OPERATION AND MAINTENANCE PLAN (REV. 2019-01)
NORTH SHORE AT MANDALAY BAY
198 SOUTH HARBOR BOULEVARD
OXNARD, CALIFORNIA

Prepared for

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Project Number S041.001.001

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ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
Arcadis	Arcadis U.S., Inc.
bgs	below ground surface
CDFW	California Department of Fish and Wildlife
CDP	Coastal Development Permit
CEQA	California Environmental Quality Act
CLRRA	California Land Reuse and Revitalization Act of 2004
COC	constituent of concern
CQAQCP	Construction Quality Assurance Quality Control Plan
CVOC	chlorinated volatile organic compound
cy	cubic yard(s)
DCA	dichloroethane
DCE	dichloroethene
DNAPL	dense nonaqueous-phase liquid
DTSC	Department of Toxic Substances Control
Environmental CC&Rs	Environmental Covenants, Conditions, and Restrictions
EPA	U.S. Environmental Protection Agency
FS/RAP	Feasibility Study and Remedial Action Plan
GAC	granular activated carbon
HOA	homeowners' association
ICS	Innovative Construction Services
J&E	Johnson and Ettinger
J&H	J. & H. Drilling Co., Inc.
LFR	LFR, Inc.
LUC	Land Use Covenant
milkvetch	Ventura Marsh milkvetch
mg/L	milligrams per liter
MPL	MPL Property Holdings, LLC
MNA	monitored natural attenuation
MRP	Monitoring and Reporting Program

msl	mean sea level
NEC	Northshore Environmental Conservancy, Inc.
O&M	operation and maintenance
O&M Plan	Operation and Maintenance Plan
OEM	original equipment manufacturer
P&ID	Process and Instrumentation Diagram
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PID	photoionization detector
PLC	programmable logic control
PMW	permanent monitoring well
PRACR	Partial Remedial Action Completion Report
PTDR	Vapor Extraction Pilot Test Design Report
QA/QC	quality assurance/quality control
RAO	Remedial Action Objective
RPO	Response Plan Objective
RDIP	Remedial Design and Implementation Plan
RI	Remedial Investigation
RMW	remedial monitoring well
RPA	Resource Protection Area
RW	remedial well
RWQCB	Los Angeles Regional Water Quality Control Board
SCA	Soil Consolidation Area
scfm	standard cubic feet per minute
Site	90 acres of land situated at the northeast corner of the intersection of Harbor Boulevard and West Fifth Street in Oxnard, California
SoundEarth	SoundEarth Strategies California, Inc.
SRP	Site Responsible Party
SVE	soil-vapor extraction
SVE Design Report	Soil-Vapor Extraction Pilot Test and Design Report
SVOC	semi-volatile organic compound

SWRCB	State Water Resources Control Board
TCE	trichloroethene
TPH	total petroleum hydrocarbon
TSCA	Toxic Substances Control Act
VCAPCD	Ventura County Air Pollution Control District
VFD	variable frequency drive
VIM	Vapor Intrusion Mitigation
VOC	volatile organic compound

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CERTIFICATION

All geologic information, conclusions, and recommendations in this document have been prepared by a California Professional Geologist.

January 30, 2019

Melissa C. Schuetz, PG — Date
Principal Geologist

All engineering information, conclusions, and recommendations in this document have been prepared by or under the direction of a California Professional Engineer.

January 30, 2019

Charles E. Robinson, PE — Date
Principal Engineer

**A professional's certification of conditions, designs, and methodologies comprises a declaration of his or her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations, and ordinances.*

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1.0 STATEMENT OF PURPOSE–O&M PLAN

This Operation and Maintenance Plan ("O&M Plan") has been prepared by Terraphase Engineering Inc. (Terraphase) for the North Shore at Mandalay Bay property ("the Site") and presents the policies and procedures for long-term operation and maintenance (O&M) for environmental obligations at the Site, including long-term groundwater monitoring, soil vapor extraction (SVE), vapor intrusion mitigations built into building foundations, and Soil Consolidation Area (SCA) inspection and monitoring activities. The O&M Plan is a living document and will be updated as needed. Figure 1 presents the Site location map.

1.1 Site-Wide Remedial Action Objectives

The status of actions completed and those still required to meet site-wide and media-specific Remedial Action Objectives (RAOs) that were originally included in the Feasibility Study/Remedial Action Plan (FS/RAP) approved by Department of Toxic Substances Control (DTSC) in 2006 were summarized in the Partial Remedial Action Completion Report (PRACR; Arcadis 2013b) approved by DTSC in 2013. Terraphase prepared a January 4, 2019, Response Plan that presented response action objectives (RPOs) for remaining actions identified in the PRACR (Terraphase 2019a). The purpose of this O&M Plan is to provide the ongoing monitoring data and O&M requirements and procedures in order to continue to maintain remedial and mitigation systems and track the progress and efficacy of the remaining actions described in the Response Plan.

Media-specific RPOs for native soils and groundwater, including remaining vapor risks, are generally discussed in the applicable section of this O&M Plan. The Response Plan, as well as the PRACR, Remedial Investigation (RI), FS/RAP, and Remedial Design and Implementation Plan (RDIP) provide greater detail and history of the Site's remedial history.

1.2 Goal and Objectives

The primary goal of this O&M Plan is to define ongoing remedial monitoring obligations and O&M requirements to establish procedures for maintaining, evaluating, and documenting long-term remedial effort progression consistent to achieve RPOs. In order to accomplish this goal, this O&M Plan addresses the following objectives:

- Define remaining O&M and monitoring procedures and obligations.
- Establish a single comprehensive O&M program to demonstrate the progression toward achieving RPOs.
- Provide for record-keeping and reporting to future residents and other users of the Site, DTSC, Los Angeles Regional Water Quality Control Board (RWQCB), the current and future Site Responsible Parties (SRPs), and the Community Facilities District that will be formed to levy and collect taxes, which will be used to underwrite the implementation of this O&M Plan.

Costs to implement the O&M scope defined herein are being provided to DTSC under separate cover.

A Contingency Plan to this O&M Plan (Contingency Plan) that addresses an unanticipated need for additional response actions is included as Appendix A.

1.3 Entities, Roles, and Responsibilities

The various entities listed below have the following roles and responsibilities with this O&M Plan.

1.3.1 Site Responsible Party

The SRP is MPL Property Holdings, LLC (MPL), the Site's current owner. MPL is entering into a California Land Reuse and Revitalization Act of 2004 (CLRRA) Agreement to perform the Response Actions described in the Response Plan and this O&M Plan. MPL will continue in this role until such time that DTSC approves a future replacement SRP or provides MPL a Certificate of Completion. The SRP will regularly update DTSC on the status and progress of the Response Actions, including those detailed in this O&M Plan.

The SRP will retain, manage, and oversee environmental and other consultants or professionals and/or contractors to implement, or assist in the implementation of, the Response Plan and O&M Plan and requirements to maintain the Resource Protection Area (RPA) in accordance with Site conditions, as defined in the Site's Environmental Impact Report conditions. Further, the SRP shall work with the Project Professional (described in Section 1.3.2) to evaluate progress of the O&M Plan and other Response Actions annually to maintain achievement of RPOs.

1.3.2 Project Professional

The SRP shall designate an individual or individuals (Project Professional) professionally capable and responsible for implementing the obligations of this O&M Plan. The responsibilities of the Project Professional include, but are not limited to, overseeing the management and implementation, of the following activities on behalf of the SRP:

- Review and accept professional responsibility for the vapor intrusion mitigation (VIM) design Construction Drawings peer review and installation oversight.
- Oversee and/or conduct routine and emergency inspections and Five-Year Review.
- Oversee and/or conduct maintenance and repairs, and any modifications of all long-term O&M systems described in this O&M Plan.
- Direct preparation and sign Annual Inspection Summary Reports and Five-Year Review Reports.
- Prepare and sign Completion Reports for intrusive work activities (Section 8.0).

1.3.3 Builder(s)

Merchant Builders will construct the residences. The Builders will install VIM systems in accordance with the final VIM design to be completed by the Builder's professionals (VIM Designer) who integrate the January 30, 2019, VIM Systems Design and Construction Plan (Terraphase 2019b) with the Builder's architectural and structural residence designs. This final design (Construction Drawings) shall be reviewed, and after necessary revisions are implemented by the VIM Designer, approved by the Project Professional for each residence. The Project Professional shall direct the Quality Assurance/Quality Control of the VIM systems construction in accordance with the Construction Quality Assurance Quality Control Plan (CQAQCP) to be devised by the Builder's VIM Designer in accordance with the VIM Systems Design and Construction Plan, which is to be reviewed and approved by the Project Professional. The VIM Systems Design and Construction Plan includes the Vapor Intrusion Mitigation and Remote Date Sensing System Design Standards and Construction Guidelines for the Builders. The final approved Construction Drawings and CQAQCP will serve as the project's binding documents once completed and approved by the Project Professional.

1.3.4 Homeowners and Homeowners Associations

As indicated in the Environmental Covenants, Conditions, and Restrictions (Environmental CC&Rs), the homeowners' association or associations (HOA[s]) and owners of homes constructed on the Site will be required to comply with the Environmental CC&Rs, which the SRP will enforce. The Environmental CC&Rs (a) prohibit the HOAs and each owner from modifying, damaging, removing, or tampering with, in any manner, the VIM systems, the SVE and vapor monitoring systems, the groundwater wells and monitoring systems, the SCA access restrictions, SCA Caps, and all other long-term O&M-related infrastructure (O&M Systems[1]); and (b) require the HOAs and each owner to provide the SRP cooperation, electrical power, and access to the O&M Systems to operate, maintain, repair, replace, and/or enhance mechanical, electrical, and other elements of these systems. The HOAs and homeowners will be required to cooperate with the SRP in ensuring compliance with the Environmental CC&Rs.

1.3.5 DTSC as Lead Agency

DTSC is the current and anticipated future lead regulatory agency for remedial and response matters under the Response Plan and CLRRA Agreement and will oversee the SRP performance of the O&M activities described in this O&M Plan. DTSC will review and approve reports and other updates, conduct inspections, and may consider and approve how and when O&M activities may be modified, reduced, or terminated, including implementation of contingencies in cooperation with the SRP.

[1] "O&M Systems" as defined in the land use covenant (LUC) are those systems installed on the Site as required and/or approved by the DTSC or any other regulatory body with jurisdiction over remediation of the Site for purposes of carrying out the O&M Plan, including, without limitation, the VIM Systems (with associated barriers, fans and monitoring devices), groundwater monitoring wells, SCA soil caps and access controls, the SVE system, any and all monitoring wells, probes, piping, and other associated infrastructure.

1.3.6 Additional Regulatory Agencies

Other regulatory agencies include:

- RWQCB administers Waste Discharge Requirements that evaluate potential water quality impacts from the enhanced attenuation substrate injections and oversee the associated implementation of the groundwater monitoring and reporting program (MRP). The MRP requirements are considered short term and are not part of the O&M Plan. Additionally, the RWQCB is a key commenting agency to the DTSC for groundwater issues.

- The U.S. Environmental Protection Agency (EPA) has additional jurisdiction governing chemical substances on this Site through the Toxic Substances Control Act (TSCA) for the soils containing residual polychlorinated biphenyls (PCBs) within the SCAs.

- State Water Resources Control Board (SWRCB) sets standards for compliance with applicable SWRCB Title 27 monitoring requirements, which are reflected in the O&M Plan.

- The Ventura County Air Pollution Control District (VCAPCD) regulates the discharge of the treated SVE vapor discharge under a permit to operate, with regular reporting of the treated vapor effluent.

- California Department of Fish and Wildlife (CDFW) and/or City of Oxnard oversees activities related to the Ventura Marsh milkvetch (milkvetch) monitoring and maintenance. The milkvetch monitoring requirements are an SRP responsibility, monitored for compliance by the CDFW. See Appendix B for a summary of the milkvetch activities and obligations.

Governmental agencies will provide comment and input to DTSC, as appropriate, to consider in DTSC's role as lead agency.

1.4 Document Organization

The remainder of this report is organized as follows:

- **Section 2.0, Site Description.** This section includes a physical description of the Site and the geology and hydrogeology of the Site.

- **Section 3.0, Site History.** This section provides a brief overview of the operational history of the Site, the current Site conditions, and the approved Site uses. Additional information on the previous investigations and regulatory determinations along with groundwater monitoring history and soil-vapor sampling history is provided in the Response Plan.

- **Section 4.0, Site-Wide Groundwater Monitoring Operation and Maintenance Activities.** This section describes the procedures and protocols for annual groundwater O&M activities.

- **Section 5.0, Soil-Vapor Extraction System Operation and Maintenance Activities.** This section describes the procedures and protocols for periodic O&M activities during the operation of the SVE system.

- **Section 6.0, Vapor Intrusion Mitigation Operation and Maintenance Activities.** This section describes the procedures and protocols for monitoring the VIM systems.

- **Section 7.0, Soil Consolidation Areas Operation and Maintenance Activities.** This section describes the procedures and protocols for semiannual inspections of the SCA cap system and annual groundwater sampling.

- **Section 8.0, Intrusive Work Activities.** This section provides procedures to be followed during Site grading and utility installation activities at the Site.

- **Section 9.0, Response for Unplanned Events.** This section describes the procedures to be followed in the event of an earthquake, flood, or fire. Emergency Response Inspection Forms are included in Appendix C.

- **Section 10.0, Five-Year Review and Inspection.** This section describes the procedures and protocols for five-year reviews.

- **Section 11.0, Reporting and Record Keeping.** This section provides the format and frequency of reporting and record keeping. Field Inspection Forms are included in Appendix D.

- **Section 12.0, Site Access.** This section identifies the Site access procedures.

