	BA	BB	BD
56 56C	6.50	4.50	3.50	2.44	3.00	0.34	2.44 —	6.81	6.62	0.625	1.88	0.50	5.22	— 2.06	— 5.88	3/8-16	— 4.50	2.75	— 0.12	— 6.50
143T 143TC	6.50	5.94	3.50	2.75	4.00	0.34	2.50 —	6.81	6.62	0.875	2.25	0.50	5.22	— 2.12	— 5.88	3/8-16	— 4.50	2.25 2.75	— 0.12	— 6.50
145T 145TC	6.50	5.94	3.50	2.75	5.00	0.34	2.50 —	6.81	6.62	0.875	2.25	0.50	5.22	— 2.12	— 5.88	3/8-16	— 4.50	2.25 2.75	— 0.12	— 6.50
182T 182TC	8.63	6.50	4.50	3.75	4.50	0.41	3.56 —	8.44	7.88	1.125	2.75	0.75	5.97	— 2.62	— 7.25	1/2-13	— 8.50	2.75 3.50	— 0.25	— 8.89
184T 184TC	8.63	6.50	4.50	3.75	5.50	0.41	3.56 —	8.44	7.88	1.125	2.75	0.75	5.97	— 2.62	— 7.25	1/2-13	— 8.50	2.75 3.50	— 0.25	— 8.89
213T 213TC	9.50	8.00	5.25	4.25	5.50	0.41	3.88 —	10.03	9.56	1.375	3.37	0.75	8.06	— 3.12	— 7.25	1/2-13	— 8.50	3.50 4.50	— 0.25	— 9.04
215T 215TC	9.50	8.00	5.25	4.25	7.00	0.41	3.88 —	10.03	9.56	1.375	3.37	0.75	8.06	— 3.12	— 7.25	1/2-13	— 8.50	3.50 4.50	— 0.25	— 9.04
254TC 256TC	11.25	11.25	6.25	5.00	8.25 10.00	0.53	—	12.00	12.43	1.625	4.00	1.25	9.73	3.75	7.25	1/2-13	8.50	4.75	0.25	9.44

NOTE: Dimension for reference only. Contact a Baldor District Office or www.baldor.com for the detailed dimension drawing for your specific catalog number.

Dimensions

Three Phase - Close-Coupled Pump Motors
Open Drip-Proof - NEMA 143JM through 326JM



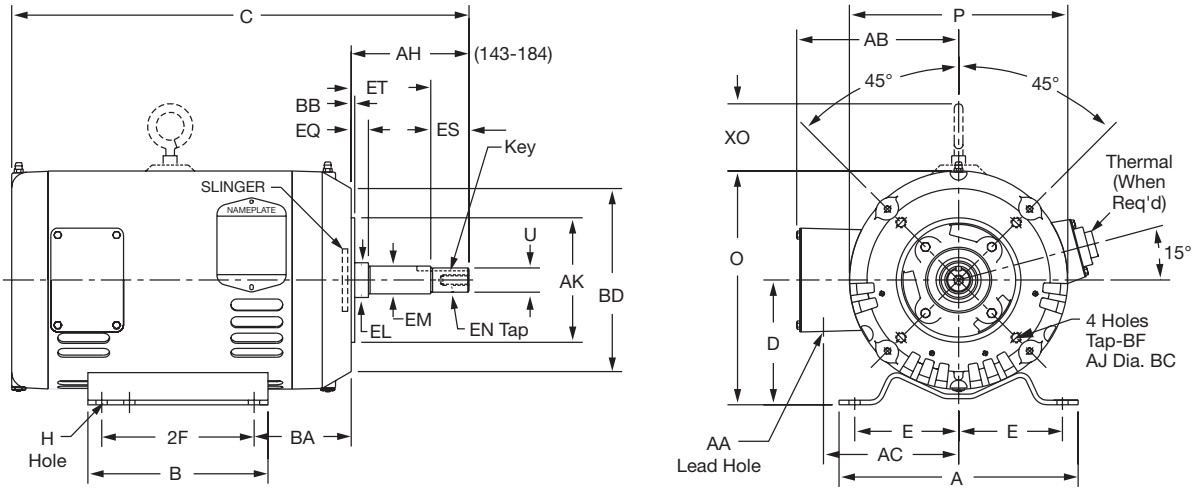
NEMA Frame	A	B	D	E	2F	H	Key	O	P	U	AA	AB	AC	AH	AJ	AK	BB	BD	BF	Tap BA
143JM 145JM	6.50	5.94	3.50	2.75	4.00 5.00	0.34	0.19	6.77	6.62	0.875	0.88	5.61	4.56	4.28	5.88	4.50	0.13	6.51	0.38-16	2.88
182JM 184JM	8.63	6.50	4.50	3.75	4.50 5.50	0.41	0.19	8.44	7.88	0.875	1.09	6.74	5.70	4.25	5.88	4.50	0.13	6.61	0.38-16	3.50
213JM 215JM	9.50	8.00	5.25	4.25	5.50 7.00	0.41	0.188	10.03	9.57	0.875	1.38	7.92	6.72	4.25	7.25	8.50	0.25	9.07	0.50-13	4.25
254JM 256JM	11.25	11.25	6.25	5.00	8.25 10.00	0.53	0.25	12.00	11.50	1.25	1.38	9.49	7.69	5.25	7.25	8.50	0.25	9.45	0.50-13	4.75
284JM 286JM	12.25	12.25	7.00	5.50	9.50 11.00	0.53	0.25	13.63	13.25	1.25	2.00	12.21	9.72	5.25	11.00	12.50	0.25	13.03	0.62-11	4.75
324JM 326JM	14.04	13.50	8.00	6.25	10.50 12.00	0.66	0.25	15.59	15.16	1.375	2.50	13.20	10.71	5.25	11.00	12.50	0.25	13.31	0.62-11	5.25

NOTE: Drawings shown are for reference only. Contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or at www.baldor.com.

NEMA Frame	EL	EM	EN	EQ	ES	ET
143JM 145JM	1.56	1.00	0.38-16x0.88	0.64	1.39	2.89
182JM 184JM	1.25	1.00	0.38-16x0.88	0.64	1.39	2.89
213JM 215JM	1.25	1.00	0.38-16x0.88	0.64	1.36	2.89
254JM 256JM	1.75	1.375	0.50-13x1.25	0.625	2.25	3.00
284JM 286JM	1.75	1.375	0.50-13x1.25	0.625	2.25	3.00
324JM 326JM	1.75	1.375	0.50-13x1.25	0.625	2.25	3.00

Dimensions

Three Phase - Close-Coupled Pump Motors
Open Drip-Proof - NEMA 213JP through 326JP



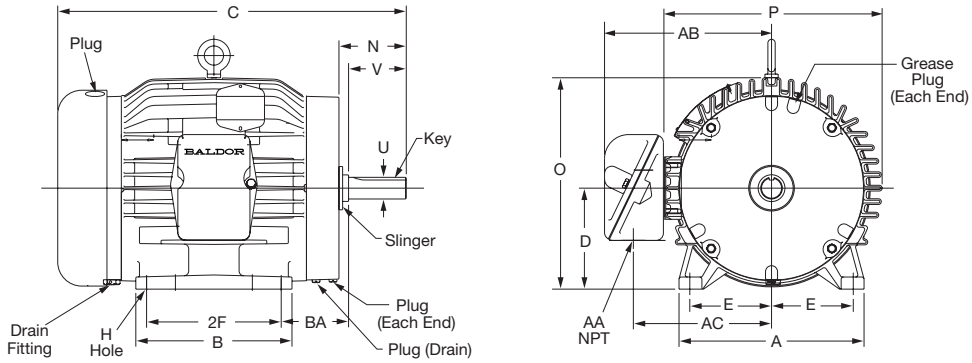
NEMA Frame	A	B	D	E	2F	H	Key	O	P	U	AA	AB	AC	AH	AJ	AK	BB	BD	BF	Tap BA
213JP	9.50	8.00	5.25	4.25	5.50	0.41	0.188	10.03	15.59	0.875	1.38	7.92	6.72	8.125	7.25	8.50	0.25	9.07	0.50-13	4.25
215JP	9.50	8.00	5.25	4.25	7.00	0.41	0.188	10.03	15.59	0.875	1.38	7.92	6.72	8.125	7.25	8.50	0.25	9.07	0.50-13	4.25
254JP	11.25	11.25	6.25	5.00	8.25	0.53	0.25	12.00	15.59	1.25	1.38	9.49	7.69	8.125	7.25	8.50	0.25	9.45	0.50-13	4.75
256JP	11.25	11.25	6.25	5.00	10.00	0.53	0.25	12.00	15.59	1.25	1.38	9.49	7.69	8.125	7.25	8.50	0.25	9.45	0.50-13	4.75
284JP	12.25	12.25	7.00	5.50	9.50	0.53	0.25	13.63	13.25	1.25	2.00	12.21	9.72	8.125	11.00	12.50	0.25	13.03	0.62-11	4.75
286JP	12.25	12.25	7.00	5.50	11.00	0.53	0.25	13.63	13.25	1.25	2.00	12.21	9.72	8.125	11.00	12.50	0.25	13.03	0.62-11	4.75
324JP	14.04	13.50	8.00	6.25	10.50	0.66	0.25	15.59	15.16	1.375	2.50	13.20	10.71	8.125	11.00	12.50	0.25	13.31	0.62-11	5.25
326JP	14.04	13.50	8.00	6.25	12.00	0.66	0.25	15.59	15.16	1.375	2.50	13.20	10.71	8.125	11.00	12.50	0.25	13.31	0.62-11	5.25

NOTE: Drawings shown are for reference only. Contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or at www.baldor.com.

NEMA Frame	EL	EM	EN	EQ	ES	ET
213JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
215JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
254JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
256JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
284JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
286JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
324JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875
326JP	1.75	1.38	0.50-13x1.12	2.375	2.25	5.875

Dimensions

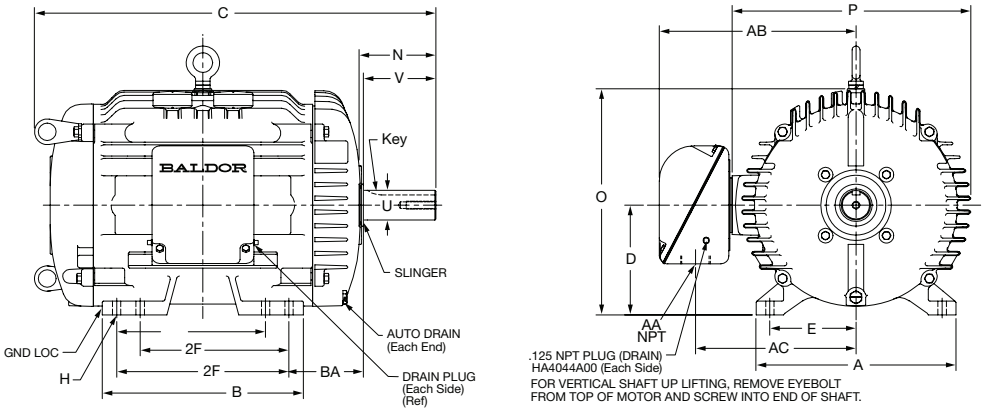
Three Phase Motors - Cast Iron Construction - Automotive Approved
Totally Enclosed Fan-Cooled - NEMA 182 through 445U



NEMA Frame	A	B	D	E	2F	H	Key	N	O	P	U	V	AA	AB	AC	BA
182 184	8.62	6.50	4.50	3.75	4.50 5.50	0.41	0.188	2.37	9.23	10.12	0.875	2.25	0.75	7.12	5.75	2.75
213 215	9.62	8.12	5.25	4.25	5.50 7.00	0.41	0.25	3.50	10.99	11.25	1.125	3.00	1.00	9.20	7.38	3.50
254U 256U	11.50	11.50	6.25	5.00	8.25 10.00	0.53	0.312	4.07	12.88	12.94	1.375	3.75	1.25	10.11	8.27	4.25
284U 286U	12.75	12.84	7.00	5.50	9.50 11.00	0.53	0.38	5.19	14.66	15.57	1.625	4.88	1.50	12.58	10.25	4.75
324U 326U	14.50	14.00	8.00	6.25	10.50 12.00	0.66	0.50	6.00	16.25	17.85	1.875	5.63	2.00	14.05	11.72	5.25
384U 386U	16.50	14.50	9.00	7.00	11.25 12.25	0.66	0.50	6.67	18.38	19.25	2.125	6.38	2.00	14.41	12.06	5.88
404U 405U	18.88	16.63	10.00	8.00	12.25 13.75	0.81	0.62	7.48	20.31	21.44	2.375	7.12	3.00	18.84	15.15	6.62
444U 445U	21.75	20.25	11.00	9.00	14.50 16.50	0.81	0.75	9.06	22.93	24.56	2.875	8.62	2.50	20.58	16.03	7.50

NOTE: Drawings shown are for reference only. Contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or at www.baldor.com.