- **Section 13.0, Variance from, or Modification to, O&M Plan.** This section describes the procedure to be followed to modify this O&M plan.

- **Section 14.0, References.** This section provides a list of the source materials used in the development of this O&M Plan, as well as historical Site documents.

The Contingency Plan and other supporting documentation are included as appendices to this report.

2.0 SITE DESCRIPTION

2.1 Physical Description

The Site consists of an irregularly shaped area of approximately 90 acres of land situated at the northeastern corner of the intersection of Harbor Boulevard and West Fifth Street in Oxnard, California. The Site is relatively flat, with elevations ranging from 10 to 70 feet above mean sea level (msl) and is located approximately 1,700 feet from the Pacific Ocean. The Site is bordered on the northeast and east by a strip of property on which a canal (the "MRT Canal"—also known as the "Mandalay Canal," "Edison Canal," and the "Reliant Energy Canal") flows from an ocean inlet to the south with cooling water and discharges back to the ocean through a nearby electric generation power plant. An undeveloped tract of land, owned by Reliant Energy, bounds the northwestern portion of the Site. The recorded Site map is included in Appendix E.

2.2 Site Geology and Hydrology

The generalized conceptual geologic model prior to Site grading included sand (dune sand) from ground surface to depths of approximately 15 to 20 feet below ground surface (bgs), an approximate elevation 10 feet msl. An approximate 10-foot-thick clayey silt layer ("the clayey silt") occurs below the sand, from an approximate elevation of 10 feet to 0 feet msl. The clayey silt grades into a clay ("the basal clay") located at the bottom of the layer at an approximate elevation of 2 to 4 feet msl. At the top of the basal clay within the clayey silt, occasional sand stringers are present and perched water zones are encountered. Below the basal clay is an approximately 10-foot-thick sand layer ("the upper beach sand"), underlain by an approximately 5-foot-thick clayey silt layer, and then the lower beach sand. The upper and lower beach sand layers are the first water-bearing aquifers with advective transport. The upper and lower beach sands are in hydraulic communication with the canal and are tidally influenced.

Remedial and geotechnical measures included the excavation, movement, and compaction of soils throughout the Site. Engineered fill is present throughout the portions of the Site designated for residential use to depths of 5 to 25 feet bgs. In general, fill material is present to greater depths in the western portion of the Site.

The Site groundwater has little advective flow as two local recharge sources, the adjacent MRT Canal to the northeast, and the Pacific Ocean to the southwest readily flow to and from Site groundwater. Both of these sources are saline, causing the Site's groundwater to also be saline, as discussed in the Remedial Investigation Report (LFR Levine Fricke 2005), FS/RAP (LFR 2006), and the RDIP (LFR 2007). As a result of the influence of the MRT Canal and the Pacific Ocean, groundwater gradients at the Site are relatively flat and tidally influenced, with little flow, and reside at approximate elevations of -1 to 2 feet above msl.

Data from recent groundwater sampling events indicate that groundwater is present at depths of approximately 20 feet below the top of the well casings, with elevations ranging from approximately 2 to 8 feet msl. Groundwater gradients generally mildly slope toward the MRT Canal in the northern/eastern portion of the Site. Groundwater near the MRT Canal is tidally influenced and can typically fluctuate 2 to 3 feet.

Based on historical piezometric data and cone penetration test data, it appears that the regional groundwater gradient toward the ocean is interrupted by the MRT Canal. The MRT Canal also serves as a localized drain of Site water, reversing the groundwater gradient from the central portion of the Site back toward the canal.

The MRT Canal has been periodically dredged for maintenance purposes to an approximate working depth of -10.0 feet msl. The operating water elevation in the MRT Canal is 0.5 foot msl, which fluctuates with the tide. Based on the Site lithology, the dredging would be expected to have removed the aquitard over a width of 40 feet along the entire eastern and northern boundary of the Site. As a result, the lower beach sand aquifer became the hydrostatic minimum, enabling the Site to drain both to the west and to the east. The depth of the MRT Canal intersects the lower beach sand aquifer, causing regional groundwater from the east and water from the Site to slowly discharge to the canal rather than to the ocean.

While in a typical coastal setting, the area behind the dunes is characterized by upward groundwater gradients, the presence and subsequent deepening of the canal reversed the vertical groundwater gradient at the Site and increased the salt content in Site groundwater to levels not suitable for potable use. The pre-canal upward groundwater gradients were relieved by the canal construction, effectively lowering the Site's historical groundwater levels to the relatively lower elevations observed today. Some of the Site's perched water continues to be draining to the current groundwater elevation and is the remnant of the higher elevation groundwater conditions that existed before the canal effectively drained the Site's groundwater.

3.0 SITE HISTORY

3.1 Site Operational History

Prior to 1949, the Site was not extensively used. From 1954 to 1981, the Site operated as the former Carney and Son and JNJ Waste Disposal Facilities, which were permitted oil field waste disposal facilities. Various oil field waste materials (drilling mud and cuttings, tailings, sand, formation water, residual oil, and other chemical compounds) were disposed of at the Site during this time period. In the mid-1980s, the residual oil-affected drilling muds at the historical permitted landfill were covered with a 3- to 4-foot-thick soil fill/cap composed primarily of non-residual oil-affected drilling mud. The Site has not been actively used for any purpose since 1982.

3.2 Previous Investigations and Regulatory Determinations

Beginning in approximately 1991, developers began considering the Site for future residential development. In December 1996, following Site characterization efforts, a remedial action plan for the Site was submitted to and approved by the RWQCB, which was the lead regulatory agency from 1996 through 2004. DTSC has been the lead regulatory agency since 2004. Subsequent work under the oversight of DTSC includes completion of an RI, FS/RAP, RDIP, remedial action, post-remedial action sampling and analysis, Site Conditions Update Report, PRACR, SVE design and implementation (ongoing), disposition of the Site chlorinated volatile organic compound (CVOC) soil treatment stockpile, enhancement of natural attenuation of groundwater, and other ongoing monitoring and operation and maintenance. A summary of previous investigations, remedial activities, and regulatory determinations is presented in the Response Plan and PRACR.

3.3 Site Conditions

The Site conditions are summarized in the Response Plan. Below, a brief summary is provided to provide a general context for the O&M activities outlined herein. Prior remedial actions have greatly reduced residual concentrations of Site constituents of concern (COCs) in soil, groundwater, and soil vapor. Prior to implementation of the Response Plan, the Site conditions included the following:

3.3.1 Soil

Maximum detected concentrations of volatile organic compounds (VOCs) in confirmation soil samples collected from the Site residential areas were below the residential target goals identified as remedial action goals in the FS/RAP. As described in the PRACR, the RAOs for soils have been achieved (Arcadis 2013b). Standard construction protocols for soil management will be implemented during Site grading and utility installation, as described in Section 8.0. Soil-vapor concerns are addressed in Section 3.3.3. Affected soils contained within the SCAs are discussed in Section 3.3.4.

3.3.2 Groundwater

Groundwater remedial activities initiated in and since 2007 with ongoing natural attenuation have reduced the mass of CVOCs in groundwater, enhanced degradation of CVOCs, and reduced the potential for vapor migration from groundwater. Groundwater has been and is in the monitored natural attenuation (MNA) phase of remediation, in accordance with the FS/RAP. The Response Plan and O&M Plan provide monitoring procedures to document MNA progress and contingency measures if determined to be necessary and beneficial.

In 2016, MPL conducted enhanced attenuation efforts at two areas of the Site with elevated groundwater VOC concentrations. Substrate materials were injected into groundwater, which reduced residual VOC concentrations and accelerated ongoing natural attenuation processes.

Site-wide groundwater monitoring will be conducted as described in Section 4.0 of this O&M Plan and is intended to confirm the RPOs for groundwater have been met.

3.3.3 Soil Vapor and Vapor Intrusion Monitoring

Based on its review of the Site Conditions Update and Health Risk Assessment in 2013 (Arcadis 2013a), DTSC approved a Site-specific target cancer risk level of 10 in a million ($1x10^{-5}$) and a target non-cancer hazard index of 1 as risk management goals for the Site (DTSC 2013a). Two areas of the Site containing elevated VOC soil vapors were estimated by risk assessment to exceed residential levels (Section 4.3) and are being additionally remediated to reduce these observed levels. One additional area was identified as requiring additional VIM measures. These measures are described in the Response Plan and include SVE to reduce VOCs in soil vapor in the soil column in a portion of the Site. The SVE O&M is described in Section 5.6 of this O&M Plan.

The SRP will also oversee the design, installation, operation, maintenance and repair of VIM measures on the residential structures (actual installation will be done by the homebuilders under the oversight of the SRP). VIM systems are to be maintained in accordance with the Land Use Covenant (LUC) and Environmental CC&Rs to which each residential parcel and HOA common areas will be subject (see Section 3.4). This engineering control measure serves as a mitigation measure to provide protections to residents. The VIM O&M is described in Section 6.0 of this O&M Plan.

3.3.4 Soil Consolidation Areas

The SCAs were constructed, completed, and received excavated chemically affected soils and materials from other areas of the Site. The primary chemicals of concern included total petroleum hydrocarbons (TPH), PCBs, and barium.

A total of 967,286 cubic yards (cy) of soil (including 826,738 cy of affected soils and sludge and 140,548 cy of cap material, separated by a felt geotextile) was placed in the SCAs during remedial activities in 2007. An additional approximate 11,961 cy of soils with VOC concentrations below industrial screening levels from the ex situ soil treatment stockpile were placed as cap material in 2015 following the ex situ soil treatment stockpile characterization.

The SCA cap also serves as habitat mitigation with indigenous plants established to stabilize the cap and minimize erosion. This habitat mitigation also serves to isolate and protect the Milkvetch Protection Area.

As the soils stored in the SCAs include non-hazardous levels of PCBs, these repositories are also regulated in accordance with TSCA, as included in the remedial actions defined in the FS/RAP and PRACR.

In accordance with SWRCB Title 27 regulations and the FS/RAP, a Site inspection and groundwater monitoring program for the SCAs will be conducted, as described in Section 7.0 of this O&M Plan.

3.4 Anticipated Land Uses, Land Use Controls, and Access

Reasonably anticipated land uses (including the current and projected land use and zoning designations) for the Site include the following, which the City of Oxnard has approved in accordance with Tentative Tract Map No. 5592 (PZ 05-300-8) and related entitlements:

- Single-family detached homes with 183 individual lots
- Condominium residential units with three commonly owned properties
- Streets, sidewalks, and roads
- Open space
- Resource protection and Ventura Marsh milkvetch preservation
- Landscape setbacks
- Surface water conveyance features
- Sewer pump station

These land uses are subject to land use controls that have been developed for the Site and are memorialized in the LUCs and Environmental CC&Rs, which were separately submitted to DTSC. The land use controls contained in the LUCs and Environmental CC&Rs will include, but not be limited to, the following:

- The SRP will approve the Builder's CQAQCP and implement the CQAQCP of the VIM Systems installation, and then operate, maintain, and repair VIM systems on all residences.

- Prohibit the HOAs, each homeowner, and any guest or invitee from: (a) modifying, damaging, removing, or tampering with in any manner of the O&M Systems; (b) preventing or impairing access by the SRP or DTSC to any of the O&M Systems; and (c) preventing or impairing the performance of any of the Response Actions.

- Require the HOAs and each homeowner to provide the SRP electrical power, cooperation, and access to the O&M Systems to operate, maintain, repair, replace, and/or enhance their mechanical, electrical and other elements.

- Require the HOAs to cooperate with the SRP to assist the SRP in ensuring compliance with the Environmental CC&Rs and LUCs.

- Prohibit installation of groundwater extraction wells and groundwater extraction.
- Limit access to the RPA and SCA areas, except for required O&M purposes.

4.0 SITE-WIDE GROUNDWATER MONITORING OPERATION AND MAINTENANCE ACTIVITIES

The RPOs for groundwater as stated in the Response Plan and consistent with the RAOs as established in the FS/RAP, are to (1) reduce CVOC concentrations in groundwater through MNA to attain water quality objectives or MCLs within a reasonable time frame, (2) to prevent ingestion of groundwater with CVOC concentrations in excess of MCLs, and (3) prevent or control exposures to potential residual contaminants in soil-vapor or groundwater using institutional or engineering controls and monitoring.. The proximity to the ocean and the MRT Canal results in saline groundwater at the Site. Any pumping or extraction of this resource would draw additional saltwater into the Site and increase salinity, thus decreasing water quality. Given the lack of demands and saline water quality, attainment of RWQCB-defined water quality objectives (the maximum contaminant levels allowed in drinking water) has been estimated to be achieved over numerous decades, in accordance with SWRCB Resolutions 92-49 and FS/RAP. In view of the substantial, sustained reductions in the concentrations of COCs in the Site's groundwater, and the specified use of MNA as the final remedial step, as well as the Site and regional restrictions on groundwater use (Fox Canyon Groundwater Management Agency 2014), achieving the water quality objectives over a long time period has been accepted by the DTSC and RWQCB to be reasonable and integral to the Site's groundwater objectives.

Groundwater remedial activities previously conducted at the Site included excavation of highly affected soils containing dense nonaqueous-phase liquid (DNAPL), pumping and treatment of groundwater, substrate (Daramend) injection to enhance biodegradation of residuals, and engineered lower permeability fill placement. In accordance with the FS/RAP, groundwater has been in an MNA phase since July 2012 (RWQCB 2012). To enhance this natural attenuation, MPL performed a limited injection of substrate EHC-L and vitamin and bio-augmentation additives into two areas of higher VOC concentration-affected groundwater. This enhancement appears to have accelerated the degradation of VOCs in those areas (SoundEarth 2017b). To date, more than an estimated 98 percent of the original CVOC mass has been removed or destroyed, thereby substantially diminishing remaining threats to water quality, health concerns, and resource damage (SoundEarth 2018).

The need for monitoring is influenced by both the observed rate of degradation and attenuation, as well as the evaluated potential for the water's beneficial use. Natural attenuation will continue as long as contaminant material remains in groundwater. To assess the rate of natural attenuation, groundwater monitoring will continue until such time that the DTSC agrees to cease monitoring based on ongoing test results. State Board Resolution 92-49 and other related resolutions[2] specifically indicate that monitoring need not continue indefinitely nor until water quality objectives are actually achieved, but should continue until it

[2] State Water Resources Control Board Resolution No. 96-079 amending Resolution No. 92-49 Section III A states that the Regional Water Quality Control Board shall concur that the abatement will "have a substantial likelihood to achieve compliance within a reasonable time frame…" and in II B that the remedial burden (including monitoring) "bears a reasonable relationship to the need for the reports and the benefits to be obtained from the reports…"

is determined, based on the monitoring data presented, that water quality objectives will be attained within a reasonable time frame for this Site water.

4.1 Site-wide Groundwater Monitoring O&M Goals and Objectives

Groundwater beneath a portion of the Site is affected by VOCs. The purpose of the Site-wide groundwater O&M is to monitor groundwater concentrations over time, document continuing natural attenuation, and confirm that residual levels continue to meet RPOs. This O&M Plan defines the well network, sampling and analytical parameters, and monitoring schedule in accordance with the Response Plan.

This O&M Plan establishes the following:

- The number and locations of monitoring wells that will be used for evaluation of Site-wide groundwater quality.
- The frequency of monitoring.
- The data requirements for demonstrating MNA performance, including evaluation of the plume extent and plume stability.
- The conditions for increasing or reducing the data requirements and the frequency of monitoring.
- The methods for evaluating water quality trends as well as potential for beneficial uses.
- Alternatives for enhancements and considerations in the event that conditions change and MNA is no longer feasible.

4.2 Groundwater Monitoring and Remediation History

Groundwater monitoring and sampling have been conducted at the Site from the third quarter of 2001 to the present. Groundwater monitoring efforts evaluating Site-wide groundwater quality became focused on the area in the northeastern portion of the Site as additional data were collected during the RI and FS/RAP. The history of groundwater monitoring and remediation activities is described in the Groundwater Conceptual Site Model and Remedial Status Report (SoundEarth 2018a).

4.3 Baseline Groundwater Site Conditions

Groundwater conditions in September 2017 indicate the following:

- The average level of total dissolved solids was in excess the potable limit of 3,000 milligrams per liter (mg/L), as defined by State Board Resolution 88-63.
- In addition to the prevalence of salts, the principal groundwater contaminants at the Site were the following VOCs: vinyl chloride; benzene; xylenes; tetrachloroethene (PCE);

trichloroethene (TCE); 1,1-dichloroethane (1,1-DCA); 1,1-dichloroethene (1,1-DCE); 1,2-dicloroethane (1,2-DCA); cis-1,2-dichloroethene (cis-1,2-DCE); trans-1,2-dichloroethene (trans-1,2-DCE); and 1,4-dioxane.

- The highest concentration of TCE was detected in well RMW-13 at 8.09 micrograms per liter (µg/L); PCE in well PMW-03 at 10.1 µg/L; benzene in well RMW-10 at 4.91 µg/L; 1,1-DCA in well RMW-10 at 113 µg/L; 1,2-DCA in well RMW-10 at 3.35 µg/L; cis-1,2-DCE in well RMW-10 at 42.2 µg/L; trans-1,2-DCE in well RMW-10 at 1.89 µg/L; vinyl chloride in well RMW-10 at 235 µg/L; and 1,4-dioxane in well RMW-10 at 94.6 µg/L.

- Concentrations of these compounds have been declining over the monitoring period. Monitoring will be conducted to confirm that groundwater concentrations continue to decline and that RPOs continue to be met.

Table 1 presents a summary of historical groundwater analytical results. Table 2 presents the construction details of the existing groundwater monitoring wells.

4.4 Site-wide Monitoring Well Network and Frequency

The Site-wide groundwater monitoring network has been established to satisfy the objectives described in Section 4.1 above. The groundwater monitoring well network for Site-wide monitoring includes 18 monitoring wells, with 13 monitored annually and 5 biennially (every other year). The Site-Wide groundwater monitoring well network is shown on Figure 2. The SCA groundwater monitoring well network is discussed in Section 7.0 and shown on Figure 3.

- RMW-10 (annually)
- RMW-11 (annually)
- RMW-12 (annually)
- RMW-13 (annually)
- RMW-14 (annually)
- RMW-15 (annually)
- RMW-04 (every other year)
- RMW-05 (every other year)
- RW-01 (every other year)
- RW-07 (annually)
- RW-12 (annually)
- RW-14 (annually)
- RW-16 (annually)
- RW-17 (annually)
- RW-21 (every other year)
- RW-24 (every other year)
- RW-25 (annually)
- RW-27 (annually)

As stated in Section 1.0, the O&M Plan is a living document and will be updated as needed. This includes adjusting the number and/or locations of monitoring wells in consultation with DTSC based on the data.

4.5 Groundwater Monitoring and Reporting

The groundwater quality and hydraulic monitoring schedule and reporting are described below. The frequency and type of monitoring may be modified in the future, based on discussions and agreements with the regulatory agencies. The monitoring program will be evaluated annually and recommendations for changes to the monitoring program, if any, will be presented in the annual reports. Groundwater sampling procedures are included in Appendix F.

4.5.1 Hydraulic Monitoring

For the long-term, Site-wide O&M program, static water levels for all wells in the monitoring well network will be measured to the nearest 0.01 foot annually (tentatively scheduled for April or May). A figure will be prepared that depicts the groundwater elevation contours and flow direction.

4.5.2 Groundwater Quality Monitoring

Groundwater quality samples will be collected annually (tentatively scheduled for April or May) from 13 monitoring wells and biennially from 5 monitoring wells and analyzed for the following constituents, at a minimum:

- VOCs using EPA Method 8260B
- Total organic carbon using EPA Method 9060M
- Water quality parameters including pH, dissolved oxygen, redox, total dissolved solids, total suspended solids, conductivity, turbidity, and temperature
- Boron and major ions (bromide, chloride, sulfate, nitrate, nitrite, o-phosphate, and sulfide)

These parameters, which include concentration and redox indicators, will be used to evaluate the Site-wide MNA performance.

4.5.3 Groundwater Data Evaluation Methods

The following multiple lines of groundwater data evaluation and methods will be used to evaluate the MNA progress:

- Trend Analysis: Time-concentration data, including individual chemicals of concern, will be plotted and data will be compared to determine if temporal and spatial trends exist within the plume and in surrounding areas. Regression analysis as well as other lines of evidence will be used as appropriate to plot concentrations trends and evaluate if the individual wells or the chemical plume are showing statistically increasing, decreasing, or stable trends.

- Site Conditions Evaluation: Changes in groundwater flow rates, elevations, and directions will be evaluated and considered, as they may relate to plume stability.

- Geochemical Evaluation: Changes in the geochemical setting that may be indicative of changes in biotic or abiotic processes affecting the rate and extent of natural attenuation will be evaluated.

- Contaminant Mass Calculations: The total contaminant mass in groundwater will be estimated to evaluate progress toward contaminant reduction objectives and timelines as outlined in the Response Plan.

4.5.4 Reporting

Groundwater monitoring reports will be submitted to DTSC as part of the annual O&M reporting described in Section 11.0.

4.5.5 Monitoring Well Maintenance and Repair

Wells will be inspected during each monitoring event, as well as following any unplanned (catastrophic) event (noted in Section 9.0). Periodic maintenance activities may include minor well or surface completion repairs, redevelopment to improve flow, or removal of silt buildup or blockages. If damage or disturbance appears to be continuous or excessive, the Project Professional will include that in the annual report to DTSC, along with any repairs or recommendations for corrective actions.

The overall condition of the monitoring wells will be evaluated during the routine sampling events and recorded during routine groundwater sampling. The following maintenance items will be checked:

4.5.5.1 Surface Observations

- Visibility—the well is easily located
- Access—there is a clear path to the well
- Lock—present and not rusted
- Cap—the hinge or threads are working and not damaged
- Well box—bolts are present and the box can be opened and secured
- Identification—the well ID is clearly marked and legible
- Surface seal—observation of cracks in concrete
- Downhole—well casing checked using a mirror or flashlight

4.5.5.2 Subsurface Observations

- Water level—confirm within expected range
- Total depth—compare to previous measurements

4.5.5.3 Groundwater Sample Quality

- Field parameters—confirm within range of historical data
- Analytical results—confirm with range of historical data
- Changes in physical appearance (color, presence of slime or microbial growth)

Well rehabilitation will be considered if well performance (decrease in flow rate, mineralization, etc.) has been reduced significantly. Wells that have been damaged beyond repair will be decommissioned and reinstalled, if necessary.

5.0 SOIL VAPOR EXTRACTION SYSTEM OPERATION AND MAINTENANCE ACTIVITIES

As described in the Response Plan, the RPO for soil vapor is to reduce soil-vapor concentrations through SVE that, without proper installation, testing, and maintenance of mitigation measures, would pose a risk to future residents from potential inhalation of vapors containing CVOCs posing risks greater than 1×10^{-5} and a hazard index (HI) of 1. This objective is expected to be achieved by the operation of the SVE system (reducing existing soil-vapor concentrations) and will be confirmed by soil-vapor monitoring.

5.1 SVE O&M Goal and Objectives

The goals of the SVE O&M are to monitor soil-vapor concentrations over time to provide for the ongoing operation and maintenance of the SVE system and confirm the achievement of the objectives for soil vapor as and when this occurs.

This SVE O&M Plan establishes the following:

- The nature of the system and system components.
- The operational procedures and evaluations to optimize the effectiveness of the SVE operation.
- The means and criteria to evaluate the effectiveness of the SVE.
- The observation and monitoring program that provides the data from which operations and effectiveness are evaluated.
- The maintenance, repair, and replacement guidelines needed to restore damaged system components.
- The protocols and procedures to estimate contaminant mass removal during SVE system operation to determine SVE remediation value and effectiveness.
- The reporting and record keeping requirements for inspections and repairs and reporting to DTSC.

5.2 Soil-Vapor Evaluation History

Multiple soil-vapor evaluations and monitoring events have been conducted at the Site. Based on the considerable iterative characterization efforts, two areas have been identified by DTSC as requiring SVE remediation to diminish observed soil vapors (SoundEarth 2015e; DTSC 2015c): Area A located in the northeastern portion of the Site and Area B located in the southwestern portion of the Site (Figure 4). The conceptual site model is presented in the SVE Design Report (SoundEarth 2016b). The conceptual site model for potential sources of CVOCs in Site soil vapor identifies the following potential sources:

1. Volatilization of low levels of CVOCs in soil used for engineered fill (A and B).
2. Residual native CVOC-affected soil near the margins of the excavation area (Area A).
3. Volatilization of VOC-affected groundwater (Area A).

5.3 Baseline Site Conditions

In April 2015, in consultation with DTSC, SoundEarth installed 42 multi-depth soil-vapor monitoring probes for the purpose of establishing a more complete understanding of Site vapors and to establish a baseline to monitor future planned SVE remedial system performance. The 42 probes and 6 additional existing multi-depth monitoring probes were sampled for VOCs and gasoline using H&P Method 8260SV. The VOC concentrations were compared to Site-Specific Target Levels developed by Exponent with Johnson and Ettinger (J&E) modeling for both cancer and non-cancer risks (Arcadis 2013a).

The results of the 2015 baseline sampling indicated the following:

- 20 probes exceeded risk management goals at the 5-foot depth.
- 6 probes exceeded risk management goals at the 10-foot depth.
- 31 probes exceeded risk management goals at the 15-foot depth.

The estimated cumulative or total cancer risks and non-cancer hazard indices associated with residential exposure to multiple chemicals detected at soil-gas sample locations were compared to Site-specific target cancer risk level of 10 in a million (1×10^{-5}) and a target non-cancer hazard index of 1 for VOCs in soil vapor, identified by DTSC for preliminary screening purposes. The incremental cancer risks for soil-gas samples collected from 2008 through 2015 (not considering the proposed elimination of the exposure pathway by the proposed VIMs) are shown on Figure 5 and Table 3.

5.4 System Design Elements and Details

This section summarizes the construction of the SVE system, including the vapor extraction wells, soil vapor probes, SVE conveyance piping, mechanical equipment, vapor treatment components, and the equipment compound. The SVE system was constructed in general accordance with the Soil Vapor Extraction Pilot Test and Design Report (PTDR) and Construction Quality Assurance Plan (SoundEarth 2016e, 2015f), and subsequent minor field design modifications. DTSC provided approval for design-build construction by a May 19, 2016, approval of the SoundEarth PTDR (DTSC 2016).

The final SVE system as-built drawings are included in Appendix G. The system was constructed from August through October 2016 by SoundEarth, with the subcontractor Innovative Construction Services (ICS), of Santa Ana, California. SVE wells and soil vapor probes were installed by SoundEarth with the subcontractor J. & H. Drilling Co., Inc. (J&H) of Buena Park, California. Construction quality assurance and quality control (QA/QC) monitoring was performed by SoundEarth field personnel as part of the design-build implementation. The

construction of the SVE system, including completing electrical wiring and programming was completed on October 30, 2016.

5.4.1 Vapor Extraction Wells

The SVE system includes a total of 41 SVE extraction wells (Figure 2). The extraction wells for the SVE system include the following:

- Twenty-four extraction wells in Area A (A-SVE-01 through A-SVE-24), constructed to a depth of approximately 20 feet bgs with a 10-foot screen interval.
- Seventeen extraction wells in Area B (B-SVE-01 through B-SVE-17), constructed to a depth of approximately 20 feet bgs with a 10-foot screen interval.