Three Phase Motors - Cast Iron Construction - Chiller/Cooling Tower
Totally Enclosed Air Over - NEMA 182 through 445U

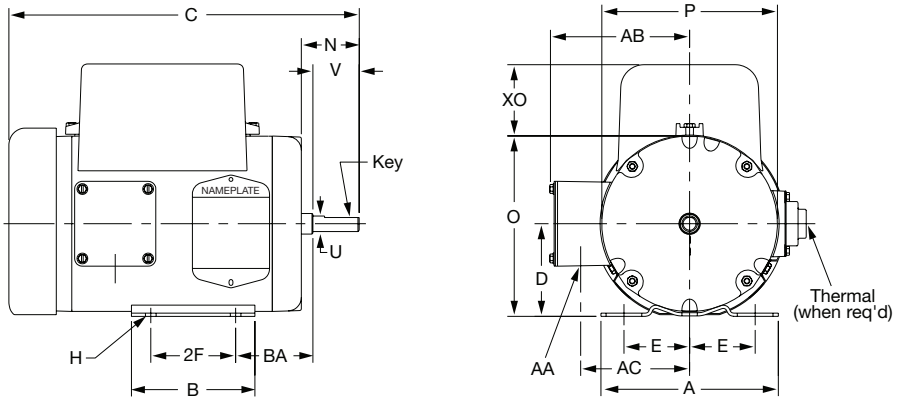


Frame Size	A	B	D	E	2F	H	Key	N	O	P	U	V	XP Terminal Box			
													AA	AB	AC	BA
182T 184T	8.62	6.5	4.5	3.75	4.5 5.5	0.41	0.25	2.81	9.23	9.46	1.125	2.75	0.75	7.12	5.75	2.75
213T 215T	9.62	8.12	5.25	4.25	5.5 7.0	0.41	0.31	3.88	10.99	11.5	1.375	3.38	1	9.22	7.43	3.5
254T 256T	11.5	11.5	6.25	5	8.25 10	0.53	0.38	4.32	12.88	12.94	1.625	4	1.25	10.1	8.32	4.25
284T 286T	12.76	12.84	7	5.5	9.5 11	0.53	0.5	4.91	14.44	15.24	1.875	4.63	1.5	12.56	10.25	4.75
324T 326T	14.5	14	8	6.25	10.5 12	0.66	0.5	5.63	16.25	17.65	2.125	5.25	2	14	11.75	5.25
364T 365T	16.5	14.5	9	7	11.25 12.25	0.66	0.625	6.12	18.38	18.86	2.375	5.88	2.5	14.4	12.09	5.88
404T 405T	18.88	16.63	10	8	12.25 13.75	0.81	0.75	7.62	20.31	21.17	2.875	7.25	3	18.01	14.53	6.62

NOTE: Drawings shown are for reference only. Contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or at www.baldor.com.

Dimensions

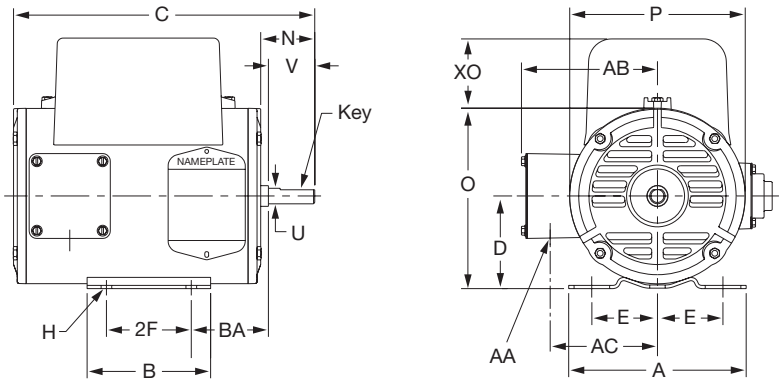
Single Phase Motors - Totally Enclosed Fan-Cooled, NEMA 48 through 184T



NEMA Frame	A	B	D	E	2F	H	Key	N	O	P	U	V	AA	AB	AC	BA	XO
48	5.75	4.00	3.00	2.13	2.75	0.34 Slot	Flat 0.047 Deep 1.12 Long	1.87	5.85	5.69	0.50	1.50	0.88	5.18	3.60	2.50	2.31 1.56
56 400 Typ	6.50	4.00	3.50	2.44	3.00	0.34 Slot	0.19	2.50	6.36	5.69	0.625	1.88	0.88	4.90	3.53	2.75	1.56 2.31
56 56H	6.50	4.50 6.50	3.50	2.44	3.00 5.00	0.34 Slot	0.19	2.47 2.12	6.81	6.62	0.625	1.88	0.88	5.73	4.62	2.75	2.24
143T 145T	6.50	5.94	3.50	2.75	4.00 5.00	0.34	0.19	2.50	6.81	6.62	0.875	2.25	0.88	5.73	4.62	2.25	2.25
182T 184T	8.63	6.50	4.50	3.75	4.50 5.50	0.41	0.25	3.56	8.44	7.88	1.125	2.75	1.09	6.87	5.76	2.75	2.69

NOTE: Drawings shown are for reference only. Contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or at www.baldor.com.

Single Phase Motors - Open Drip-Proof, NEMA 48 through 184T

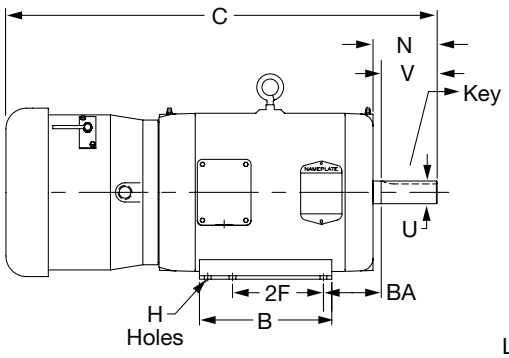


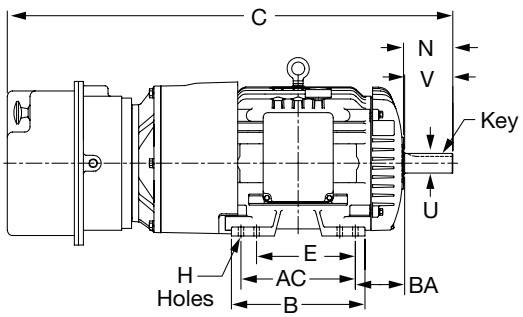
NEMA Frame	A	B	D	E	2F	H	Key	N	O	P	U	V	AA	AB	AC	BA	XO
48	5.75	4.00	3.00	2.12	2.75	0.34 Slot	Flat 0.047 Deep 1.12 Long	1.75	5.85	5.69	0.50	1.50	0.88	5.06	3.54	2.50	1.50 2.25
56 400 Typ	6.56	4.00	3.50	2.44	3.00	0.34 Slot	0.19	2.13	6.34	5.69	0.625	1.88	0.88	5.06	3.54	2.75	1.50 2.25
56 56H	6.50	4.50 6.50	3.50	2.44	3.00 5.00	0.34 Slot	0.19	2.44 2.13	6.81	6.62	0.625	1.88	0.88	5.62	4.56	2.75	2.18
143T 145T	6.50	5.94	3.50	2.75	4.00 5.00	0.34	0.19	2.50	6.81	6.62	0.875	2.25	0.88	5.73	4.62	2.25	2.18
182T 184T	8.63	6.50	4.50	3.75	4.50 5.50	0.41	0.25	3.56	8.44	7.88	1.125	2.75	1.09	6.75	5.76	2.75	2.24 2.63

NOTE: Drawings shown are for reference only. Contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or at www.baldor.com.

Dimensions

Brake Motors

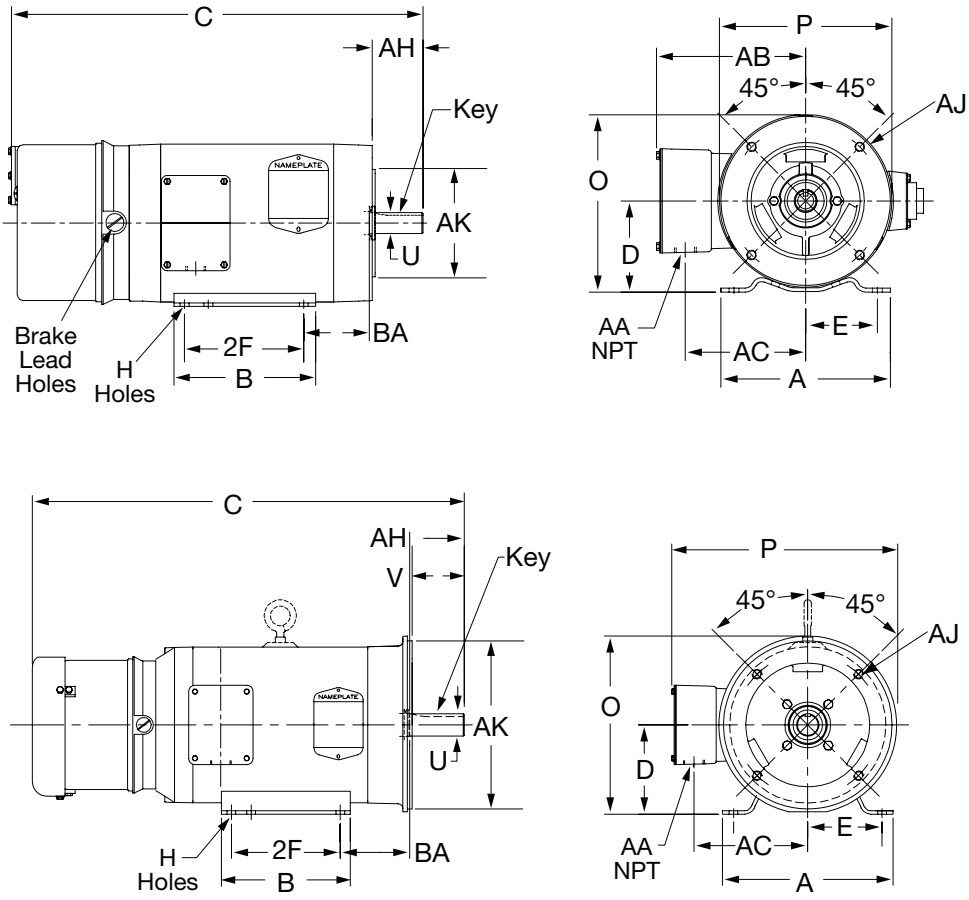




	NEMA Frame	A	B	D	E	2F	H	Key	N	O	P	U	V	AA	AB	AC	BA
Steel Band Construction																	
EBM TENV	56	6.50	4.50	3.50	2.44	3.00	0.34 Slot	0.19	2.44	6.81	6.63	0.625	1.88	0.88	5.75	4.62	2.75
EBM TEFC	143T 145T	6.50	5.94	3.50	2.75	4.00 5.00	0.34	0.19	2.50	6.81	6.62	0.875	2.25	0.88	5.22	4.18	2.75
EBM TEFC	182T 184T	8.63	6.50	4.50	3.75	4.50 5.50	0.41	0.25	3.56	8.44	7.89	1.125	2.75	1.09	5.97	4.94	2.75
EBM TEFC	213T 215T	9.50	8.00	5.25	4.25	5.50 7.00	0.41	0.31	3.88	10.03	9.56	1.375	3.38	1.09	8.05	6.79	3.50
Cast Iron																	
EBM TEFC	254T 256T	11.50	11.50	6.25	5.00	8.25 10.00	0.53	.038	4.32	12.88	12.94	1.625	4.00	1.38	9.49	7.99	4.25
EBM TEFC	284T 286T	12.75	12.84	7.00	5.50	9.50 11.00	0.53	0.5	4.75	14.44	15.72	1.875	4.63	2.00	13.11	10.56	4.75

Dimensions

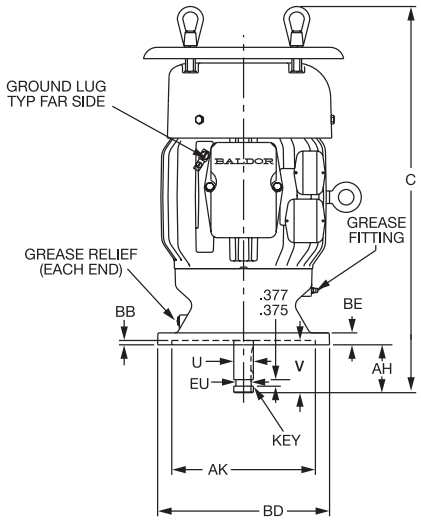
Washdown Brake Motors

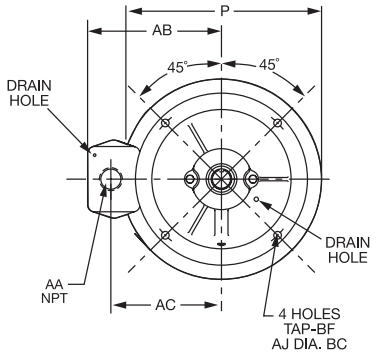


	NEMA Frame	A	B	D	E	2F	H	Key	O	P	U	V	AA	AB	AC	AH	AJ	AK	BB	Tap BF	BA
CEWDBM TENV	56C	6.50	4.50	3.50	2.44	3.00	0.34 Slot	0.19	6.75	6.63	0.625	1.88	0.50 NPT	5.74	4.62	2.06	5.88	4.50	0.12	0.38-16	2.75
CEWDBM TENV	143TC 145TC	6.50	5.94	3.50	2.75	4.00 5.00	0.34	0.19	6.81	6.62	0.875	2.13	0.50 NPT	5.73	4.62	2.13	5.88	4.50	0.12	0.38-16	2.75
CEWDBM TEFC	143TC 145TC	6.50	5.94	3.50	2.75	4.00 5.00	0.34	0.19	6.81	6.69	0.875	2.13	0.50 NPT	5.73	4.62	2.12	5.88	4.50	0.12	0.38-16	2.75
CEWDBM TEFC	182TC 184TC	8.63	6.50	4.50	3.75	4.50 5.50	0.41	0.25	8.99	7.89	1.125	2.75	0.75 NPT	5.88	5.75	2.62	7.25	8.50	0.25	0.50-13	3.50