The SVE wells were constructed from August 8 through 16, 2017. The wells were constructed with 4-inch-diameter schedule 40 PVC casing and were screened from approximately 10 to 20 feet bgs. Wellheads were constructed with vaults suitable for non-traffic areas, at elevations consistent with future development plans. The vaults may be adjusted to reflect the final ground elevation during site development. Wellheads include ports for vacuum and airflow monitoring and for vapor sample collection.

5.4.2 Soil Vapor Probes

Soil vapor probes are being used to monitor concentrations of VOCs in soil vapor and to measure the induced vacuum as a result of operation of the SVE system. In total, there are 47 soil vapor probes installed in the vicinity of the SVE extraction wells in Area A and Area B that can be used to monitor the SVE system. These soil vapor probes are listed below:

Area A

- Three multi-depth vapor monitoring wells (MB-96, MB-103, and MB-120) installed by Arcadis in Area A in October 2012.
- Twenty-three multi-depth vapor monitoring wells (P-SG-01 through P-SG-23) installed by SoundEarth in Area A in April 2015.

Area B

- Two multi-depth vapor monitoring wells (MB-11 and MB-29) installed by Arcadis in Area B in October 2012.
- One multi-depth vapor well (NS-11) installed by SoundEarth in in Area B March 2015.
- Eighteen multi-depth vapor monitoring wells (P-SG-24 through P-SG-41) installed by SoundEarth in Area B in April 2015.

The soil vapor probes were completed with sample probes either at 5 and 15 feet bgs or at 5, 10, and 15 feet bgs. Soil vapor probes included an airtight valve attached to the end of the probe and each soil vapor probe is labeled with an identification tag that indicates the probe identification and the probe depth. The probes were completed with either a flush mounted well box or completed with excess tubing and a PVC protective casing for future completion during development.

5.4.3 SVE Conveyance Piping

The SVE conveyance piping was installed such that extracted air flows from each well, through 2-inch-diameter pipe to branches of 4-inch-diameter pipe, and into trunk lines of 6-, 8-, or 10-inch diameter pipe, depending on the number of extraction wells feeding the trunk line and the lineal distance from the compound. There are two primary conveyance piping runs, one each from Area A and Area B, which lead to the remediation compound. The piping was constructed of Schedule 40 PVC pipe and fittings buried underground.

All pipes were sloped toward the extraction wells or toward one of four buried moisture collection sumps to avoid moisture collection in the vapor extraction conveyance piping. The moisture collection sumps are constructed of 12-inch-diameter Schedule 40 PVC pipe, installed vertically, and are connected to the trunk lines by 4-inch-diameter Schedule 40 PVC pipes. The invert of each sump is approximately 4 feet below the invert of the trunk line adjacent to each sump. The sumps are fitted with submersible pumps activated by float switches to pump accumulated water through 1-inch-diameter Schedule 40 PVC piping to the condensate storage tank at the treatment compound.

SVE piping invert elevations and locations were coordinated with MPL's civil engineer, Stantec, Inc., for integration with future utility infrastructure for the proposed development to avoid conflicts with other planned subsurface utilities. Pneumatic leak testing of the pipe was performed prior to backfilling trenches. The trenches were backfilled and compacted with excavated soil. The compaction was tested and confirmed by MPL's geotechnical engineering firm. Metallic warning tape was placed in the backfill above all belowground SVE piping to assist in pipe location to provide protection from future excavations. The vacuum and flow rate at each well is controlled by individual valves in access vaults that are located in public rights-of-way.

The primary piping from Area A and Area B are connected to a manifold at the SVE treatment compound leading to the three vacuum blowers. Inlet pipes at the manifold include sample ports for measurement of vacuum, collection of vapor samples, and measurement of flow rates. Piping downstream from the manifold includes condensate moisture separators or "knockout pots," temperature indicators, vacuum relief valves, dedicated thermal air velocity transmitters, and sample ports for collection of vapor samples. Silencers are installed downstream from the vacuum blowers, before the vapor filtration vessels. There is a single 8-inch-diameter Schedule 40 PVC discharge stack that is a minimum of 13 feet high in accordance with the air pollution control district (APCD) permit.

5.4.4 Treatment System Compound

The SVE system compound was constructed in the northeastern portion of the Site between the Soil Consolidation Area and the MRT Canal (Sheet 4, Appendix G). The compound includes the extraction equipment, vapor treatment vessels, and a condensate storage tank. All vapor extraction equipment including the controls, the vapor manifold, knockout pots, and blowers were constructed inside a steel Conex box or "shipping container" with lockable doors. The three air-to-air heat exchangers, installed on the roof of the Conex box, two backup condensate water containers, and the granular-activated carbon (GAC) vessels are the only system components that are installed outside of the Conex box. Security fencing with lockable gates and barbed wire was constructed around the Conex box, the backup condensate water containers and the GAC vessels (Sheet 7, Appendix G). Emergency contact information is included on the security fence.

5.4.5 SVE System Blower

The SVE extraction blowers are three Sutorbuilt Legend 5LR blowers, connected in parallel for redundancy and flow rate flexibility, which are each capable of providing a flow rate of 520 standard cubic feet per minute (scfm) and a nominal vacuum of up to -14 inches of mercury (in. Hg)[3]. The blowers are each powered by 15 horsepower motors that are each equipped with variable frequency drives (VFDs) to provide control of blower throughput and energy consumption.

5.4.6 Vapor Treatment

The extracted vapors are treated with a total of four GAC vessels, two parallel pairs of two vessels in series. Sample ports and pressure indicators are located before and after each vessel that allow for vapor sampling and to monitor compliance with the APCD permit. The initial fill of GAC for the vessels consisted of a total of 4,000 pounds, 1,000 pounds per vessel that was provided by Slaby Environmental, Inc. of Capistrano Beach, California.

5.4.7 System Monitoring and Controls

5.4.7.1 Emergency System Shut Down

The SVE system is equipped with an emergency stop push-button for manual system shutdown, if necessary.

5.4.7.2 System Controls and Communication

System control and communications are provided by a programmable logic controller (PLC), which is programmed to control critical system operations. An Internet connection allows remote monitoring of critical system operational parameters and also facilitates remote modifications of system operations. Regular emails are sent from the PLC with critical system data such as flow rate, influent and effluent photoionization detector (PID) readings, and

[3] Values less than atmospheric pressure (vacuums) are shown as negative values.

airstream temperatures. The PLC is programmed to send text and email notifications of alarm conditions that require attention such as SVE system shut down, condensate high water levels, and flow rates or temperatures outside of normal operating conditions.

5.5 Mechanical Component Maintenance and Remote Monitoring and Operation

The SVE vacuum blower and treatment system require regular maintenance in accordance with the original equipment manufacturer (OEM) guidelines to ensure ongoing and reliable system performance, and to maintain the warranties associated with each component. The SVE systems mechanical components requirements for O&M are detailed in Appendix H.

5.6 SVE O&M Monitoring Procedures

Performance and process monitoring is being conducted during SVE system operation to evaluate overall COC mass reduction, system effectiveness, and RAO/RPO attainment. The specific scope, methodology, and objectives of the sampling program and operational decisions are summarized below.

5.6.1 Performance Monitoring

Performance monitoring monitors and assesses the remedial performance of the SVE system. Performance monitoring includes the following:

1. **SVE Vapor Stream Monitoring**. Performance monitoring data from the SVE vapor stream, before passing through the vapor-phase GAC will be used to estimate and assess the systems COC mass removal rates and estimate cumulative COC mass removed from the Site's soil-vapor phase. Monitoring will consist of the following:

    a. Measurement of COC concentrations from the SVE well field vapor stream.

    b. Measurement of the total SVE well field flow rate.

    c. Estimation of the COC mass removal rates at each monitoring event using the COC vapor concentration and SVE flow rate.

    d. Estimation of the cumulative VOC mass removed using the average COC mass removal rate and the length of time elapsed between monitoring events.

    e. The observed reduction of mass removal rate shall be graphically represented to facilitate evaluations of the ongoing value of the SVE effort.

2. **Soil Vapor COC Concentration and Site Mass Estimates**. Soil-vapor sampling data will be used to assess reductions in soil-vapor concentrations in Areas A and B.

    Based on these measurements, estimates will be made of the remaining mass in the vadose zone of Areas A and B, and these reductions compared to the removed vapor stream mass estimated in number 1, above. Data from the soil-vapor sampling conducted in April 2015 will serve as the estimated COC mass baseline.

3. **Soil-vapor sampling**. There are currently 41 SVE wells installed as part of the SVE system. Soil-vapor sampling has been conducted at all SVE wells and selected vapor probes at startup and during the SVE system operation to gain understanding of the relative VOC contribution from the different SVE wells. This data is used to evaluate changes in VOC concentrations over the operating duration of the SVE system, which will be used to indicate treatment progress in Areas A and B. It should be noted that not all 41 SVE wells, nor all vapor probes, will be sampled during each sampling event. Rather, strategically selected sample locations will be sampled. This provides flexibility to monitor those locations where elevated risks may continue to be present, or to discern if some areas no longer require SVE treatment. Figure 4 shows the locations of the SVE wells and vapor probes. Soil-vapor sampling will consist of the following:

    a. Periodic field screening for total VOCs, oxygen, and flow rate at each SVE wellhead and vapor probe using a PID, field gas instrument, and field velocity meter, as appropriate to facilitate operational decisions.

    b. Annual sampling of soil vapors for laboratory analysis at selected SVE process, wellheads, sub-slab vapor probes (after their construction), and vadose zone vapor probes. Soil-vapor sampling procedures are included in Appendix F.

    c. Radius of influence, as indicated in observed pressure reductions in the soil vapor probes, were evaluated during startup that facilitated system adjustments of flow and pressure through the valve and blower systems to effect desired extraction over the area of concern.

5.6.2 Process Monitoring

The objective of process monitoring is to evaluate the mechanical performance of the system to ensure that equipment is operating as designed, track system operating conditions, and identify potential areas for system optimization. The process and instrumentation diagram (P&ID) for the SVE system is shown on Figure 6. Process monitoring data from the SVE process will be used to evaluate the mechanical performance of the equipment and will consist of the following:

1. Monitoring of system vacuums/pressures, flow rates, and temperatures
2. Monitoring vacuum/pressures and flow rates at wellheads
3. Monitoring vacuum/pressures observed at vapor points
4. Monitoring water/condensate (e.g., totalizer readings)

5.6.3 Compliance Monitoring

The objective of compliance monitoring is to satisfy the VCAPCD air discharge permit requirements. In accordance with VCAPCD requirements, the compliance monitoring includes vapor treatment sampling. Vapor/air discharge sampling will be performed on the carbon vessel influent mid-point and effluent measured by PID to assess treatment of extracted soil vapor by

the SVE unit(s) prior to discharge to atmosphere and to demonstrate compliance with the VCAPCD. Discussions with VCAPCD suggest that the first year of operation will require frequent sampling (daily initially, followed by less frequent sampling). The estimated annual O&M budget assumes that monthly PID sampling will be required following the first year of operation.

5.6.4 System Shut Down and RPO Attainment

The below procedures and approach will be used to evaluate when RPOs for soil vapor risk have been successfully abated to achieve the Site's RPOs.

1. The SVE system will be operated as described above. Initial shutdown of the SVE system will be determined via multiple lines of evidence, including indications that RPOs for soil vapor have been achieved through risk assessment to verify resident CVOC risk exposure of less than $1x10^{-5}$ cancer risk. Other lines of evidence and evaluation include evaluation of the mass flux rates being removed over time; and evidence that extracted COC mass flux rates have achieved asymptotic removal rates. Should sub-slab and other vapor probes yield vapor results that are evaluated to pose a risk less than $1x10^{-5}$ cancer risk, consideration will be given to stopping SVE efforts in that vicinity. The SVE system may continue to operate on part of the Site while being shut down on another part of the Site.

2. RPO attainment will be evaluated using multiple lines of evidence, including CVOC soil-vapor sampling results collected from selected monitoring probes where previous risks were observed.

3. Rebound testing will be conducted to confirm that the SVE system is ready to be shut down, or if pulsed operation could prove beneficial. For each test, the SVE system will be shut down and the subsurface will be allowed to re-equilibrate for at least 2 weeks without the SVE extracting vapors in the rebound area. Soil gas measurements will be made at the SVE wells and monitoring probes in the area where potential vapor intrusion risks are being evaluated.

4. To assess progress with meeting RPOs, measurement of vapor concentrations using sub-slab, or soil probes at 5, 10 or 15 feet bgs. Applicable attenuation factors will be applied to the results in close consultation with DTSC. Sampling protocols will consider

5. Rebound testing will be conducted over an extended period of time, as approved by DTSC, to evaluate whether unacceptable soil-vapor concentrations rebound in the absence of active SVE. The first test will be conducted 1 month after SVE shutdown. A second test will be conducted 3 months after SVE shutdown, and a third test will be conducted 6 months after SVE shutdown. Results of the soil-vapor samples collected during the rebound testing will be evaluated using Site-specific conditions and most current regulatory practices at the time of closure to meet the RPOs. Lacking Development or Site-specific attenuations, concentrations shall be multiplied by a conservative slab attenuation factor based on current literature and agency practice and then compared to risk-based levels for residential indoor air. In addition, building-

specific attenuation will be estimated using naturally occurring radon in soil gas. Attenuation factors will be updated in accordance with current practices in consultation with DTSC.

6. If rebound occurs to equal or above risk based levels at these locations during either of the phases of the rebound testing (either at 1 month, 3 months, or 6 months), the SVE system will be restarted and SVE will continue as indicated in this O&M Plan until acceptable risk levels have been achieved or until there is no appreciable benefit to continuing with the SVE.