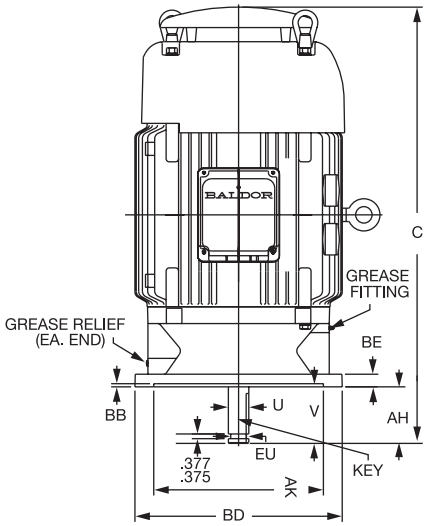
Dimensions

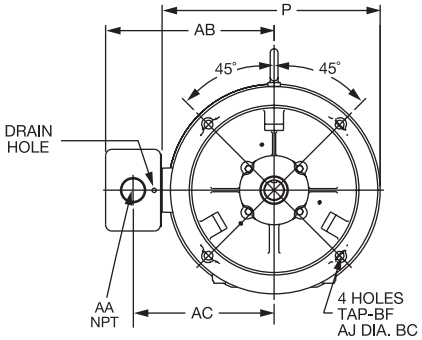
P-Base Vertical Solid Shaft Pump - Cast Iron Construction Motors
Totally Enclosed Fan Cooled - NEMA 182LP-365VP
LP Style (Medium Thrust)





VP Style (High Thrust)



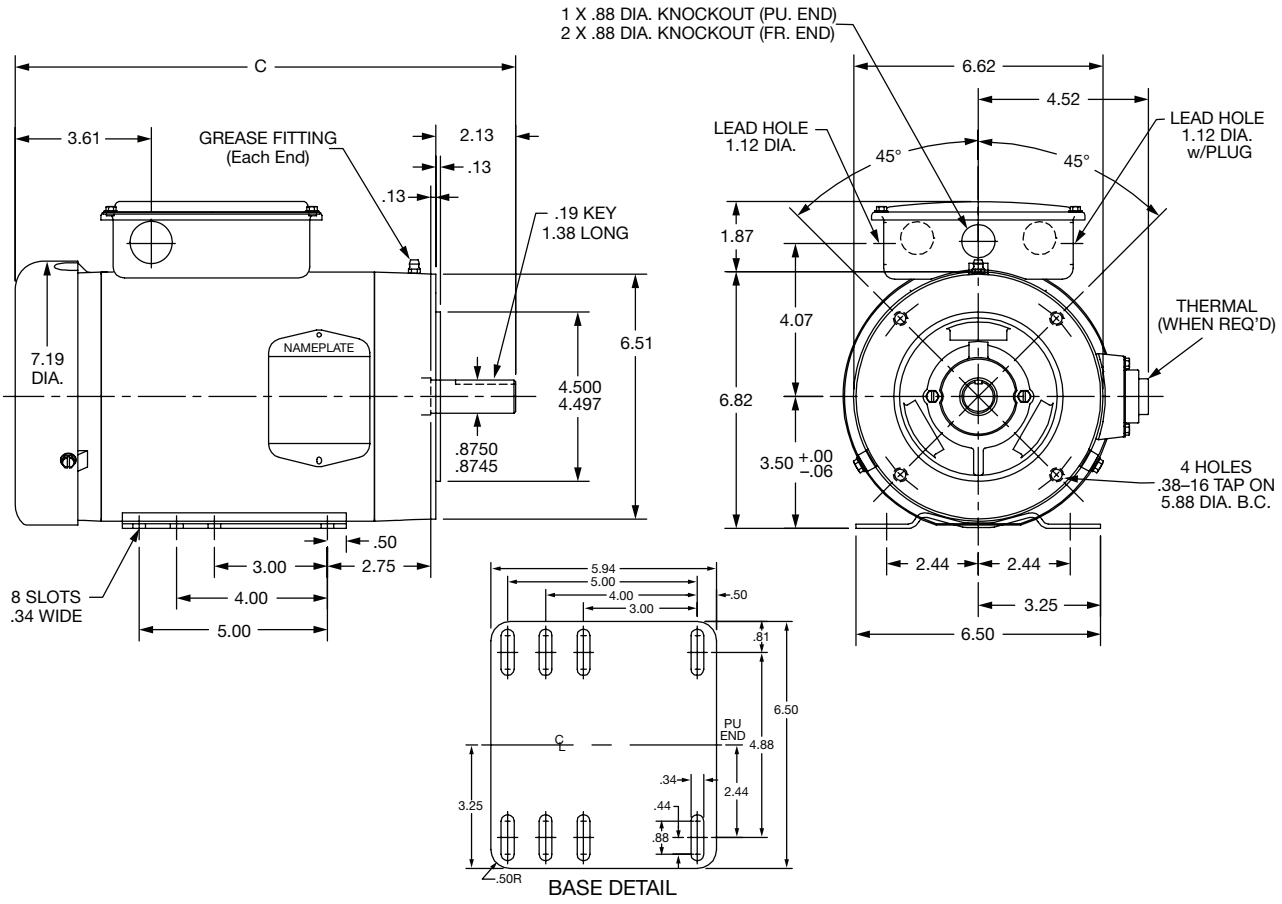


NEMA Frame	Key	P	R*	S*	U	V Min	AA	AB	AC	AH	AJ	AK	BB	BD	BE	Tap BF	EU
182LP 184LP	0.25	11.50	0.984	0.25	1.125	3.00	1.00 NPT	7.69	6.35	2.75	9.12	8.25	0.25	9.88	0.68	0.44	0.875
213LP 215LP	0.38	12.13	1.406	0.375	1.625	3.00	1.50 NPT	8.68	7.11	2.75	9.12	8.25	0.25	9.88	0.69	0.44	1.25
254LP 256LP	0.38	12.94	1.406	0.375	1.625	3.00	1.50 NPT	9.50	8.07	2.75	9.12	8.25	0.25	9.87	0.69	0.44	1.25
284LP 286LP	0.50	15.32	1.843	0.50	2.125	4.00	2.00 NPT	12.34	10.16	4.50	9.12	8.25	0.25	9.87	0.69	0.44	1.75
324LP 326LP	0.50	17.35	1.843	0.50	2.125	4.00	2.00 NPT	13.41	11.22	4.50	14.75	13.50	0.25	16.50	1.00	0.69	1.75
324VP 326VP	0.375	17.35	1.406	0.375	1.625	4.75	2.00 NPT	13.41	11.22	4.50	14.75	13.50	0.25	16.49	1.00	0.69	1.25
364VP 365VP	0.38	19.25	1.406	0.375	1.625	4.75	2.00 NPT	14.37	12.13	4.50	14.75	13.50	0.25	16.49	1.00	0.69	1.25

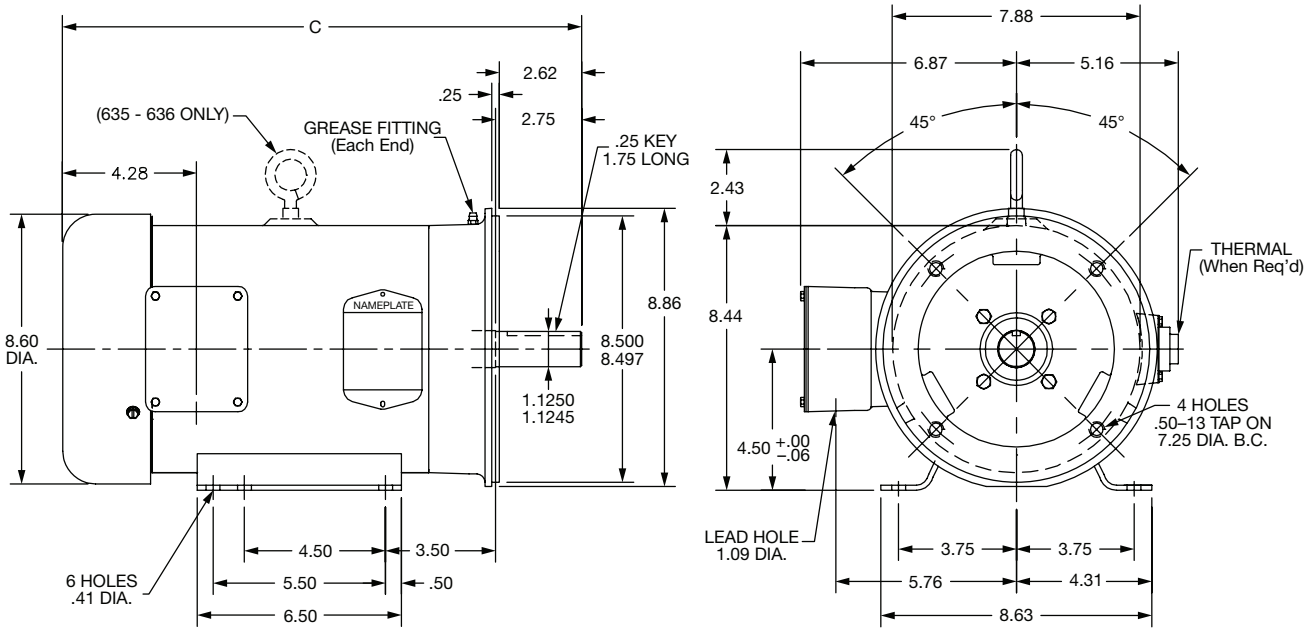
NOTES: * Please refer to Keyway Detail at the end of the AC section. Drawings shown are for reference only.
Please contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our website at www.baldor.com.

Dimensions

Super-E® Unit Handling Motors 140TYC

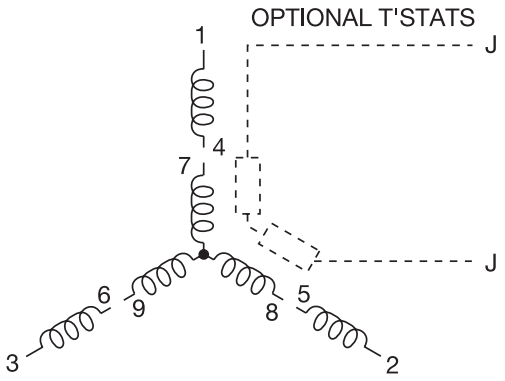


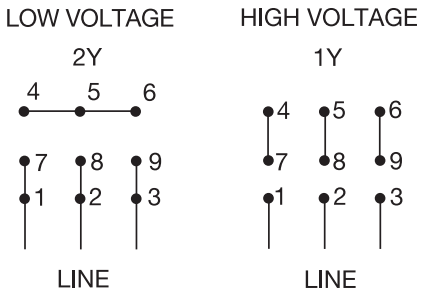
Super-E® Unit Handling Motors 180TC



Connection Diagrams

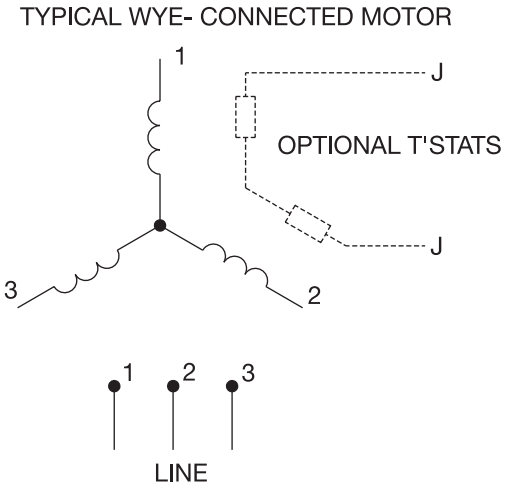
CD0005 and 416820-1

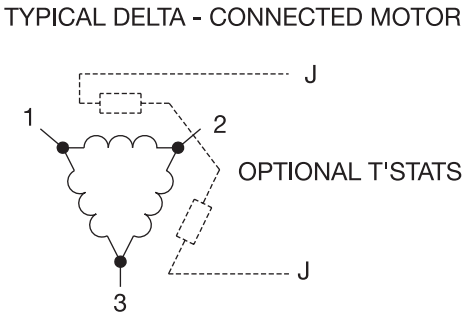




Notes:
1. Interchange any two line leads to reverse rotation.
2. Optional thermostats are provided when specified.
3. Actual number of internal parallel circuits may vary.
4. Lead colors are optional. Leads must be numbered as shown.

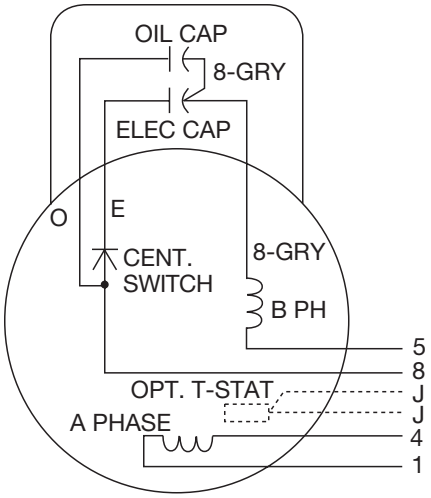
CD0006, 416820-24 and 416820-25





Notes:
1. Three lead motors may be designed as either wye-connected or delta-connected.
2. Interchange any two line leads to reverse rotation.
3. Optional thermostats are provided when specified.
4. Actual number of internal parallel circuits may vary.
5. Lead colors are optional. Leads must be numbered as shown.