7. Once an area has been determined to have achieved acceptable vapor levels and with DTSC concurrence and approval, the SVE system shut down in that particular area and confirmation monitoring will commence. It should be noted that part of the SVE system may remain active in one area while it is shut down in another area(s), if the data support shutting down parts of the system footprint.

8. Post-SVE monitoring will then commence. Post-SVE monitoring includes monitoring soil gas concentrations annually using sub-slab and soil vapor probes. Post-SVE monitoring will continue until approved for discontinuation by the DTSC (estimated for a period of 10 years for cost estimating purposes).

6.0 VAPOR INTRUSION MITIGATION OPERATION AND MAINTENANCE ACTIVITIES

As described in the Response Plan, the RPOs for vapor intrusion are to (1) prevent indoor vapor intrusion of CVOCs at concentrations in excess of a total excess cancer risk of greater than 1 x 10^{-6} and HI of 1, and (2) prevent or control exposures to potential residual contaminants in soil-vapor or groundwater using institutional or engineering controls and monitoring. These objectives are expected to be achieved by the operation of the SVE system (reducing existing soil-vapor concentrations as described in Section 5.0) and through the installation, operation, maintenance, and monitoring of VIM systems at future residences.

The following sections clarify and define the operation, maintenance, and responsibility for the future Site residential VIM systems, constructed in accordance with the Site covenants and the VIM Systems Design and Construction Plan (Terraphase 2019b). The third-party residence builders (the Builders) will engage a VIM Designer to incorporate the designs and requirements included in the VIM Systems Design and Construction Plan into VIM Construction Drawings consistent with the Builder geotechnical and structural designs. The Project Professional will review and approve the VIM Construction Drawings. In addition, the VIM Designer will devise suitable CQAQCPs for Project Professional approval that will incorporate the Builder's construction constraints and final designs as well as the VIM plans and specifications in the VIM Systems Design and Construction Plan, for Project Professional approval. When these approvals are provided, the Builders shall cooperate with the SRP for the Project Professionals implementation of the CQAQCP. With the successful implementation of the Building Construction and CQAQCP by the Project Professional, the SRP will gain responsibility for the operation and maintenance of the VIM Systems.

Testing of the VIM will be conducted in accordance with the VIM Systems Design and Construction Plan and the VIM Designer's CQAQCP to document that construction was implemented successfully. O&M will commence following installation and certification of proper operation of the VIM systems as provided in the CQAQCP.

6.1 VIM O&M Goals and Objectives

VIM is a Response Action included in the Response Plan, and this O&M Plan provides steps to both install and maintain the vapor barrier function. This O&M Plan provides guidelines, record-keeping, and reporting for timely repairs and replacement of the VIM system components to maintain and restore effective operation to VIM systems and monitoring elements. VIM system construction will be completed by the builder as part of their residence construction. Following the geotechnical and structural design by the builder, the builder will engage a VIM Designer to devise Construction Drawings necessary to facilitate the construction of the VIM Systems in accordance with the VIM Systems Design and Construction Plan, to be approved by the Project Professional.

6.2 Routine Pressure and Systems Monitoring Procedures

The SRP will direct and oversee the CQAQCP initial testing of the VIM systems, in accordance with the VIM Systems Design and Construction Plan and as indicated above, and the implementation of long-term routine monitoring and verification. This monitoring will include the following elements:

- Remote data sensing of ongoing sub-slab depressurization by the electronic surveillance system specified in the VIM Systems Design and Construction Plan, shall provide real-time evaluation of ongoing system effectiveness. This requirement may be modified as determined by the Project Professional with DTSC concurrence where insignificant health threats remain and RPOs have been achieved.

- Pedestrian inspections of monitoring system equipment shall be conducted quarterly for 1 year on the first houses constructed as determined by the Project Professional to establish that the VIM systems and remote monitoring systems perform as expected. Once the SRP determines that the VIM systems and electronic monitoring system perform well, periodic pedestrian inspections will be reduced or terminated. While the VIM systems are envisioned to run in perpetuity, once acceptable risks are confirmed, the SRP, with DTSC approval, could modify or terminate the operation, maintenance, and monitoring requirements.

- The first year of quarterly inspections and subsequent annual inspections shall consist of an environmental professional, under the direction of the SRP, verifying, by physical inspection of the fan alarm light and other fan elements, that operation is apparent and consistent with the remote data sensing indications. Incidental observation of the foundation integrity (meaning if obvious and apparent changes had occurred) would also be noted, to be consistent with homeowner obligations to maintain foundation integrity and function. The Vapor Barrier Field Inspection Form for these inspections is included in Appendix D. This protocol may be modified with Project Professional and DTSC concurrence.

6.3 Vapor Barrier Maintenance and Repair

Typical maintenance will include repair and/or replacement of sub-slab depressurization fans, electronic monitoring system components, external panel lights, manometers, and other equipment integral to the operation of the VIM systems to maintain sub-slab depressurization. This will be implemented until such time as analytical results demonstrate that unacceptable risks, as agreed by the Project Professional and DTSC, are not present at the residence or residences being evaluated.

In the event that the remote data sensing provides a signal to the Project Professional, or their representative, that a depressurization fan was not operating properly, the SRP shall have the non-operational depressurization fan inspected within approximately 1 week of being inoperative to evaluate the particular failure notice and shall establish prudent and timely responses and/or repairs. The Project Professional will use judgment to direct the appropriate response, considering if significant risk is believed to be present in the vicinity or beneath the

residence that has the system failure. In the event that the repair appears to be more problematic and complex, the VIM systems will become more dependent on the passive barrier elements, and the Project Professional shall use measurement and established protocols to evaluate the nature of any risk to the residents with the passive systems, and take appropriate measures to be protective of residents and the public. DTSC will be notified of if significant a VIM system failure occurs to be kept abreast of the Project Professional's decisions should significant risks to residents exist. Responses will be detailed in the annual reporting, and shall reflect the nature of potential risks to residents.

7.0 SOIL CONSOLIDATION AREAS OPERATION AND MAINTENANCE ACTIVITIES

As described in the Response Plan, the RPO for the SCAs is to prevent contact with soils containing TPH, PCBs, and metals in the SCAs through monitoring and maintaining engineering and institutional controls. This objective is expected to be achieved through maintaining the existing vegetated soil cap covering the SCAs, preventing pedestrian access to the SCAs, and monitoring groundwater to evaluate the integrity of the SCAs.

As part of the Site remedy, the SCAs were created by excavating soil to depths of approximately 2 feet above observed water table, to accept and contain soils of concern excavated and consolidated from other portions of the Site. There are two SCAs on the Site – a northern SCA and a southern SCA (Figures 3, 7, and 8). In the South SCA, through the agreement of involved agencies, the Milkvetch Preservation Area was not excavated or disturbed in order to protect the sensitive habitat associated with the milkvetch. The two SCAs contain an approximate estimated total of 826,738 cy of affected or mixed affected soils and sludge materials excavated from various areas of the Site that contain non-hazardous wastes containing TPH, metals, PCBs, dioxins, and other COCs. A minor portion of the SCA cap material contains low levels (below industrial screening levels) of VOCs. As a result of the PCBs being regulated under the TSCA, the EPA maintains overlapping regulatory jurisdiction over the SCAs, as non-PCB containing wastes might have been mixed with PCB affected soils. The DTSC and EPA coordinate oversight of the SCAs, with DTSC assuming the regulatory lead role.

The affected soil and sludge materials in each SCA are overlain with a geotextile fabric beneath an approximate 3- to 6-foot layer (generally 6 feet, with the understanding that erosional features might cause localized thinning) of clean, vegetated soil cap that also serves as required habitat mitigation, which stabilizes erosion and secures the cap. The cap (along with exclusion fencing) serves to prevent human contact with affected materials in each SCA, and the geotextile fabric serves to prevent penetration of the cap into the affected material, as well as a clear demarcation in the event that maintenance of the cap or the SCA is ever required in the future.

In addition, the Site complies by recordation of a Declaration of Restrictive Covenant For Storm Water Quality Control Measures Maintenance and Access (City of Oxnard), which according to Ventura County's MS4 permit, contains an Operations and Maintenance Plan. The current stormwater quality control and maintenance documents are included in Appendix I.

The approximately 24-acre designated RPA (Figure 3) is protected through zoning, the City of Oxnard Coastal Land Use Plan, conditions of approval within a Coastal Development Permit (CDP), and conservation easement with the City of Oxnard and the California Department of Fish and Wildlife as Grantees. Together these entitlements establish and protect the land use of the RPA. The RPA is closed to the public and pedestrian traffic, with the exception of approved interpretive trails.

This O&M Plan is intended to provide an inspection and maintenance program to preserve the integrity of the soil cap installed at each SCA, as well as a groundwater detection monitoring program in general accordance with SWRCB Title 27 regulations, as approved by DTSC. This O&M Plan will be conducted under DTSC oversight, as required by Health and Safety Code Division 20, Chapter 6.8, commencing with Section 25300 et seq. Additional requirements related to the Milkvetch Preservation Area are described in Appendix B.

7.1 SCA O&M Goal and Objectives

The primary goal of the SCA O&M is to protect human health by preventing incidental ingestion, inhalation of particulates, and dermal contact with TPH, PCBs, and metal affected SCA soils through monitoring and maintaining engineering and institutional controls. To accomplish this objective, the remedial elements of the SCA remediation shall be maintained to prevent uncontrolled releases of affected soils from the SCA. In order to accomplish this goal, the SCA O&M addresses the following objectives:

- Establish an inspection and monitoring program to identify and mitigate potential future damage to the cap or fence systems and evaluate remedial effectiveness.
- Establish a groundwater monitoring program to detect and monitor potential adverse impacts from the SCA on groundwater quality.
- Establish requirements that will provide for timely repair and replacement needed to restore damaged fence or cap systems.
- Establish an inspection program to ensure that the indigenous plants remain viable to stabilize the soil cap, minimize erosion, and stabilize soil movement.
- Prevent disturbances to the SCA and to COC-impacted soils.
- Provide for record keeping of inspections and repairs and reporting to DTSC.

7.2 Current Site Conditions

Table 4 summarizes material volumes that were consolidated in the SCAs.

Figures 7 and 8 provide topographic depictions of the extent of affected materials within the SCAs.

The cleanup option selected in the FS/RAP included implementation of engineering controls in the form of soil caps placed over the COC-impacted soils placed in the SCA, to create barriers to prevent any significant exposures. Engineering cap systems in use at the Site are summarized in Table 5 and described below. The engineering design of the cap systems is specified in the RDIP (LFR 2007).

Approximately 176,000 cy of soil were used as cap material over the two SCAs. The extent of cap systems for the North and South SCAs are shown on Figures 7, 8, and 9.

A groundwater monitoring well network is in place to monitor potential impacts from the SCA on groundwater quality. The groundwater monitoring well network for the SCA includes seven monitoring wells: two in the North SCA and five in the South SCA. Two upgradient monitoring wells (SCA-01 and SCA-02) and three downgradient monitoring wells (SCA-03, SCA-04, and SCA-07) are located around the South SCA, and one upgradient monitoring well (SCA-05) and one downgradient monitoring well (SCA-06) are located around the smaller North SCA. In addition, five permanent monitoring wells (PMW-01 through PMW-05) are located around the Milkvetch Preservation Area within the South SCA. The locations of these wells are shown on Figure 3.

7.3 SCA O&M Procedures

The cap systems will be inspected twice each year to observe the integrity of the cap and fence system as well as operational effectiveness. Given that maintenance of the plant cover provides for long-term cap stability and sustainability, these inspections shall be performed at the beginning of the rainy season in November and following the rainy season in May. Inspections will be conducted in November and May of each year under the direction of the Project Professional. The Project Professional will notify DTSC at least seven days in advance of each inspection.

The cap inspection will consist of a walking survey of the entire cap system (e.g., capped area, surface water drainage features, fenced perimeter). The Project Professional will document observations on the Field Inspection Form (Appendix D) and in photographs. Each inspection will include a general evaluation as to whether the cap currently performs its intended function of providing an effective engineered control to prevent the transport or migration of consolidated affected materials. If the inspector believes the cap is not performing effectively as intended, or if the plant cover appears less robust than what is required to control and minimize any erosional threat to the cap function, appropriate corrective actions (see Section 7.3.7) will be identified in the report, and the Project Professional shall notify the SRP in writing to implement suitable actions to upgrade or repair identified deficiencies. Appendix D includes a copy of the cap system inspection form.

The following table summarizes the routine O&M inspection activities, as well as the protocol for unplanned events and maintenance and repair. Details regarding each component are discussed in the following sections.

7.3.1 Cap Inspections

Surveying stakes will be used to establish a cap thickness baseline measurement to assist in evaluating future cap conditions. Survey stakes extend approximately 7 feet and have markings every foot. These stakes are placed across the SCAs (a minimum of four stakes in the Southern SCA and two stakes in the Northern SCA). Stakes are placed so that the bottom is resting on the geotextile fabric.

On an annual basis, the Project Professional will inspect the cap for the presence of any signs of damage, failure, or disturbance, including the following:

- Slope failure or slope stability
- Changes in the thickness of the cap
- Drainage patterns, which could result in erosional damage
- Vandalism or signs of unauthorized pedestrian traffic
- Rodent or other animal holes or burrows which would compromise cap integrity
- Seepage or ponding
- Erosional damage or sloughing of edge materials
- Missing sign posting

The inspection form will note the locations and dimensions of the damage (e.g., area, crack width, crack length). The observed damage will be photographed. The inspections will include a general evaluation as to whether the cap currently performs its intended function or has been compromised and needs maintenance or repair.