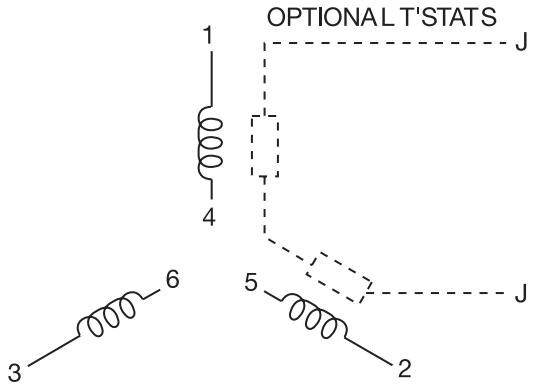
CD0017A02

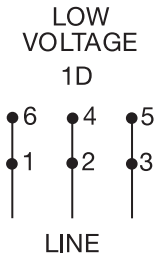


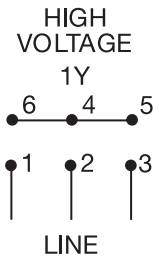
	LINE A	LINE B
STD	1,8	4,5
OPP	1,5	4,8

Connection Diagrams

CD0022 and 416820-4

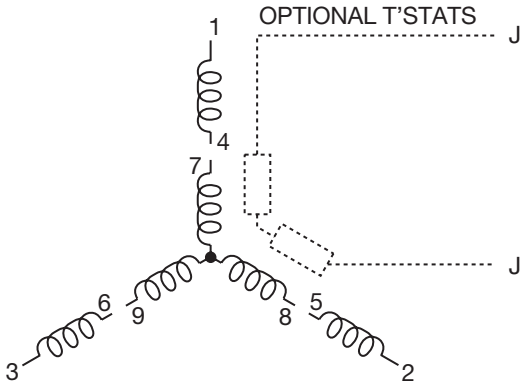


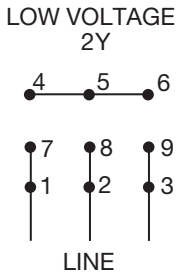


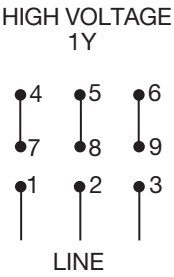


Notes:
1. Interchange any two line leads to reverse rotation.
2. Optional thermostats are provided when specified.
3. Actual number of internal parallel circuits may vary.
4. Lead colors are optional. Leads must be numbered as shown.

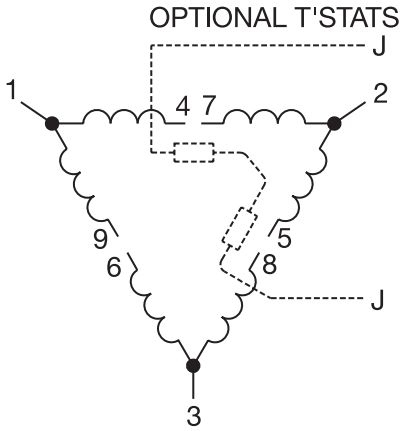
CD0055

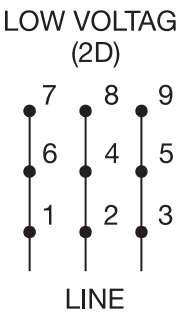


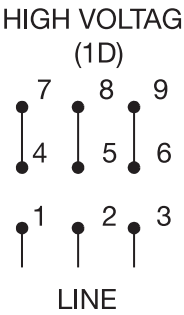




CD0180 and 416820-2



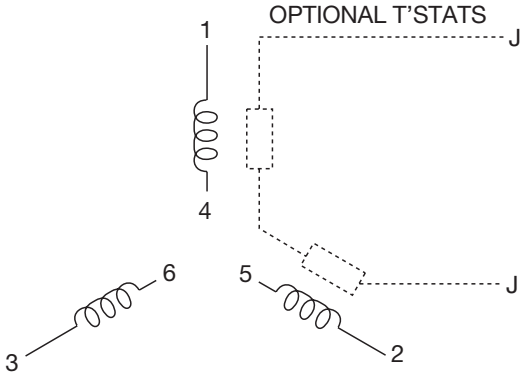


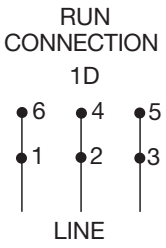


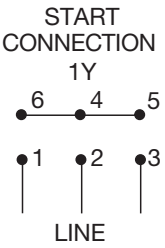
Notes:
1. Three lead motors may be designed as either wye-connected or delta-connected.
2. Interchange any two line leads to reverse rotation.
3. Optional thermostats are provided when specified.
4. Actual number of internal parallel circuits may vary.
5. Lead colors are optional. Leads must be numbered as shown.

Connection Diagrams

CD0382

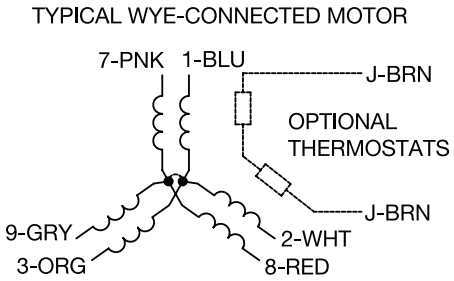


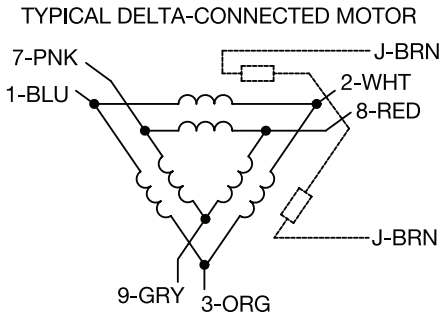


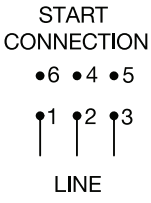


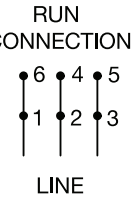
Notes:
1. Interchange any two line leads to reverse rotation.
2. Optional thermostats are provided when specified.
3. Actual number of internal parallel circuits may vary.
4. Lead colors are optional. Leads must be numbered as shown.
5. For Across-The-Line starting, use "RUN" connection

CD0695









Notes:
1. Motor may be wye-connected or delta-connected.
2. Interchange any two line leads to reverse rotation.
3. Optional thermostats are provided when specified.
4. Actual number of internal parallel circuits may vary.
5. Lead colors are optional. Leads must be numbered as shown.

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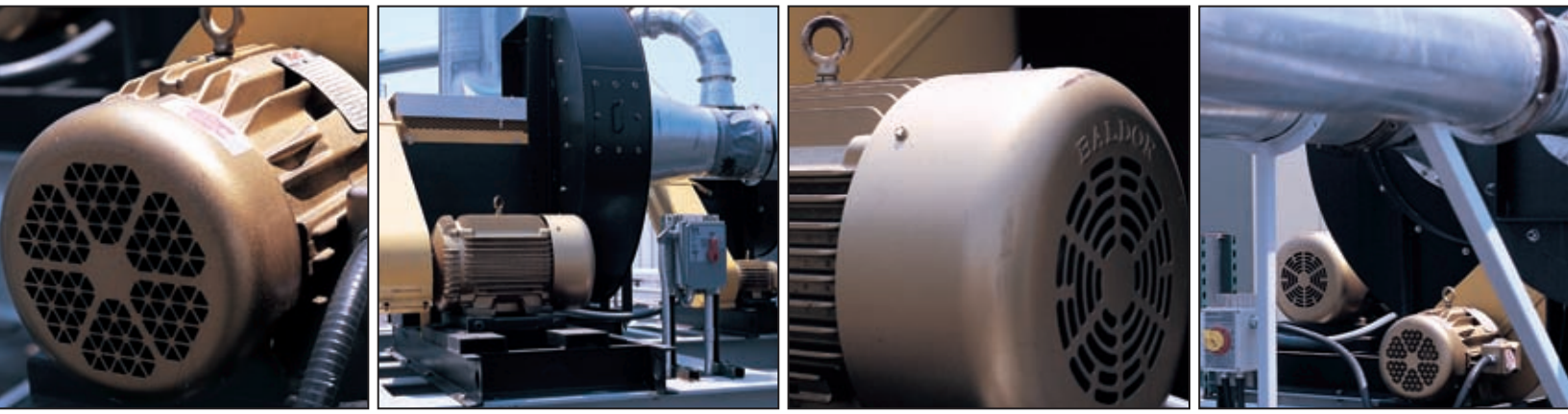
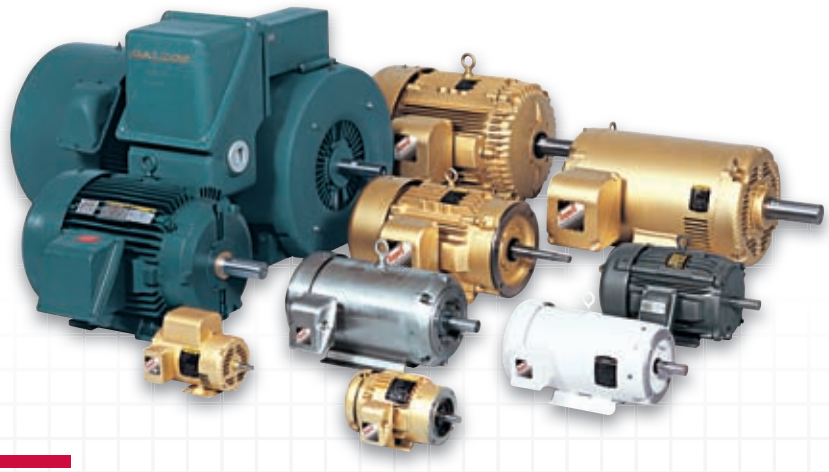
BALDOR® • RELIANCE

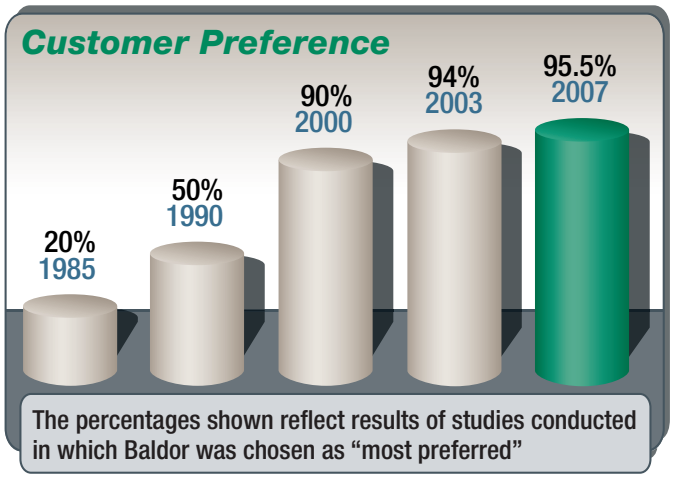


Super-E® Premium Efficient Motors



BALDOR®

Why Baldor?



For nearly 100 years, Baldor has strived to provide customers with the best value and reliability in industrial electric motors. That dedication shows in customer preference for Baldor•Reliance motors. To be considered as the most preferred...

Baldor offers the industry's broadest line of stock products. Save valuable time with just one call to Baldor. We offer more than 10,000 stock motors, drives and gearboxes.

Energy-efficiency leader. We began lowering the energy consumption of our motors in the 1920s, long before others were even talking about it. Today, our expansive line of Super-E® premium-efficient motors ranges from 1 through 15,000 Hp. Baldor's Super-E® line offers customers the highest overall efficiency levels in the industry.

Baldor products are available at more locations than any other brand. Our 35 district offices across North America and offices around the world, offer immediate availability of Baldor products to thousands of customers.

Continuous innovation to improve reliability. Baldor leads the motor industry in applying new technologies to improve motor reliability. Recent improvements to the line of Severe Duty motors are further proof that Baldor is the leader in motors for process industry applications. These improvements are explained in detail in the following pages.

Industry's shortest lead times/Flexible manufacturing. Baldor has the industry's shortest lead times on custom motors – just ten working days. Our unique LEAN FLEX FLOW™ manufacturing process lets us produce any order in any quantity, quickly and efficiently.

Industry's best information. Only Baldor offers customers so many choices for product information with a wide variety of catalogs and product brochures, the Baldor Web site at www.baldor.com, or you may talk to a Baldor customer service person at one of our sales offices.

Table of Contents

The Baldor Super-E®

In the mid-70s, a southeastern tire manufacturing plant asked Baldor to increase their plant's operating efficiencies. After analyzing the efficiencies of the plant's 75 Hp motors, Baldor engineers determined that considerable energy savings could be gained from a motor design focused on "active materials." By adding more copper to the windings, upgrading the laminations to a premium-grade steel, designing precision air gaps between the rotor and stator, and reducing fan and other losses in the motor, Baldor was able to supply the plant with the premium efficient motors it needed. This was the birth of the Baldor Super-E®.

Over 1,000 Stock Motor Ratings

Today's line of Baldor Super-E motors offers customers some from the highest levels of efficiencies, in ratings of 1 to 15,000 horsepower. Baldor has ratings available immediately from stock, with non-stock motors with the industry's shortest load times. All Super-E motors (except Explosion-Proof) are also "Inverter-Ready".

The Right Premium Efficient Motor for your Application

Whether it's a premium efficient motor for harsh, outdoor conditions at a petro-chemical plant, or for continuous duty in a distribution center, Baldor offers customers a variety of choices.

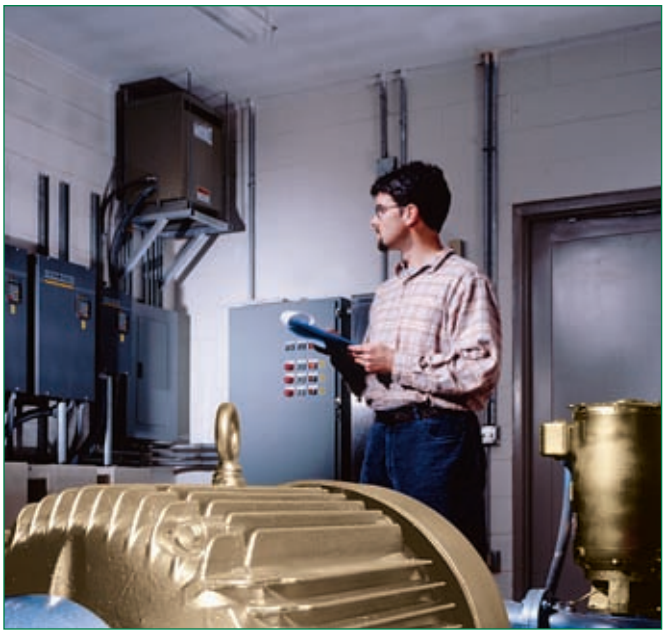
Super-E Totally Enclosed Fan Cooled (TEFC) and Open Drip Proof (ODP) are reliable motors that have kept plants operating efficiently since their introduction in 1983. Explosion-Proof, Close Coupled Pump and Automotive Approved Super-E's deliver premium efficiency for special applications.

In applications requiring added protection from corrosion caused by severe environmental operating conditions, Baldor•Reliance Super-E Severe Duty motors are available in TEFC ratings from 1 through 2250 Hp. Cast-iron construction, epoxy primer and finish paint inside and out, gaskets on all joints and many other features provide added protection where and when you need it most.

For the ultimate in protection from severe environments – where you need added insurance against downtime – Baldor offers IEEE 841 motors. Delivering reliable, rugged performance with the industry's highest energy efficiencies, these motors exceed IEEE 841 - 2001 standards for severe duty TEFC induction motors. Inpro/Seal® bearing isolators at both the drive end and fan end. Baldor IEEE 841 motors are available immediately off the shelf, in 1 - 250 Hp ratings, with special designs available as custom motors.

Leadership in Premium Efficiency

Called a "key breakthrough" by the Consortium for Energy Efficiency, the CEE in 1998 recognized Baldor's Super-E as the first premium efficient motor line to meet their stringent efficiency criteria, citing "For the first time, one manufacturer will carry all qualifying products."



A Baldor Super-E motor and Inverter Control provide premium energy efficiency and improved process control to a municipal water treatment facility.

Minimum Efficiency Performance Standards (MEPS) for electric motors are becoming commonplace throughout the world. The first of these was the Energy Policy Act of 1992 (EPAct) that mandated efficiency levels for 1-200 Hp general purpose motors for sale in the U.S. after October 1997. The Energy Independence and Security Act of 2007 (EISA) builds upon EPAct and raises the efficiency level for these motors to NEMA Premium® efficiency and adds other configuration and 201-500 Hp ratings for MEPS compliance. Baldor•Reliance Super-E motors manufactured today meet or exceed EISA requirements.

As countries and regions across the world establish minimum efficiency levels for motors, more companies are turning to the Baldor•Reliance Super-E. This includes plant and processing applications, as well as OEM products for shipment overseas. Super-E motors meet or exceed the efficiency levels defined by NEMA Premium®, EPAct in the U.S., NRC in Canada, and CEMEP EFF1 in Europe, and the new IE3 level of IEC 60034-30.

A wide selection of premium efficient motors, available from stock, manufactured and sold by a company committed to building better products for industries worldwide. No wonder, since the 1920s, Baldor•Reliance is recognized as the leader in energy efficient industrial motors and drives.

Green catalog numbers in this brochure denote motors that meet or exceed NEMA Premium® Efficiency.

ENERGY STAR PARTNER

NEMA Premium®

Going Beyond the Industry Standard in Premium Efficient Motors

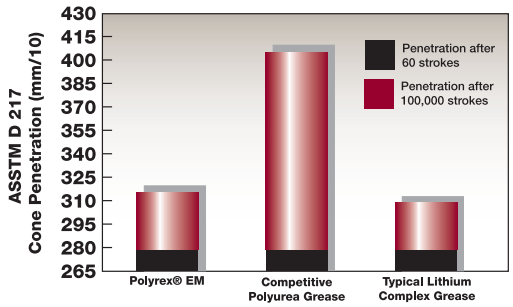
Baldor's Super-E® motors are another example of our commitment to provide reliable performance, while exceeding customer expectations.

Standard on All Baldor Motors: Exxon Polyrex® EM Polyurea Grease

It's a fact: Bearing failure is the #1 mechanical reason for motor failure. So the better the grease protecting those bearings, the better and longer the motor performs.

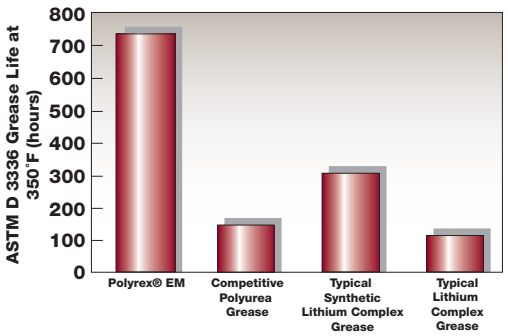
Today, that better grease is Exxon's new Polyrex® EM polyurea grease – now standard on all Baldor•Reliance motors. It provides lubrication life of more than four times greater than other polyurea greases in tests up to 350°F. It exhibits greater durability when subjected to mechanical shearing forces. Furthermore, a specially formulated additive in the grease resists washout, rust and corrosion even when subjected to salt water conditions.

Excellent Shear Stability



As illustrated here, the proprietary polyurea thickener system in Polyrex EM exhibits excellent durability and stability when subjected to a mechanical shearing force. Mechanical shear stability is a measurement of the greases thickener system. Good mechanical shear stability is important in roller bearing applications where excessive grease softening may lead to grease leakage or purging from the bearing.
Source: Exxon Mobil Product Data Sheet DG-3C, 6/15/99.

Outstanding High-Temperature Lubrication Life



In the severe ASTM D 3336 High-Temperature Grease Life Test, Polyrex EM dramatically out performed a competitive polyurea grease and conventional lithium-complex greases.

Source: Exxon Mobil Product Data Sheet DG-3C, 6/15/99.

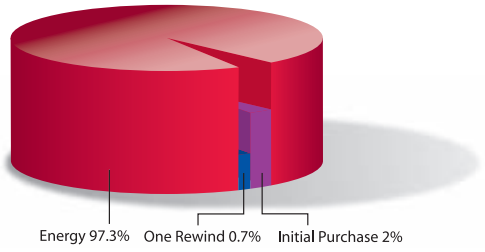
Making Energy Efficiency Work For You

Why is Energy Efficiency Important?

Electric motor-driven systems used in industrial processes consume 63% of all electricity used in U.S. industrial sector according to a U.S. Department of Energy report published in 1998. A 2002 report shows that companies that practiced DOE "best practices" actually averaged 33 percent savings if they were to apply motor and motor system efficiency upgrades, including the use of adjustable speed drives. The potential positive impacts on companies' bottom lines and the environment are significant.

Purchase Price is Only a Small Piece of the Pie

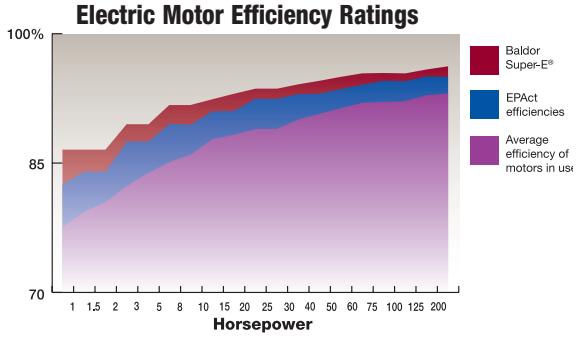
The pie chart to the right shows the typical life cycle cost of a 100 Hp motor operating in continuous duty over a 20-year life. As you can see, the original purchase price is almost insignificant compared to what it will cost to power the motor during its useful life.



How Baldor Super-E® Efficiencies Compare to Industry Standards

Baldor's line of Super-E motors offers customers the highest level of overall efficiencies available from any motor manufacturer, meeting or exceeding NEMA Premium® efficiency.

Electric Motor Efficiency Ratings

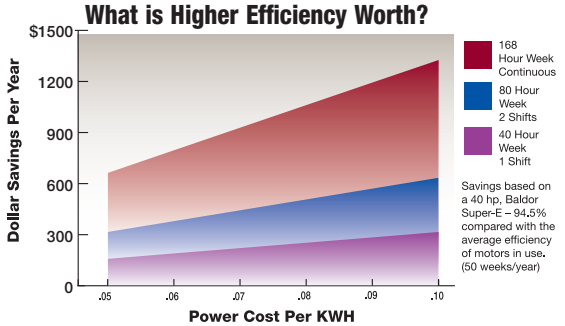


BE$T™ Baldor Energy Savings Tool Makes Calculating Payback Easy

In order to make payback calculations easier for customers, Baldor developed BE$T, Baldor Energy Savings Tool. The software helps calculate energy cost and energy savings for motors, as well as payback time frames. A popular feature of BE$T is that it allows users to make head-to-head comparisons of up to three motors, giving customers the information to make an informed decision through comparative analysis.

BE$T, Baldor Energy Savings Tool is available as a download through Baldor's award-winning Web site (www.baldor.com/support/software_BEST.asp,) as well as a stand-alone CD-ROM, available from your Baldor District Office.

What is Higher Efficiency Worth?



Super-E® Premium Efficiency Motor Construction

The family of Baldor • Reliance Super-E TEFC (Totally-Enclosed Fan-Cooled) motors shares a number of electrical and mechanical features that add up to outstanding value. "EM" motors are general-purpose premium efficient motors. For more severe environmental applications, our "ECP/XEX" Severe Duty motors provide added weather and chemical protection. For extreme applications, where downtime is critical, Baldor "841XL" motors are ideal; these motors exceed IEEE 841-2001 specifications.

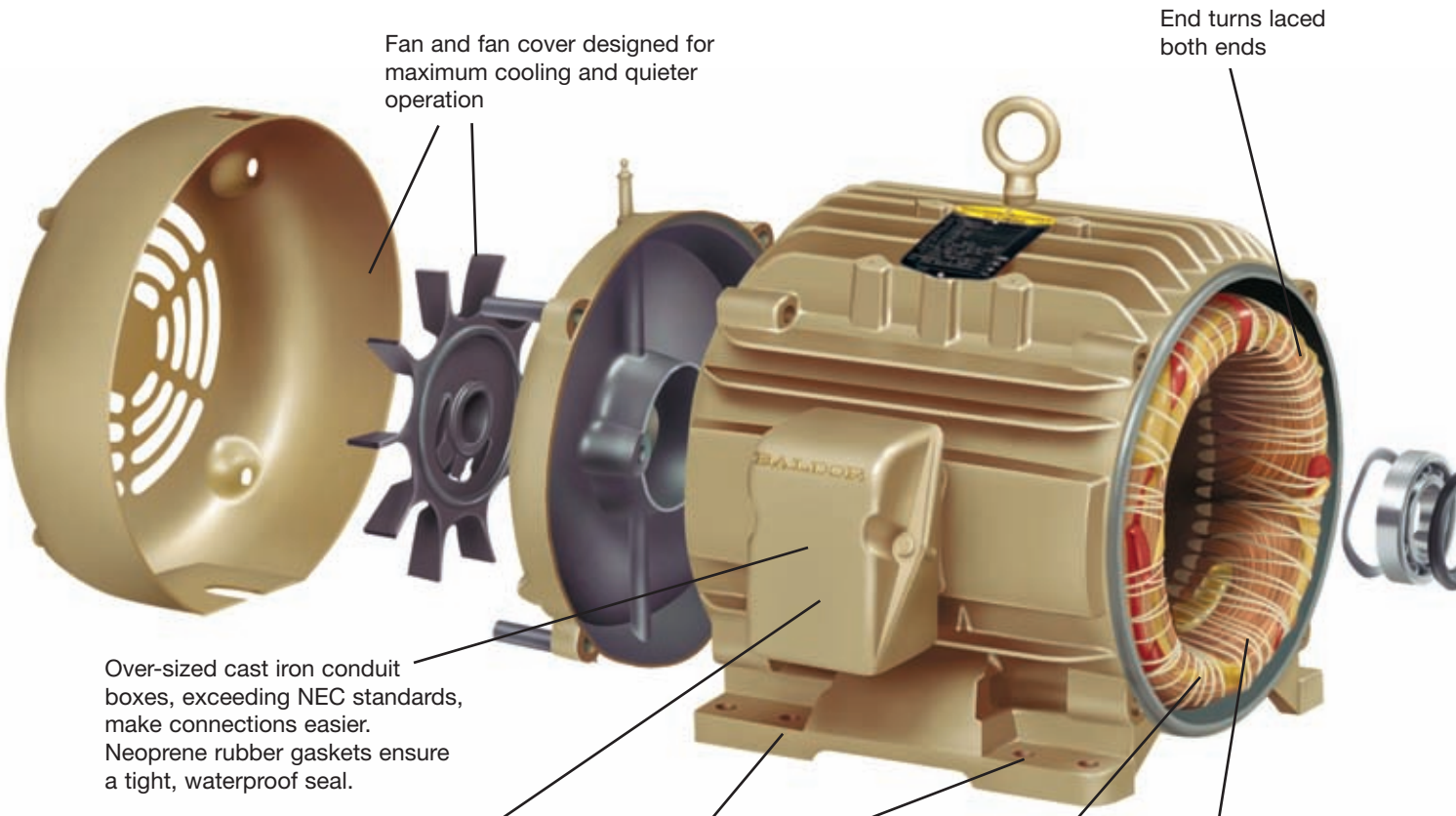
The chart below lists standard features ("S") in Baldor's TEFC Premium Efficient motors. Horsepower ranges indicate where certain features are standard in stock products. Additional features optional ("O") on custom motors, or through Baldor's Mod-Express.