7.3.2 Surface Water Drainage System

Surface water drainage patterns that channel surface water runoff at the SCA (e.g., ditches, slope edges) will be evaluated to ascertain if corrective measures to arrest or eliminate future erosion are necessary or advantageous to ensure the sustainability and effectiveness of the cap. Each inspection will ensure that the erosion control measures at the Site remain free of damage and obstructions, are providing adequate runoff, are enhanced as necessary to maintain the cap, and do not generate excessive erosion which has the potential to affect cap function (DTSC 2008a). Appendix L of the PRACR provides the basis for EPA TSCA compliance in accordance with the FS/RAP.

7.3.3 Vegetation

The cap vegetation will be evaluated during the SCA inspection to assess whether there is inadequate vegetation in combination with other Site drainage features that could facilitate excessive erosion and affect cap integrity (DTSC 2008a). Should vegetation augmentation be required to address changing site conditions, hydro seeding with plants native to the Ventura coast shall be used.

7.3.4 Perimeter Fence

The perimeter fence will be inspected to identify significant damage or the need to replace or repair fence elements or posted signs.

7.3.5 Groundwater Monitoring

Groundwater monitoring and corrective activities at the SCA include the following elements (consistent with SWRCB Title 27, as approved by the DTSC [DTSC 2014c]). Pursuant to the DTSC approval, water quality protection standards at the SCAs have been established. For the detection monitoring program, groundwater is being monitored annually from the SCA monitoring well network (monitoring wells SCA-01 through SCA-07 and PMW-01) for the following constituents:

- VOCs using EPA Method 8260B
- PCBs using EPA Method 8082
- TPH using EPA Method 8015 modified
- Metals using EPA Method 6010/7000 series
- Alkalinity
- Dissolved ions, including bromide, chloride, sulfate, nitrate, o-phosphate, and sulfide using EPA Method 300.0
- Field parameters, including pH, temperature, and turbidity

Major dissolved ions, alkalinity, turbidity, and temperature are included as indicators of sample and analytical quality and general aquifer/well background conditions. Groundwater will be sampled for all constituents on an annual basis. Groundwater sampling procedures are included in Appendix F.

Monitored groundwater is evaluated in general accordance with SWRCB Title 27 regulations and includes the following:

- Detection Monitoring.

- Evaluation Monitoring (Trigger #1): The SRP shall institute evaluation monitoring whenever there is "measurably significant" evidence of a release (as outlined in SWRCB Title 27, Subchapter 3—Water Monitoring) from the SCA during a detection monitoring program.

- Evaluation Monitoring (Trigger #2): The SRP shall institute evaluation monitoring whenever there is significant physical evidence of a release from the SCA. Significant physical evidence of a release includes unexplained volumetric changes in surface impoundments, unexplained stress in biological communities, unexplained changes in soil characteristics, visible signs of leachate migration, and unexplained water table mounding beneath or adjacent to the SCA and any other change to the environment that could reasonably be expected to be the result of a release from the SCA.

At each SCA monitoring point, the SRP will determine whether there is measurably significant evidence of a release from the SCA for any monitoring parameter (or COC), in general accordance with SWRCB Title 27 requirements. If the SRP determines that there is measurably significant evidence of a release from the SCA, SRP shall:

- Notify DTSC staff verbally of the finding and provide written notification by certified mail within 7 days of such determination.

- Choose to initiate a verification procedure (retest) to verify that there is measurably significant evidence of a release from the SCA for a parameter or constituent which has indicated a release. A work plan would then be prepared and submitted to DTSC.

- Perform the non-statistical scanning (as outlined in Section 20420 of SWRCB Title 27) in the event of a release submit an amended annual report to establish an evaluation monitoring program meeting the provisions of Section 20425 of SWRCB Title 27, and submit an

engineering feasibility study for a corrective action program necessary to meet the requirements of Section 20430 of SWRCB Title 27.

- Consider the possibility that the measurably significant release is from a source other than the SCA, or that the evidence is an artifact caused by an error in sampling, analysis, or statistical evaluation, or by natural variation in the ground water, surface water, or the unsaturated zone.

The evaluation monitoring program shall be used to assess the nature and extent of the release from the SCA and to design a corrective action program, as needed, in order to meet the requirements of Section 20430 of SWRCB Title 27. A detailed description of corrective action measures that will be taken to achieve compliance will be proposed in general accordance with Section 20385 of SWRCB Title 27, if corrective actions are warranted.

7.3.6 Reporting and Follow-up

The findings of the cap inspections will be documented in individual inspection forms (Appendix D) and summarized in the Annual Inspection and Monitoring Report (Section 11.2). The report will be submitted to DTSC within 45 days of completing the final inspection for the reporting period. Should the inspections yield the finding of a necessary repair or system improvement to maintain the efficacy of the remedial systems, this necessary improvement shall immediately be brought to the attention of the Project Professional to implement repairs or replacement actions to ensure the short- and long-term integrity of the remedial systems, specifically the cap and fences.

If the Project Professional believes the cap is not performing effectively as intended, appropriate corrective actions will be implemented (described below). The Project Professional is responsible for follow-up review to ensure that identified repairs are completed on schedule and will sign off on the completion blocks of the inspection reports. The Project Professional will notify DTSC of any damage that is not repaired within 15 days of discovery.

The monitoring well network monitoring results will also be summarized in the Annual Inspection and Monitoring Report submitted to DTSC within 45 calendar days of the last day of the final inspection and monitoring event.

7.3.7 Cap Maintenance and Repair

7.3.7.1 Cap

Typical maintenance will include filling or regrading of depressions, redirecting problematic drainage patterns, and revegetation or mulching of eroded areas.

For areas where the cap damage or disturbance appears to be continuous or excessive, the Project Professional will notify DTSC and recommend measures to correct the problem(s). Examples of such problems include slope stability issues, excessive erosion, and significant cracks or rills that have the potential to affect the cap function.

7.3.7.2 Surface Water Drainage System

Typical maintenance will include removal of debris, silt, or other obstructions from the surface water drainage system. If the Project Professional identifies excessive erosion that materially impacts the effectiveness of the cap, inadequate runoff capacity, or other significant damage, the Project Professional will notify DTSC and recommend measures to correct the problem(s).

7.3.7.3 Vegetation

Vegetation will be maintained in accordance with the CDP. If the Project Professional identifies areas that are persistently poorly vegetated, such that cap integrity is affected, the Project Professional will notify DTSC and recommend measures to correct the problem.

7.3.7.4 Perimeter Fence

If damage to the fence or signage is identified, the Project Professional will notify DTSC and will repair the fence or signs within 1 week of identifying the damage. Temporary fencing will be installed as necessary.

7.3.7.5 Periodic Resurfacing of Cap

If erosional forces degrade the cap by more than 3 feet relative to the baseline measurements and survey markers, measures shall be implemented to restore the cap in the degraded areas to its original 3- to 6-foot thickness, and plants or other features shall be installed to stabilize the soils to prevent future erosion, which threatens cap effectiveness.

7.3.7.6 Monitoring Well Network

The overall condition of the monitoring wells will be evaluated during the routine sampling events and recorded during routine groundwater sampling on the Groundwater Sampling Information Form (Appendix D). The following maintenance items will be checked:

Surface Observations

- Visibility—the well is easily located
- Access—there is a clear path to the well
- Lock—present and not rusted
- Cap—the hinge or threads are working and not damaged
- Well box—bolts are present and the box can be opened and secured
- Identification—the well ID is clearly marked and legible
- Surface seal—observation of cracks in concrete
- Downhole—check the well casing using a mirror or flashlight

Subsurface Observations

- Water level—confirm within expected range
- Total depth—compare to previous measurements

Groundwater Sample Quality

- Field parameters—confirm within range of historical data
- Analytical results—confirm with range of historical data
- Changes in physical appearance (color, presence of slime or microbial growth)

Well rehabilitation will be considered if well performance has been reduced significantly. Wells that have been damaged beyond repair will be decommissioned and reinstalled, if necessary.

8.0 INTRUSIVE WORK ACTIVITIES

In the event that intrusive activities are necessary to address a component of the Site remedy, the Project Professional will complete the following:

- Notify DTSC of the type, cause, location, and date of disturbances that could affect the ability of the remedy to function properly.
- Provide DTSC with written notification at least 30 days prior to any proposed intrusive activity with the potential to disrupt the operation of the remedy. The written notice will include a detailed description of the work to be done and a map showing the exact location of the proposed work and the reasons for the modifications/disruptions.
- Provide notification to DTSC within 30 days after completion of modifications/repairs to the remedy in an Intrusive Work Completion Report that summarizes all intrusive work and certifies that the remedy was restored to specified design requirements (Section 11.3).

8.1 Post-Construction Residential Areas

Activities that otherwise have the potential to disturb Site remedy components within the residential portion of the Site, including the groundwater monitoring well network, SVE system, and vapor mitigation system, will be conducted in accordance with the Environmental CC&Rs to maintain the integrity of the remedy.

8.2 Site Grading and Utility Installation

Standard Construction Protocols as generally described below will be followed during the site grading and utility installations conducted as part of the Site development. .

The Site was primarily used for oil waste disposal generated during oil drilling operations in the 1950s, 1960s, and 1970s. Historical operations resulted in the release of VOCs, semi-volatile organic compounds (SVOCs), TPH, heavy metals, and PCBs into the environment that affected Site soils. These affected soils have been successfully addressed by significant remedial grading efforts that consolidated the affected soils from the residential area where the infrastructure is to be constructed. Limited ongoing remedial efforts include SVE to address concerns for indoor air quality.

Soils within the residential-designated areas of the Site have been remediated to residentially accepted levels and approved for construction of homes. Development of the Site requires excavation and replacement of these soils to install foundation, roads, and utilities. The likelihood of encountering impacted soil during residential grading and utility installation activities, etc., is considered very low. However, as a precaution given the Site's industrial history, Standard Construction Protocols are herein outlined that will apply to the initial Site construction activities that disturb soil (i.e., excavation, grading, soil movement) as a part of the Site grading and utility installation activities. Because discovery of affected soils is not anticipated, these protocols will require observing conditions during this work, and if suspicious

conditions (visual or odors) are observed, sampling and isolating the area until the results are obtained.

Notification. For the grading and utility installation activities, no notification of the DTSC is necessary. If, during the course of grading or utility installation activities, stained or odorous soils that may have COCs (including VOCs, TPH, or PCBs) are identified or suspected, an evaluation by the SRP will be conducted. If the results of the investigation show impacted soils, then the DTSC will be notified within 72 hours of receiving the findings.

Key Contacts. The names, addresses, and phone numbers of key DTSC and SRP personnel are provided below.

Sara Vela, DTSC Project Manager
DTSC Brownfields and Environmental Restoration Program
9211 Oakdale Avenue
Chatsworth, California 91311
818-717-6611

John Mellon, Construction Project Manager
MPL Property Holdings LLC (MPL)/SunCal/Argent Management
805-722-5776

Charles Robinson, PE, President
Northshore Environmental Conservancy (NEC)
949-230-9044

Procedures. Management and oversight of grading and utility installation activities in the residential construction areas can be performed by trained and experienced construction personnel. For this type of work, the construction contractor would not need 40-hour trained personnel; however, the foreman or construction manager would need to be able to discern unusual conditions if encountered.

If unusual soil conditions are encountered (soils that are visibly stained or appear to have a chemical odor), the construction worker is to communicate with the construction foreman or manager who will assess the situation. If the construction foreman or manager believes that the soil may require further assessment, they are to notify MPL/NEC, or its subcontractor, to evaluate the soil in question and may screen the soil using a PID or other method to determine whether a response action is warranted.

If a response action is warranted, MPL/NEC or its subcontractor will:

- Review construction and maintenance activities to be conducted for potential applicability of these construction protocols.
- Assign a Site Safety Officer, when required.
- Notify and report to any outside agencies (e.g., DTSC, EPA, etc.), as applicable.

- Compile an activity-specific Health and Safety Plan that identifies the personal protective equipment and worker training requirements for the excavation activity, when required.

- Handle all decision-making related to soil disposal issues, including analytical requirements, disposal facilities, and transportation.

- Develop and implement (or cause to be implemented) activity-specific soil sampling plans, when required.

- Develop and administer training programs to communicate these protocols to appropriate personnel and identify staff who are authorized to oversee soil disturbance field activities.

Storage, Transportation, and Disposal: Soils that are excavated when working around COC-impacted soils in the residential portion of the Site will be placed in covered containers or stockpiled near the area of the excavation. Stockpiled soil will be placed on plastic sheeting to prevent cross contamination of underlying soils and covered with plastic sheeting to control the creation of dust and prevent runoff. The plastic sheeting covering the stockpile will be of sufficient length and width to cover the entire stockpile and be secured with sandbags or other devices. A berm will be placed such that surface water cannot undermine the plastic sheeting and come into contact with the stockpiled soil.

Soil containers or stockpiles will be placed in a designated area, as specified by MPL/NEC, and access to that area will be limited through the use of physical barriers, such as a caution tape cordon with warning signs or temporary fencing and warning signs. The duration of soil stockpiling will be kept to the minimum required for off-Site disposal determination, or characterization for placement in other areas of the Site. Disposal determination includes sample analysis, waste classification, and disposal facility acceptance and off-Site shipment of the soil, if appropriate.

Characterization soil samples will be collected and analyzed in accordance with the procedures described below. Based on the results of laboratory analysis and the appropriate future use of the soil, handling and disposal alternatives will be evaluated:

- Soil sampling and analysis of potentially affected soil will be conducted as necessary during grading or trenching activities. Suspected COC-impacted soils will be analyzed to determine whether they are impacted above residential reuse criteria.