TEFC Premium Efficiency Motor Family

Electrical Features	**EM / XE**	**ECP/XEX**	**841XL**
Hp Range - Stock	1-1000	1-1000	1-250
Class F insulation with Class B rise	S	S	S
1.15 Service factor	S	S	S
200°C Inverter Spike Resistant insulation system	S	S	S
Phase insulation	S	S	S
Corona inception testing - meets NEMA Part 31.4.4.2	S	S	S
Varnish dip & bake with 100% solids	S	S	S
No silicone lead wire		S	S
Documented final motor tests - data shipped with motor	O	O	S
Mechanical Features			
NEMA Frame sizes	143T - 449T	143T - 449T	143T - 449T
Steel Band Frame Die cast aluminum endplates, steel fan cover	S 143T - 215T		
Cast iron frame - cast iron endplates & fan cover (steel fan cover standard on EM/XE 140-280T)	O 143T - 286T S 324T - Up	S	S
Die cast aluminum conduit box	S thru 360T		
Cast Iron conduit box	S 400T - up	S	S
Threaded inlet hole in conduit box		S	S
Neoprene conduit box lid gasket & lead separator gasket		S	S
Seal endplate to frame joints		S	S
V-ring shaft seals - DE & ODE (except some 440 frame)	S 250T - up DE only	S	
Inpro/Seal® VBX or VBXX bearing isolators - DE and ODE			S
Hardware - zinc plated	S	S	S
Motor unfiltered vibration at rated voltage and frequency <0.15 in/sec peak velocity	S	S	
Motor unfiltered vibration at rated voltage and frequency <0.08 in/sec peak velocity			S
Test vibration on DE & ODE and document - ship with motor			S
Low bearing temperature specs (IEEE 841)			S
Foot flatness to < NEMA tolerances (0.005"/ft.)			S
Shaft runout < NEMA			S
Sound power level < 90 dBA			S
Grease inlet fitting - grease fitting	S		
Grease inlet with tube extension & grease fitting		S	S
Grease outlet with screw-in plug	S		
Grease outlet with automatic relief fitting	S 250T - up		
Grease outlet with tube extension & automatic relief fitting		S	S
Non-metallic external cooling fan	S	S	S
Casting coated with water base primer	S		
Castings coated with 2-part epoxy primer and epoxy finish coat		S	S
Finish paint with gold enamel	S		
Finish paint with 2-part dark gray epoxy		S	S
ASTM B117-90 96-hour salt spray test compliance		S	S
Laser etched aluminum nameplate with NEMA data	S		
Embossed Stainless steel nameplate with NEMA data		S	S
Stainless steel nameplate with bearing and grease data		S	S
Limited Warranty	3 year	3 year	5 year

Note: Contact your Baldor District Office for certified data, dimensions and features of a specific motor.

Baldor Super-E®: Premium efficiency inside and out

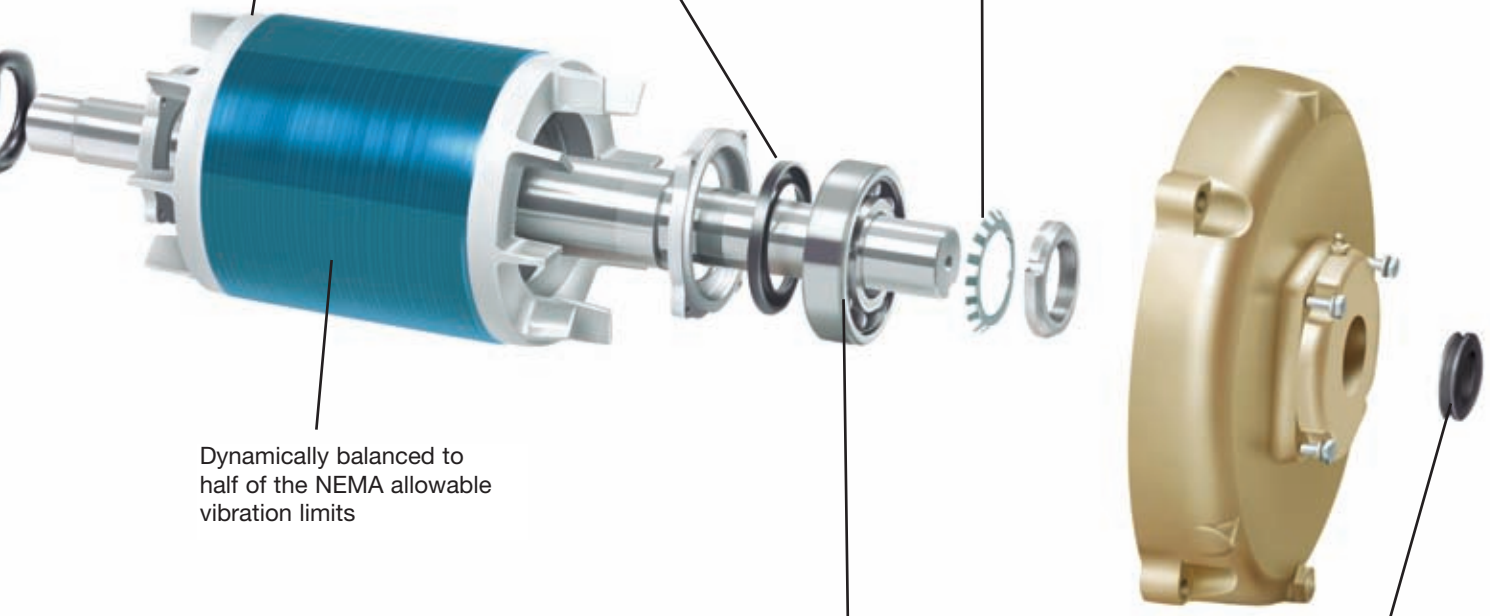


NEMA Premium

High-pressure die cast aluminum rotor through 449T frames coated to prevent corrosion

Patented Lube-Lok retainer grease seal on both ends, 250T frame and up

Locked bearing construction reduces endplay



Dynamically balanced to half of the NEMA allowable vibration limits

Baldor was the first motor manufacturer to use Exxon Polyrex® EM grease. Polyrex® EM protects motor bearings better, providing improved lubrication life, greater shear stability, and superior resistance to washout, rust and corrosion.

Neoprene v-ring rubber shaft slinger on pulley end of motor prevents contaminants from entering

Severe Duty Super-E® ECP/XEX NEMA Premium® Efficient Motors

Designed to meet the demanding application requirements typically found in severe duty processing environments. Baldor•Reliance Super-E, ECP motors have XEX features including all cast iron frame construction with oversized and rotatable cast iron conduit box. All bearings use the exclusive Positive Lubrication System (PLS) which channels grease directly into the bearing track. The Class F premium "Spike Resistant" insulation system meets the requirements of NEMA MG 1 Part 31.4.4.2 for use on variable frequency control. All internal surfaces are epoxy coated for corrosion protection.

Super-E® ECP/XEX TEFC - Totally Enclosed Fan Cooled - Foot Mounted, 460 Volts, Three Phase, 1-40 Hp

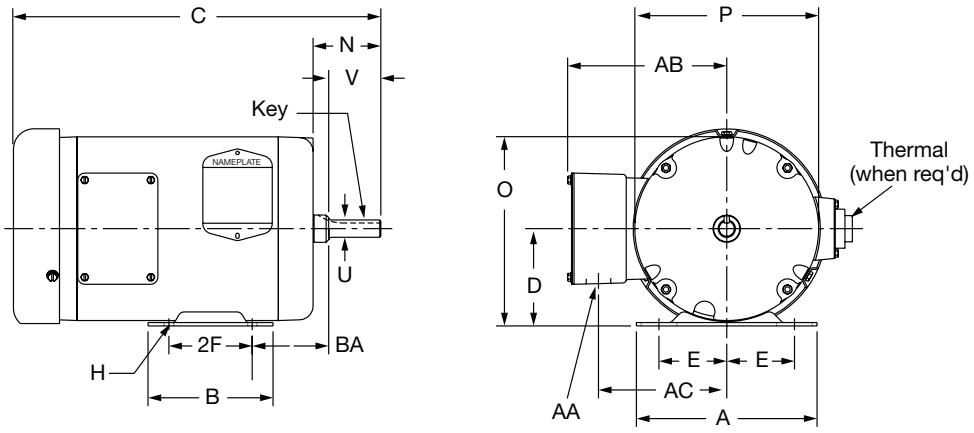
Hp	kW	RPM	Frame	Catalog No.	Amps		F.L. Torque Lb. Ft.	Efficiency %			Power Factor %			Bearings ODE/DE	"C" Dim.	Conn. Diag. No.
					F.L.	L.R.		1/2	3/4	F.L.	1/2	3/4	F.L.			
	0.75	3600	143T	ECP3580T-4	1.4	12.1	1.5	80.5	83.6	84	65	77	84	6205	12.88	CD0006
	0.75	3600	143T ▮	ENCP3580T-4	1.3	11.2	1.5	80.5	83.9	84.0	73	83	88	6205	11.37	CD0006
1	0.75	1800	143T	ECP3581T-4	1.5	14.0	3	83.8	86.2	87.5	58	72	78	6205	12.88	CD0006
	0.75	1800	143T ▮	ENCP3581T-4	1.5	15	3.0	84.4	87.0	87.5	48	60	70	6205	11.37	CD0006
	0.75	1200	145T	ECP3582T-4	1.8	9.6	4.5	82.3	84	82.5	42	55	63	6205	12.88	CD0006
	0.75	900	L182T	ECP3687T-4	1.75	9.2	6	80.2	83.1	82.5	43	56	64	6205/6206	17.12	416820-24
	1.1	3600	143T	ECP3583T-4	2	20.1	2.3	81.3	84.3	85.5	68	78	83	6205	12.88	CD0006
1 1/2	1.1	1800	145T	ECP3584T-4	2.1	19.7	4.5	86.7	88.6	88.5	55	68	76	6205	12.88	CD0006
	1.1	1200	182T	ECP3667T-4	2.4	20	6.8	84.2	86.9	87.5	47	59	67	6205/6206	15.62	416820-24
	1.1	900	L184T	ECP3668T-4	2.4	13.4	9	83.5	85.3	84	48	60	68	6205/6206	17.12	416820-24
	1.5	3600	145T	ECP3586T-4	2.5	30	3	83.8	86.2	86.5	70	80	85	6205	12.88	CD0006
2	1.5	1800	145T	ECP3587T-4	2.7	24.7	5.95	87.1	86.6	88.5	59	71	79	6205	12.88	CD0006
	1.5	1200	L184T	ECP3664T-4	2.8	18	9	86.4	88.3	88.5	49	62	70	6205/6206	17.12	416820-24
	1.5	900	L213T	ECP3772T-4	3.2	16.8	12.2	85.3	86.8	86.4	48	61	69	6206/6207	20.19	416820-24
	2.2	3600	182T	ECP3660T-4	3.6	30	4.5	87.7	88.8	88.5	78	86	88	6205/6206	15.62	416820-24
3	2.2	1800	182T	ECP3661T-4	4.2	32	9	88.1	89.5	89.5	55	68	76	6205/6206	15.62	416820-24
	2.2	1200	213T	ECP3764T-4	4.2	31	13.4	88.4	89.7	89.5	55	68	75	6206/6207	19.31	416820-24
	2.2	900	L215T	ECP3775T-4	4.7	25	18.3	85.4	86.3	85.5	51	63	70	6206/6207	20.19	416820-24
	3.7	3600	184T	ECP3663T-4	6	44	7.5	89.2	89.6	88.5	74	84	88	6205/6206	15.62	416820-24
5	3.7	1800	L184T	ECP3665T-4	6.6	46	15	89.4	90.1	89.5	62	74	80	6205/6206	17.12	416820-24
	3.7	1200	L215T	ECP3768T-4	6.8	46	22.5	89.7	90.2	89.5	60	71	77	6206/6207	20.19	416820-24
	3.7	900	254T	ECP2280T-4	7.3	46	29.8	88.2	89.6	89.5	53	65	72	6309	24.56	416820-24
	5.6	3600	213T	ECP3769T-4	8.6	62	11.2	90.6	90.9	90.2	81	87	90	6206/6207	19.31	416820-24
7.5	5.6	1800	L213T	ECP3770T-4	9.4	64	22.3	91.7	92.2	91.7	64	76	81	6206/6207	20.19	416820-24
	5.6	1200	254T	ECP2276T-4	9.9	64	33.5	90.7	91.4	91	61	72	78	6309	24.56	416820-25
	5.6	900	256T	ECP2401T-4	10.5	62	44.8	89.5	90.5	90.2	57	68	74	6309	24.56	416820-24
	7.5	3600	215T	ECP3771T-4	11.1	81	15	91.6	91.9	91	87	92	93	6206/6207	19.31	416820-24
10	7.5	1800	L215T	ECP3774T-4	12.3	81	30	92.3	92.4	91.7	68	78	83	6206/6207	20.19	416820-24
	7.5	1200	256T	ECP2332T-4	12.5	78	44.8	91.7	91.8	91	70	79	82	6309	24.56	416820-25
	7.5	900	284T	ECP2402T-4	13.7	81	59.4	89.6	90.7	91	60	70	76	6310	27.44	416820-24
	11.2	3600	254T	ECP2394T-4	16.8	114	22.3	92.8	93.1	91.7	85	90	91	6309	24.56	416820-25
15	11.2	1800	254T	ECP2333T-4	18.1	116	44.6	92.3	92.8	92.4	75	82	84	6309	24.56	416820-25
	11.2	1200	284T	ECP4100T-4	18.7	113	66.7	91.9	92.7	92.4	69	78	81	6310	27.44	416820-25
	11.2	900	286T	ECP2395T-4	20	109	89.4	90.9	91.3	90.7	65	74	78	6310	27.44	416820-25
	14.9	3600	256T	ECP4106T-4	22.3	145	29.8	92.3	92.4	91.7	87	91	82	6309	24.56	416820-25
20	14.9	1800	256T	ECP2334T-4	24	145	59.6	93.5	93.6	93	74	81	84	6309	24.56	416820-25
	14.9	1200	286T	ECP4102T-4	24.8	143	89.2	92.5	92.9	92.4	71	79	82	6310	27.44	416820-25
	14.9	900	324T	ECP4112T-4	26.5	140	119	92	92.3	91.6	61	72	77	6311	30.44	416820-24
	18.6	3600	284TS	ECP4107T-4	28.1	182	37	93.5	93.7	93	84	89	89	6310	26.06	416820-25
25	18.6	1800	284T	ECP4103T-4	29.7	182	74.1	94.1	94.2	93.6	77	83	84	6310	27.44	416820-25
	18.6	1200	324T	ECP4111T-4	30.9	182	111	92.8	93.3	93	68	77	81	6311	30.44	416820-25
	22.4	3600	286TS	ECP4108T-4	33.9	214	44.5	93.9	94.1	93	87	90	89	6310	26.06	416820-25
30	22.4	1800	286T	ECP4104T-4	36.1	217	89.1	94.1	94.2	93.6	74	81	83	6310	27.44	416820-25
	22.4	1200	326T	ECP4117T-4	36.4	217	133	93.6	94	93.6	70	79	82	6311	30.44	416820-25
	29.8	3600	324TS	ECP4109T-4	44.3	278	59	94.2	94.5	94.1	80	87	90	6311	28.94	416820-25
40	29.8	1800	324T	ECP4110T-4	47.7	287	118	94.6	94.7	94.1	73	80	83	6311	30.44	416820-25
	29.8	1200	364T	ECP4308T-4	49	290	177	93.6	94.3	94.1	69	77	81	6313	33.44	416820-25