- Soil sampling will be performed by Hazardous Waste Operations and Emergency Response-trained contractors or personnel approved by MPL/NEC. Soils will be sampled to characterize the suspected soils. Soils will be analyzed in accordance with the latest SW 846 protocols. Soil samples will be submitted to a California-certified laboratory for analysis by one or more of the following methods:

    - U.S. EPA Method 8015B—Hydrocarbon Range
    - U.S. EPA Method 8082—PCBs
    - U.S. EPA Method 8260 B—VOCs

- U.S. EPA Method 8270C—SVOCs
- U.S. EPA Method 6010B—California Assessment Manual 17 Metals

Results of soil analyses will be reviewed to determine whether or not soils are impacted and if they exceed residential reuse criteria. Impacted soils that exceed residential reuse criteria will be moved off the residential portion of the Site. Soils that do not exceed these levels can be placed back into the excavation. If soils are classified as hazardous, they will be transported and disposed of off-Site at an appropriate facility. Laboratory analytical reports, waste profiles, and manifests will be obtained, and copies will be maintained by MPL/NEC and submitted to DTSC, as required.

8.3 SCAs

Activities are not anticipated that would disturb the waste materials consolidated in the SCAs. However, in the event that such activities are planned in the future, any waste materials removed will be placed back into the excavation and then covered with a minimum 3-foot soil cap.

9.0 RESPONSE FOR UNPLANNED EVENTS

Immediate and appropriate action will be taken to prevent, abate, or minimize an emergency related to any action or occurrence, such as a fire, earthquake, or explosion that threatens to damage the integrity of the Site remedy. Unless there are mitigating circumstances, the Project Professional will inspect and notify DTSC within 72 hours of any such occurrence. The need for action will be evaluated by inspecting the remedy, including the SCA cap, the groundwater wells, the vapor barrier system (i.e., verifying fan operation and apparent foundation failures), and the SVE system, after an unplanned event that has the potential to impact the remedy integrity or based on a report of damage observed by persons at the Site. Inspection observations will be documented on the applicable Emergency Response Inspection Forms (Appendix C).

The Project Professional will take appropriate action in consultation with DTSC and in accordance with the applicable provisions of the CLRRA Agreement. A report describing the events that occurred and response measures will be submitted to DTSC within 60 days of the event. Reporting of these events will be made to DTSC using the form in Appendix C. It is understood that risk determinations that are driving the Site remedial activities are calculated over decades. While efforts will be made to restore the remedial and protective systems as soon as possible, it is understood that restoring systems immediately may not be feasible and will most likely not have a material impact on receptor risk.

9.1 Earthquake

The closest known fault to the Site is the Oak Ridge Fault, which is approximately 2 miles away. The estimated Maximum Credible Earthquake on the Oak Ridge fault corresponds to a value of 6.5 to 7.5 on the Richter scale. In the event of an earthquake event of 5.0 or greater, and with the earthquake epicenter within a 5-mile radius or a larger earthquake within a 20-mile radius, the Project Professional will conduct a Site inspection to evaluate the integrity of the remedy.

As soon as it is safe and practical to conduct an inspection, the SRP will complete the following:

- Visually inspect the cap systems for signs of damage.
- Visually inspect stormwater and drainage systems for signs of damage.
- Verify the vapor barrier system is creating a sub-slab depressurization of a minimum of 0.02 inches of water. Procedures to verify VIM performance will be determined in consultation with DTSC. Visually inspect the groundwater monitoring wells for signs of damage by conducting the activities outlined in Section 4.5.5.
- Visually inspect the SVE system for signs of damage. If damage is known or suspected after the visual inspection, further testing may be conducted in accordance with the activities outlined in Section 5.6.

9.2 Floods or Major Storms

In the event of a flood or major storm, the NEC will inspect the remedy to ensure its integrity within 1 week of the event. The inspector will document their observations on the form included in Appendix C. For the purpose of this O&M Plan, a major storm is defined as a storm with a 10-year return period of precipitation greater than 4 inches or more over a 24-hour period (Ventura County Watershed Protection District 2006).

9.3 Fire

In the event of a surface fire on or near the Site, NEC will inspect the remedy and document their observations on the form included in Appendix C as soon as it is safe and practical to conduct the inspection.

10.0 FIVE-YEAR REVIEW AND INSPECTION

Every 5 years, there will be an overall systems review and inspection to evaluate ongoing Response Plan effectiveness. The purpose of the review is to determine whether the Response Plan:

1. Remains protective of human health and the environment.
2. Continues to be consistent with achieving water quality objectives within a reasonable time frame, and whether monitoring provides information of value and needs to be continued.
3. Functions as designed.
4. Is maintained appropriately by O&M activities.
5. Needs to be reduced or terminated because all RPOs have been achieved or are expected to be achievable within a reasonable time, based on data collected.
6. Requires further response actions because data collected demonstrates a change in Site conditions has occurred that warrants additional actions.

Each Five-Year Review and Inspection will be conducted under the responsible charge of the Project Professional. The Project Professional will notify DTSC at least 7 days in advance of each Five-Year Review inspection. The first Five-Year Review inspection will be completed 5 years from approval of the Response Plan, and all subsequent inspections will be completed every fifth year.

The Five-Year Review and Inspection will identify and review completion of any required repairs, changes in Site conditions or usage, or any other significant information relating to the SCA caps, barriers, monitoring well network or overall remedy that may have taken place over the previous five years.

The Five-Year Review and Inspection will evaluate the progress of the MNA, the SVE (as appropriate), the VIM, and the SCAs in achieving site goals. Additionally, the Five-Year Review and Inspection will evaluate if the monitoring remains adequate, or if the monitoring could be either eliminated or scaled back. The Project Professional will prepare and sign a report that summarizes their findings, conclusions, and recommendations (see Section 11.4). The Project Professional will also sign the report. The Five-Year Review Report will be submitted to DTSC within 45 days after completion of the inspection.

The Project Professional is responsible for responding to recommendations made in the Five-Year Review Report and any additional requirements identified by DTSC. The Project Professional is responsible for follow-up review to ensure that identified repairs are completed on schedule and will sign the report.

11.0 REPORTING AND RECORD KEEPING

11.1 DTSC Notification Requirements

The SRP will notify DTSC in writing within 14 days of any changes in the names, addresses, or telephone numbers of the Project Professional or the SRP.

The Project Professional will notify DTSC of the following in writing:

- At least 7 days prior to a groundwater sampling event, routine inspection or inspection for a Five-Year Review.
- An unplanned event that impacts or threatens to impact the integrity of the remedy, which should be noted in the annual report to DTSC, along with any repairs or proposed corrective actions.
- If an impact or threat of impact to the integrity of the remedy is identified, it should be noted in the annual report to DTSC, along with any repairs or proposed corrective actions.
- At least 30 days prior to intrusive work activities that will affect the integrity of any part of the remedy (groundwater wells, vapor barriers, SCA cap materials, etc.).
- Time frame for reporting unplanned events will depend on the event and will vary.

As appropriate, notifications shall include a proposed schedule for completing required repairs and maintenance.

11.2 Annual Inspection and Monitoring Reports

Annual Inspection and Monitoring Reports will summarize the findings of the routine inspections and periodic monitoring, and document completions, delays, or failures to repair any items identified as needing repairs. The Annual Inspection and Monitoring Report will be signed by the Project Professional. The Project Professional will submit the report for DTSC review and approval no later than 45 calendar days after the annual inspection (or final inspection for the year) has been conducted.

Annual Inspection and Monitoring Reports will include the following content:

- Results of the visual inspections and any supporting data
- Results of the periodic vapor or groundwater monitoring and any supporting data
- Description of:
    - actions taken during the reporting period, including any repairs to the monitoring well network, SVE system, vapor mitigation system, or cap that were identified and carried out
    - any significant changes in Site conditions and usage

  - any additional on-Site construction or other information that may relate to the function of the Response Plan

- Description of actions planned or expected to be undertaken in the next year that will impact the Response Plan.
- Summary tables and graphs presenting current and historical site data.
- Results of analyses for natural attenuation parameters and evaluation of ongoing MNA.
- Maps depicting the sample locations, groundwater gradient, and contaminant levels.
- Descriptions of any deviations from the approved sampling procedures.
- Quality assurance and quality control data.
- Conclusions regarding the ongoing effectiveness of the remedy.
- Descriptions of any maintenance or repairs identified, as needed, during the inspection.
- Descriptions of any requirements under the CLRRA agreement that were not completed.
- Identification of any problems or anticipated problems in complying with the CLRRA agreement.
- Recommendations for O&M Plan modifications.
- Copies of signed inspection and monitoring forms completed during the reporting period.
- Copies of all field logs completed during the reporting period.
- Photographs depicting Site conditions with brief identifying captions or descriptions.
- Copies of any data generated under the CLRRA Agreement and any significant findings from the data.
- Copies of work orders and Completion Reports for any intrusive work conducted during the reporting period.
- Documentation of additional investigation, monitoring, and/or mitigation activities required by DTSC.

The reports will be maintained in the Site files as described in Section 11.5.

11.3 Reporting of Intrusive Work

Work activities that disturb the cap or contact soils contained in the SCAs will be documented in a Work Plan and Completion Report prepared and signed by the Project Professional. The report will include the following information:

- Dates work was performed
- Work location, with maps and figures
- Work activities performed, including any restoration of containment features
- Work practices taken to prevent potential exposures
- Variance or modifications (if any) to the procedures in Section 8.0
- Summary of finished Site conditions

Additional report content may be specified by DTSC. The Completion Report will be submitted within 45 days of completion of the intrusive work.

11.4 Five-Year Review Reports

As required, the first Five-Year Review Report for the Site will be completed five years from the date that DTSC approved the Site remedy. The RAP was approved in 2008, the Site Conditions Update in February 2013, and the PRACR in March 2013. A Response Plan was submitted to DTSC outlining the RPOs for the Site. All subsequent Five-Year Review Reports will be completed and submitted to DTSC every fifth year from the date of the Response Plan approval. The Project Professional will submit the Five-Year Review Report to DTSC for review and approval within 45 days after completion of each scheduled Five-Year inspection. Five-Year Review Reports will be maintained in the Site files as described in Section 11.5.

The Five-Year Review Report will summarize remedy effectiveness within the reporting period. The report will identify any incidents or problems with the O&M Systems, and will evaluate system performance, effectiveness, and protectiveness. The Five-Year Review Report will include a technical assessment and evaluation of the ongoing protectiveness of the remedy. This evaluation will address the following questions:

- Is the remedy functioning as intended by the remedy selection decision documents?
- Are the remedial action objectives, goals, and criteria used at the time of remedy selection still valid?
- Have there been any significant changes in the distribution or concentration of the impacted groundwater at the Site?
- Are any modifications needed to make the O&M Plan more effective?
- Is there reasonable certainty that water quality objectives will be attained within a reasonable time frame such that beneficial uses will be protected?
- Is the monitoring providing useful information, and, if not, should the monitoring either be diminished or eliminated?
- Do Site conditions justify reducing the frequency of monitoring or sampling, the number of wells monitored, or other activities associated with the Response Actions, based on sampling and other data obtained in the previous 5 years?
- Do Site conditions pose an unreasonable risk to human health and safety or the environment that would warrant additional response actions?

The Five-Year Review Report will state conclusions and make recommendations for any changes needed to maintain remedy protectiveness, or to alter the monitoring program to provide only data which will provide value in future evaluations. Any modifications to the monitoring program will be agreed to by the DTSC. The Five-Year Review Report will be prepared by the Project Professional, who will sign the report. The report will be submitted to DTSC within 45 days of completing the Site inspection.

11.5 Record Keeping and Retention

All documentation records, including raw and field data, prepared under this O&M Plan will be maintained by the Project Professional at a specially-designated website <www.northshore-ec.com> as well as the DTSC EnviroStor website. The records will be available for inspection by the public and DTSC representatives. The records will include, but are not limited to, the following:

- Inspection checklists and photographs
- Annual Monitoring Reports
- Five-Year Review Reports
- Completion Reports for Intrusive Work
- Records of public inquiries about the impacted soils at the Site
- Investigation and cleanup-related documents

Because of the potential volume of paper that could be generated or stored, the Project Professional may elect to maintain paper copies of the previous 12 month of reporting and the latest Five-Year Review Report and keep the rest of the documents as electronic files (in PDF format), accessible through the SRP or DTSC EnviroStor web sites. Records will be preserved by the Project Professional for a minimum of 10 years after the completion of each activity.

The DTSC administrative record for the Site is available for public inspection during office hours at the following DTSC location:

Department of Toxic Substances Control
9211 Oakdale Avenue
Chatsworth, California 91311-6505

12.0 SITE ACCESS

Within 2 business days upon request, Site access to all areas under the control or ownership of the SRP will be provided to DTSC representatives and O&M personnel by the Project Professional at reasonable times. LUC, CLRRA, and Environmental CC&Rs further clarify access to operate and maintain remedial and mitigation system components.

13.0 VARIANCE FROM, OR MODIFICATION TO, O&M PLAN

The Project Professional may seek variance and/or modification of this O&M Plan upon a written application to DTSC at any time during the life cycle of the remedy. "Variance" refers to possible release from specific individual O&M Plan requirements for a limited time period, while "modification" refers to permanent revision of specific individual O&M Plan requirements. It is anticipated that when long-term performance of the selected remedy has been confirmed as effective and protective of human health and the environment, the Project Professional may apply to DTSC to modify the O&M Plan, based on site-specific monitoring results and conditions.

DTSC will evaluate each application for a variance or modification, and may grant a variance or modification so long as the requested change or modification remains protective of human health and the environment.

14.0 REFERENCES

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_____. 2014b. Conditional Approval of Soil Vapor Extraction Pilot Test Work Plan, North Shore at Mandalay Bay, 198 Soil Harbor Boulevard, Oxnard (Site Code: 301062). From Ivy Castillo, DTSC. To Mike Walline/John Mellon, MPL Property Holdings, LLC. June 26.