NOTES: ▮ TENV enclosure. See page 54 for Layout drawing. See page 75 for Connection Diagrams.
Efficiencies shown are nominal. Data subject to change without notice. Contact Baldor for certified data.

Shaded ratings are cast iron frames.

Dimensions

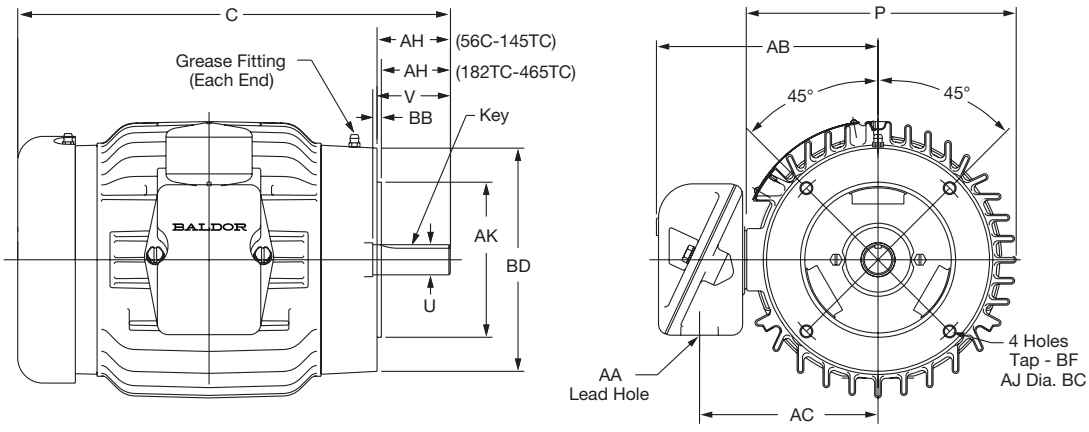
Three Phase Steel Band Construction Motors
Totally Enclosed Fan-Cooled - NEMA 56 through 215T



NEMA Frame	A	B	D	E	2F	H	Key	N	O	P	U	V	AA	AB	AC	BA
56	6.50	4.50	3.50	2.44	3.00	0.34 Slot	0.19	2.44	6.81	6.62	0.625	1.88	0.88	5.73	4.62	2.75
143T 145T	6.50	5.94	3.50	2.75	4.00 5.00	0.34	0.19	2.50	6.81	6.62	0.875	2.25	0.88	5.73	4.62	2.25
182T 184T	8.63	6.50	4.50	3.75	4.50 5.50	0.41	0.25	3.56	8.44	7.88	1.125	2.75	1.09	6.87	5.76	2.75
213T 215T	9.50	8.00	5.25	4.25	5.50 7.00	0.41	0.31	3.88	10.03	9.57	1.375	3.38	1.38	8.05	6.79	3.50

NOTE: Drawings shown are for reference only. Please contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-ROM or website at www.baldor.com

Three Phase Cast Iron Construction Motors
Totally Enclosed Fan-Cooled - NEMA 56C through 215TC - C-Face Less Base

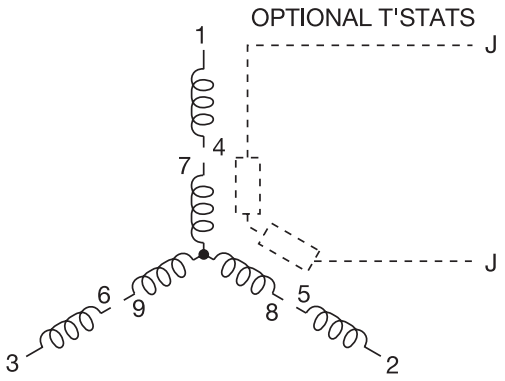


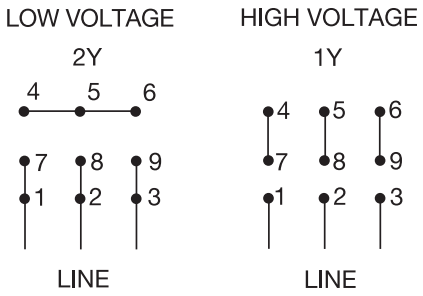
NEMA Frame	Key	P	U	V	AA	AB	AC	AH	AJ	AK	BB	BD	Tap BF
56C	0.188	8.00	0.625	1.88	1.06	6.38	5.00	2.06	5.88	4.50	0.13	6.50	3/8-16
Cast Iron Construction													
143TC 145TC	0.19	8.00	0.875	1.87	1.09	6.43	5.18	2.12	5.88	4.50	0.12	6.50	0.38-16
182TC 184TC	0.25	10.12	1.125	2.75	1.09	7.18	5.93	2.62	7.25	8.50	0.25	9.00	0.50-13
213TC 215TC	0.31	12.18	1.375	3.13	1.38	9.22	7.38	3.13	7.25	8.50	0.25	9.06	0.50-13

NOTE: Drawings shown are for reference only. Please contact Baldor for a detailed dimensional drawing of the specific motor you require. Drawings may also be available from our CD-Rom or website at www.baldor.com

Connection Diagrams

CD0005 and 416820-1

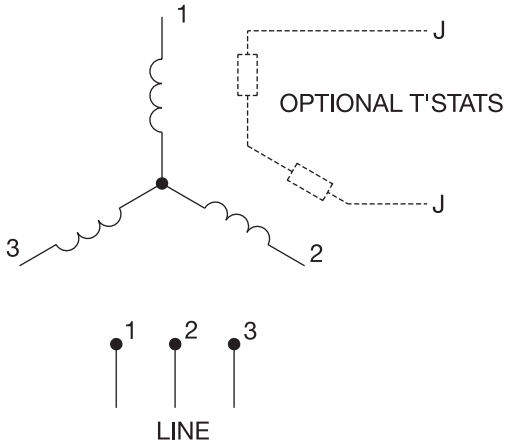




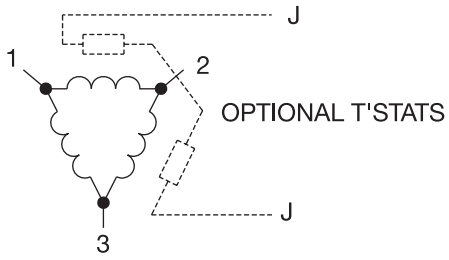
Notes:
1. Interchange any two line leads to reverse rotation.
2. Optional thermostats are provided when specified.
3. Actual number of internal parallel circuits may vary.
4. Lead colors are optional. Leads must be numbered as shown.

CD0006, 416820-24 and 416820-25

TYPICAL WYE- CONNECTED MOTOR

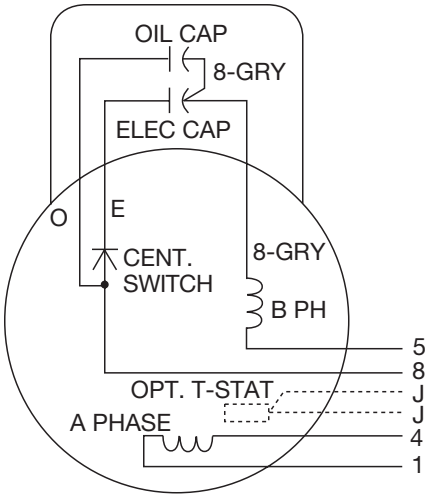


TYPICAL DELTA - CONNECTED MOTOR



Notes:
1. Three lead motors may be designed as either wye-connected or delta-connected.
2. Interchange any two line leads to reverse rotation.
3. Optional thermostats are provided when specified.
4. Actual number of internal parallel circuits may vary.
5. Lead colors are optional. Leads must be numbered as shown.

CD0017A02



	LINE A	LINE B
STD	1,8	4,5
OPP	1,5	4,8

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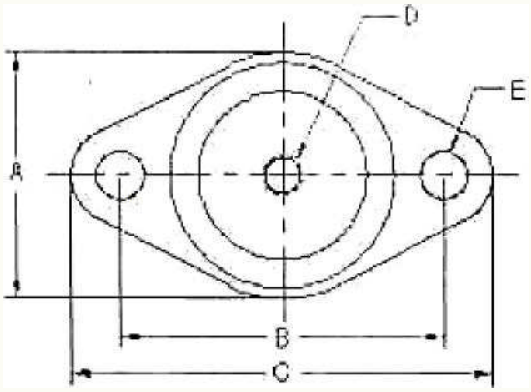
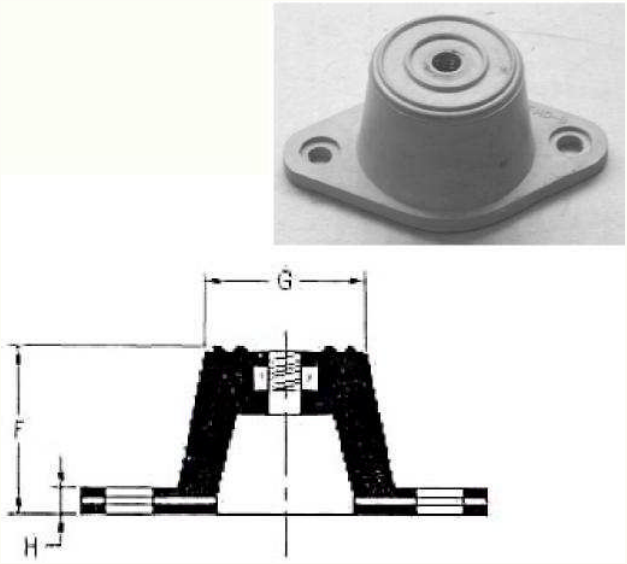
FMD series double deflection compression mounts have great elasticity in axial-radial direction and provide excellent isolation from vibration and noise. This model is designed for compression mode and is not recommended where shear or tension load exists. Maximum shock loads should not exceed 50% of maximum vertical load. FMD mounts are widely used for installations of: motors, fans, pumps, compressors, transformers, electrical – lab- testing equipment and cabinets enclosures, as well as air conditioners and other industrial equipment.

NOTE: FMD 7, 8, 9 models have a rectangular base of 5 1/2" x 3 3/8".





MODEL	MAX. LOAD (LBS)	DEFLECTION (inches)	ISOLATOR DIMENSIONS (inches)							
			A	B	C	D	E	F	G	H
FMD-1	25	1\2	1 3\4	2 3\8	3 1\8	1\4-20	3/8	1	1 1\4	3\16
FMD-2	50	1\2	1 3\4	2 3\8	3 1\8	1\4-20	3/8	1	1 1\4	3\16
FMD-3	75	1\2	1 3\4	2 3\8	3 1\8	1\4-20	3/8	1	1 1\4	3\16
FMD-4	150	1\2	2 3\8	3	3 7\8	3\8-16	3/8	1 3\4	1 3\4	1\4
FMD-5	225	1\2	2 3\8	3	3 7\8	3\8-16	3/8	1 3\4	1 3\4	1\4
FMD-6	300	1\2	2 3\8	3	3 7\8	3\8-16	3/8	1 3\4	1 3\4	1\4
FMD-7	450	1\2	3 3\8	4 1/8	5 1\2	1\2-13	9\16	2 7\8	2 3\8	5\16
FMD-8	750	1\2	3 3\8	4 1/8	5 1\2	1\2-13	9\16	2 7\8	2 3\8	5\16
FMD-9	1200	1\2	3 3\8	4 1\8	5 1/2	1\2-13	9\16	2 7/8	2 3\8	5\16

Appendix E
Prior Reports
(on CD)

Appendix F
Resumes of Key Personnel

Mohamed Ahmed, Ph.D., C.P.G.
Sr. Geologist/Principal

Experience Summary

Mohamed Ahmed is a certified professional geologist with nearly 23 years of experience in the New York City metropolitan area. He has designed and implemented subsurface investigations and is proficient in groundwater modeling, design of groundwater treatment systems and soil remediation. He has managed numerous projects focused on compliance with the New York State Brownfield Cleanup and Spills programs and the New York City "e" designation program. Dr. Ahmed also has extensive experience in conducting regulatory negotiations with the New York State Department of Environmental Conservation, the NYC Office of Housing Preservation and Development, and the Mayor's Office of Environmental Remediation.

Selected Project Experience

Willoughby Square, Downtown Brooklyn
As Project Manager, directs all regulatory interaction and investigation on this joint public-private sector redevelopment that will include a public park and four-level underground parking garage. Prepared the remedial investigation work plan and remedial action work plan, conducted investigation activities and waste characterization, and negotiated with the NYC Department of Environmental Protection and the Mayor's Office of Environmental Remediation to transition the site into the NYC Voluntary Cleanup Program.

School Facility, Borough Park, Brooklyn
Managed all regulatory agency coordination, work plan and report preparation and remedial oversight; worked with OER to determine measures to retroactively address the hazardous materials and air quality E-designations on a previously constructed school building and prepared supporting documentation to justify the use of electrical units rather than natural gas.

LGA Hotel Site, East Elmhurst, Queens
Project manager for all work conducted at this former gasoline service station which is being remediated under the NYS Brownfield Cleanup Program; technical oversight of work plans, reports, and design and implementation of field and soil disposal characterization.

436 10th Avenue, Manhattan
As project manager and technical lead, assisted client in developing remedial cost estimates used for property transaction, developed regulatory strategy to address NYS Spills and NYC E-designation requirements, and currently overseeing remedial activities which include removal and disposal of petroleum-contaminated bedrock and dewatering and disposal of impacted groundwater.

Brownfield Cleanup Program Site, Downtown Brooklyn
Managed investigation and remediation under the BCP program for a proposed mixed-use development; designed the remedial investigation and prepared the remedial action work plan which includes an SVE system monitored natural attenuation. Prepared remedial cost

estimates for several scenarios. The project will include a 53-story mixed-use structure and parking garage.

Queens West Development, Long Island City
Directed project team and subcontractors for soil investigation/remediation studies on multiple properties; provided technical support for negotiations with NYSDEC during investigation and remediation.

Former Creosote Site, Long Island City
Designed and implemented a complex investigation to assess the nature and extent of historic creosote contamination at this former industrial site; conducted studies to optimize recovery of LNAPL and DNAPL and developed strategies using bioremediation and natural attenuation in conjunction with conventional remedial approaches. Performed pilot tests for soil vapor extraction system design and coordinated with NYSDEC and NYSDOH to implement sub-slab soil vapor sampling.

NYSDEC Spill Site – Far West Side, Manhattan
Developed a detailed remedial cost estimate for to support client negotiations with a major oil company. The estimate included costs pertaining to: chipping, removal and disposal of petroleum-impacted bedrock; removal/disposal of recycled concrete; costs for dewatering and disposal of impacted groundwater during construction; and design and installation of a vapor barrier below the redevelopment.

Active Industrial Facility, Newburgh, New York
Designed remedial investigation of soil and groundwater contaminated with trichloroethane; performed soil vapor pilot test and pump test to aid in design of soil and groundwater remediation alternatives; conducted sub-slab vapor sampling in accordance with NYSDOH guidance.

Former Dry Cleaning Facility, New York City
Conducted soil and groundwater investigations, designed and installed a soil vapor extraction system and performed extensive testing of indoor air. Negotiated the scope of the RI and IRM with NYSDEC.

Waterfront Redevelopment, Yonkers, NY
Designed and performed geophysics survey of six parcels to determine locations of subsurface features; supervised test pit excavation to confirm geophysics results and evaluate and classify soil conditions prior to development activities.

Prince's Point, Staten Island, New York
Performed soil, groundwater and sediment sampling to delineate the extent of contamination; used field-screening techniques to control analytical costs and supervised soil excavation and disposal.

Apartment Complex, New York City, New York
Coordinated with Con Edison, the owner of the adjacent property and NYSDEC to determine oil recovery protocol; assessed hydrogeological conditions and conducted pilot tests to design cost-effective recovery system; designed and supervised installation of recovery system.

Publications

"Impact of Toxic Waste Dumping on the Submarine Environment: A Case Study from the New York Bight". Northeastern Geology and Environmental Sciences, V. 21, No. 12, p. 102-120. (With G. Friedman)

Metals Fluxes Across the Water/Sediment Interface and the Influence of pH. Northeastern Geology and Environmental Sciences, in press. (With G. Friedman)

"Water and Organic Waste Near Dumping Ground in the New York Bight". International Journal of Coal Geology, volume 43. (With G. Friedman)

Education and Certifications

Ph.D., Earth and Environmental Sciences, Graduate Center of the City of New York (2001)
M.Ph., Earth and Environmental Sciences, City University of New York (1998)
M.A. Geology, Brooklyn College (1993)
B.S. Geology, Alexandria University, Egypt (1982)

American Institute of Professional Geologists, Certified Professional Geologist, 1997-2015

Matthew Carroll, P.E.
Environmental Engineer/Principal

Experience Summary

Matthew Carroll is an environmental engineer experienced in all aspects of site assessment and development and implementation of remedial strategies. He has managed projects from inception through investigation, remediation and closure. His expertise includes soil, soil gas, and groundwater remediation, preparation of cost estimates, remedial alternative selection and design, soil characterization for disposal, field safety oversight, and preparation of work plans and reports to satisfy New York and New Jersey state requirements, and New York City "e" designation and restrictive declarations. Mr. Carroll's project management experience includes past management of a New York City School Construction Authority hazardous materials contract. He is responsible for all engineering work performed by Tenen and is currently the project manager and remedial engineer for several New York State Brownfield Cleanup Program sites.

Selected Project Experience

470 Kent Avenue, Brooklyn
As project manager, supported the client in due diligence and transactional activities, including a Phase I ESA, preliminary site investigation, and remedial cost estimate; preparation of BCP application and remedial investigation work plan. The former manufactured gas plant, sugar refinery and lumberyard will be developed as a mixed-use project with market rate and affordable housing and public waterfront access. As remedial engineer, will be responsible for development of remedial alternatives and oversight and certification of all remedial activities.

500 Exterior Street, Bronx
Designed and implemented the investigation of this former lumberyard and auto repair shop that will be redeveloped as mixed use development with an affordable housing component; prepared BCP application and subsequent work plans and reports. Designed a remedial strategy incorporating both interim remedial measures (IRMs) and remediation during the development phase.

Gateway Elton I and II, Brooklyn
Conducted soil disposal characterization, prepared Remedial Action Work Plans and designed methane mitigation systems for two phases of a nine-building residential development and commercial space; prepared and oversaw implementation of a Stormwater Pollution Prevention Plan during construction and prepared and certified the remedial closure reports for the project.

Affordable Housing Development, Rye, NY
Consultant to the City of Rye on environmental issues pertaining to a county-owned development site slated for an afford senior housing; reviewed environmental documentation for the project and prepared summary memorandum for City Council review; recommended engineering controls to address potential exposure to petroleum constituents, presented report findings at public meetings and currently providing ongoing environmental support during project implementation.

Queens West Development BCP Site, Long Island City, New York
Assistant Project Manager for two developers involved in the site.

- Responsible for oversight of remediation under the New York State Brownfield Cleanup Program
- Technical review of work plans and reports and coordination of the Applicant's investigation and oversight efforts
- Provided input for mass calculations and well placement for an in-situ oxidation remedy implemented on a proposed development parcel and within a City street
- Conducted technical review of work pertaining to a former refinery. Documents reviewed included work plans for characterization and contaminant delineation; pilot test (chemical oxidation); remediation (excavation and groundwater treatment). Managed field personnel conducting full time oversight and prepared progress summaries for distribution to project team
- Following implementation of remedial action, implemented the Site Management Plan and installation/design of engineering controls (SSDS, vapor barrier/concrete slab, NAPL recovery). Also responsible for coordination with NYSDEC

Brownfield Cleanup Program Redevelopment Sites – West Side, New York City
Managed remediation of a development consisting of four parcels being addressed under one or more State and city regulatory programs (NYS Brownfield Cleanup Program, NYS Spills, and NYC "e" designation program). Remediation includes soil removal, screening and disposal; treatment of groundwater during construction dewatering and implementation of a worker health and safety plan and community air monitoring plan (HASP/CAMP)

Managed an additional BCP site, supported the Applicant in coordination with MTA to create station access for the planned No. 7 subway extension; also provided support the client in coordination with Amtrak to obtain access for remedial activities on the portion of the site that is within an Amtrak easement. The site will eventually be used for construction of a mixed-use high-rise building.

BCP Site, Downtown Brooklyn, New York
Performed investigation on off-site properties and designed an SSDS for an adjacent building, retrofitting the system within the constraints of the existing structure; coordinated the installation of the indoor HVAC controls and vapor barrier; provided input to the design of a SVE system to address soil vapor issues on the site.

West Chelsea Brownfield Cleanup Program Site
Designed an in-situ remediation program and sub-slab depressurization system to address contamination remaining under the High Line Viaduct; SSDS design included specification of sub-grade components, fan modeling and selection, identifying exhaust location within building constraints and performance modeling; prepared the Operations Maintenance and Monitoring Plan and Site Management Plan sections pertaining to the SSDS.

Historic Creosote Spill Remediation – Queens, New York – New York State Voluntary Cleanup Program
Modeled contamination volume and extent and prepared mass estimates of historic fill constituents and creosote-related contamination; designed a soil vapor extraction (SVE) and dewatering system to address historic creosote release both above and below static

water table; coordinated with the Metropolitan Transit Authority and prepared drawings to secure approval to drill in the area of MTA subway tunnels.

NYSDEC Spill Site– Far West Side, Manhattan
Provided support to client during negotiations with a major oil company regarding allocation of remedial costs. Worked with client's attorney to develop a regulatory strategy to address the client's obligations under the NYSDEC Spills Program and the New York City "e" designation requirements.

Affordable Housing Site, Brooklyn, New York
Modified prior work plans for soil, soil vapor and groundwater investigation to address requirements for site entry into the New York City Brownfield Cleanup Program. Prepared technical basis for use of prior data previously disallowed by OER. Currently conducting site investigation.

New York City School Construction Authority Hazardous Materials Contract
Provided work scopes and cost estimates, managed and implemented concurrent projects, including Phase I site assessments, Phase II soil, groundwater and soil gas investigations, review of contractor bid documents, preparation of SEQR documents, specifications and field oversight for above- and underground storage tank removal, and emergency response and spill control.

Former Manufacturing Facility, Hoboken, New Jersey
Evaluated site investigation data to support a revision of the current property use to unrestricted; modified the John & Ettinger vapor intrusion model to apply the model to a site-specific, mixed use commercial/residential development; implemented a Remedial Action Work Plan that included the characterization, removal and separation of 9,500 cubic yards of historic fill; designed and implemented a groundwater characterization/delineation program using a real-time Triad approach; designed and implemented an innovative chemical oxidation technology for the property.

F**ormer Varnish Manufacturer – Newark, New Jersey**
Prepared a Phase I environmental site assessment; implemented soil and groundwater sampling to assess presence of petroleum and chlorinated compounds; prepared alternate cost remediation scenarios for settlement purposes and implemented a groundwater investigation plan, including pump tests and piezometer installation to assess the effect of subsurface utilities and unique drainage pathways upon contaminant transport.

Education and Certifications

Professional Engineer, New York
Bachelor of Engineering, Environmental; Stevens Institute of Technology, 2002
Bachelor of Science, Chemistry, New York University, 2002
Technical and Regulatory Training in Underground Storage Tanks, Cook College, Rutgers University, 2006