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TABLES

Table 1
Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[(1)] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RMW-02	05/01/08	LFR	**9.33**	<1	**4.51**	**1.44**	**1.82**	**2.71**	<1	<1	19.81
RMW-02	05/22/08	LFR	**483**	**8.85**	**104**	<1	<1	**3,810**	**187**	**22.3**	4,615.15
RMW-02	05/23/08	LFR	**55.9**	<1	**40.6**	<1	<1	**41.8**	**14.5**	<1	152.80
RMW-02	08/01/08	LFR	**15.2**	<1	**14.7**	<1	**2.06**	<0.5	**3.29**	<1	36.63
RMW-02	12/05/08	LFR	**35.7**	<1	**41.9**	<1	<1	**45.9**	**6.48**	<1	129.98
RMW-02	01/26/09	LFR	**78.6**	<1	**93.7**	<1	<1	**95.3**	**15.4**	**1.12**	284.12
RMW-02	04/06/09	LFR	**120**	<1	**162**	<1	<1	**175**	**26.8**	**1.79**	485.59
RMW-02	07/13/09	LFR	**1.42**	<1	<0.5	<1	**1.13**	<0.5	<1	<1	2.55
RMW-02 (DUP-1)	07/13/09	LFR	**1.6**	<1	<0.5	**1.05**	**1.28**	<0.5	<1	<1	3.93
RMW-02	10/06/09	LFR	**40.1**	<1	**50.2**	<1	**1.23**	**61.5**	**8.69**	<1	164.38
RMW-02	01/25/10	LFR - ARCADIS	**138**	<1	**113**	<1	**1.35**	**183**	**32.3**	**2.27**	469.92
RMW-02 (DUP-01)	01/25/10	LFR - ARCADIS	**145**	<1	**134**	<1	**1.42**	**216**	**35.7**	**2.34**	534.46
RMW-02	04/27/10	ARCADIS	**103**	<1	**72.5**	<1	**1.02**	**121**	**23.5**	**1.38**	322.40
RMW-02	07/13/10	ARCADIS	**10.2**	<1	**6.61**	<1	**2.16**	**5.8**	**2.01**	<1	26.78
RMW-02	10/12/10	ARCADIS	**103**	<1	**14.3**	<1	<1	**116**	**21.8**	**1.52**	258.09
RMW-02	01/13/11	ARCADIS	**63.3**	<1	**40.9**	<1	**1.21**	**17**	**9.11**	<1	132.52
RMW-02	04/06/11	ARCADIS	**83.3**	<1	**14.4**	<1	**1.01**	**58.4**	**15.6**	**1.31**	175.34
RMW-02 (DUP-3)	04/06/11	ARCADIS	**84**	<1	**15.1**	<1	**1.15**	**58.2**	**15.7**	**1.29**	176.78
RMW-02	07/08/11	ARCADIS	**1.65**	<1	**2.53**	**1.09**	**2.53**	<0.5	<1	<1	7.80
RMW-02	10/19/11	ARCADIS	**2.09**	<1	**0.95**	<1	**2.19**	**0.98**	<1	<1	6.21
RMW-02	12/21/11	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-02 (DUP-3)	12/21/11	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-02	03/15/12	ARCADIS	**38.6**	<1	**17.5**	<1	<1	**20.8**	**4.75**	<1	81.65
RMW-02 (DUP-3)	03/15/12	ARCADIS	**35.2**	<1	**14.8**	<1	<1	**19.2**	**4.1**	<1	73.30
RMW-02	06/07/12	ARCADIS	**88.0**	<1	**42.1**	<1	<1	**73.0**	**13.3**	**1.16**	217.56
RMW-02	10/17/12	ARCADIS	**38.6**	<1	**38.0**	<1	**1.41**	**23.4**	**4.49**	<1	105.90
RMW-02	06/20/13	SoundEarth	<1	<1	**33.2**	<1	**1.24**	**12.8**	**8.86**	<1	110.20
RMW-02	12/13/13	SoundEarth	**45.0**	<1	**22.4**	**1.08**	**1.32**	**0.60**	**5.65**	<1	76.05
RMW-02	06/02/14	SoundEarth	**52.7**	<1	**15.5**	<1	**1.14**	**1.29**	**7.89**	<1	78.52
RMW-02	12/08/14	SoundEarth	**71.9**	<1.00	**12.8**	<1.00	<1.00	**3.28**	**11.6**	**1.03**	100.61
RMW-02	06/02/15	SoundEarth	**76.7**	<1.00	**8.51**	<1.00	<1.00	**0.550**	**8.71**	**1.08**	95.55
RMW-02	12/10/15	SoundEarth	**56.3**	<1.00	**4.37**	<1.00	<1.00	**0.760**	**5.83**	<1.00	67.26
RMW-02	06/17/16	SoundEarth	**63.2**	<1.00	**7.14**	<1.00	<1.00	**1.08**	**8.35**	<1.00	79.77
RMW-03	05/01/08	LFR	**100**	<1	**583**	**7.39**	**59.1**	**21**	**64.2**	**1.33**	852.66
RMW-03	05/23/08	LFR	**103**	**2.63**	**271**	**3.62**	**45**	**58.9**	**104**	**2.11**	599.02
RMW-03	08/01/08	LFR	**63.9**	**1.27**	**48.2**	<1	**20.2**	**68.1**	**62.5**	**1.37**	270.50
RMW-03	12/08/08	LFR	**45.4**	<1	<0.5	<1	**2.66**	**19.8**	**11.6**	<1	79.46
RMW-03	01/26/09	LFR	**30.2**	<1	**1.71**	<1	<1	**10.6**	**6.08**	<1	48.59
RMW-03	04/06/09	LFR	<1	**36.9**	**3.01**	<1	**1.45**	**36.4**	**10.5**	<1	88.26
RMW-03	07/13/09	LFR	**31.3**	<1	**0.97**	<1	<1	**38.9**	**5.2**	<1	76.37
RMW-03	10/06/09	LFR	**37.5**	<1	**2.6**	<1	**2.07**	**68.4**	**12.5**	<1	123.07
RMW-03 (DUP-2)	10/06/09	LFR	**44.8**	<1	**3.25**	<1	**2.34**	**84.4**	**15.6**	<1	152.38
RMW-03	01/25/10	LFR - ARCADIS	**37**	<1	**1.93**	<1	**1.52**	**50.5**	**11**	<1	101.95
RMW-03	04/27/10	ARCADIS	**24.2**	<1	**1.97**	<1	<1	**40.4**	**4.44**	<1	71.01
RMW-03	07/13/10	ARCADIS	**22.7**	<1	**1.2**	<1	<1	**37.4**	**3**	<1	64.30
RMW-03	10/12/10	ARCADIS	**23.9**	<1	**1.01**	<1	<1	**43.6**	**3.15**	<1	71.66

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198 South Harbor Boulevard, Oxnard, California

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			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RMW-03	01/13/11	ARCADIS	**18.3**	<1	**2.09**	<1	<1	**32.7**	**2.71**	<1	55.80
RMW-03	04/05/11	ARCADIS	**16.9**	<1	**4.73**	<1	<1	**32.8**	**2.87**	<1	57.30
RMW-03	07/07/11	ARCADIS	**19.1**	<1	**2.06**	<1	<1	**41.4**	**2.47**	<1	65.03
RMW-03 (DUP-3)	07/07/11	ARCADIS	**7.65**	<1	**10.3**	<1	<1	**7.3**	**11.5**	<1	36.75
RMW-03	10/19/11	ARCADIS	**17.2**	<1	**0.95**	<1	<1	**42.3**	**2.21**	<1	62.66
RMW-03	12/21/11	ARCADIS	**18.6**	<1	**0.6**	<1	<1	**32.8**	**2.17**	<1	54.17
RMW-03	03/14/12	ARCADIS	**15.4**	<1	<0.5	<1	<1	**2.56**	<1	<1	17.96
RMW-03	06/06/12	ARCADIS	**17.0**	<1	<0.5	<1	<1	**25.4**	**1.42**	<1	43.82
RMW-03	10/15/12	ARCADIS	**20.1**	<1	<0.5	<1	<1	**34.5**	**1.59**	<1	59.11
RMW-03	06/20/13	SoundEarth	**9.61**	<1	<0.5	<1	**1.31**	**1.77**	**1.72**	<1	14.41
RMW-03	12/13/13	SoundEarth	**7.16**	<1	<0.5	<1	**1.11**	**1.88**	**1.85**	<1	12.00
RMW-03	06/02/14	SoundEarth	**7.3**	<1	**1.33**	<1	**1.79**	**2.19**	**2.44**	<1	15.05
RMW-03	12/08/14	SoundEarth	**7.30**	<1.00	<0.500	<1.00	**1.53**	**1.29**	**2.04**	<1.00	12.16
RMW-03	06/02/15	SoundEarth	**10.5**	<1.00	**10.2**	<1.00	**2.14**	**2.73**	**5.75**	<1.00	31.32
RMW-03	12/10/15	SoundEarth	**7.64**	<1.00	**1.06**	<1.00	<1.00	**1.33**	**2.63**	<1.00	12.66
RMW-03	06/17/16	SoundEarth	**8.53**	<1.00	<0.500	<1.00	**1.21**	**1.25**	**2.13**	<1.00	13.12
RMW-04	05/01/08	LFR	**151**	<1	**5.86**	<1	<1	**477**	**5.92**	**2.88**	642.66
RMW-04	05/23/08	LFR	**91.3**	<1	**4.12**	<1	<1	**241**	**5.96**	**1.45**	343.83
RMW-04	12/09/08	LFR	**95**	<1	**2.45**	<1	<1	**259**	**2.35**	**1.66**	360.46
RMW-04	01/27/09	LFR	**104**	<1	**2.35**	<1	<1	**310**	**2.47**	**1.92**	420.74
RMW-04	04/07/09	LFR	**90.2**	<1	**1.28**	<1	<1	**189**	**1.73**	**1.54**	283.75
RMW-04	07/14/09	LFR	**99.2**	<1	**1.83**	<1	<1	**315**	**1.45**	**1.56**	419.04
RMW-04	10/07/09	LFR	**147**	<1	**3.28**	<1	<1	**615**	**2.25**	**2.68**	770.21
RMW-04	01/26/10	LFR - ARCADIS	**175**	<1	**2.61**	<1	<1	**564**	**1.66**	**2.77**	746.04
RMW-04	04/27/10	ARCADIS	**163**	<1	**1.7**	<1	<1	**457**	**1.56**	**3**	626.26
RMW-04	07/12/10	ARCADIS	**160**	<1	**2.23**	<1	<1	**338**	**1.65**	**2.99**	504.87
RMW-04	10/11/10	ARCADIS	**162**	<1	**2.59**	<1	<1	**477**	**1.87**	**3.46**	650.15
RMW-04	01/13/11	ARCADIS	**77.3**	<1	**0.96**	<1	<1	**175**	<1	**1.47**	254.73
RMW-04	04/04/11	ARCADIS	**59.6**	<1	**0.99**	<1	**2.17**	**23.9**	<1	<1	86.66
RMW-04	07/06/11	ARCADIS	**176**	<1	**2.87**	<1	<1	**140**	**1.77**	**3.96**	324.60
RMW-04	10/18/11	ARCADIS	**182**	<1	**2.75**	<1	<1	**197**	**1.66**	**4.58**	387.99
RMW-04	12/20/11	ARCADIS	**135**	<1	**2.27**	<1	<1	**102**	**1.62**	**3.33**	244.22
RMW-04 (DUP-2)	12/20/11	ARCADIS	**135**	<1	**2.37**	<1	<1	**103**	**1.72**	**3.42**	245.51
RMW-04	03/13/12	ARCADIS	**157**	<1	**1.89**	<1	<1	**4.95**	<1	**4.22**	168.06
RMW-04 (DUP-1)	03/13/12	ARCADIS	**142**	<1	**1.99**	<1	<1	**11.6**	<1	**3.69**	159.28
RMW-04	06/05/12	ARCADIS	**147**	<1	**2.17**	<1	<1	**19.1**	**1.16**	**3.11**	172.54
RMW-04 (DUP-1)	06/05/12	ARCADIS	**141**	<1	**1.82**	<1	<1	**16.1**	**1.02**	**2.67**	162.61
RMW-04	10/16/12	ARCADIS	**138**	<1	**1.66**	<1	<1	**13.7**	**1.13**	**2.48**	156.97
RMW-04 (DUP-1)	10/16/12	ARCADIS	**134**	<1	**1.78**	<1	<1	**16.4**	**1.10**	**2.56**	155.84
RMW-04	06/20/13	SoundEarth	**117**	<1	**1.85**	<1	<1	**73.1**	**1.98**	**2.67**	196.60
RMW-04 (DUP-1)	06/20/13	SoundEarth	**107**	<1	**1.69**	<1	<1	**69.00**	**1.91**	**2.43**	182.03
RMW-04	12/13/13	SoundEarth	**138**	<1	**1.84**	<1	<1	**31.00**	**1.81**	**2.94**	175.59
RMW-04 (DUP-1)	12/13/13	SoundEarth	**138**	<1	**1.86**	<1	<1	**37.90**	**1.89**	**3.04**	182.69
RMW-04	06/02/14	SoundEarth	**114**	<1	**1.71**	<1	<1	**44.80**	**3.05**	**2.53**	166.09
RMW-04 (RW-99)	06/02/14	SoundEarth	**110**	<1	**1.63**	<1	<1	**45.00**	**1.78**	**2.53**	160.94
RWM-04	12/10/14	SoundEarth	**120**	<1.00	**1.54**	<1.00	<1.00	**72.4**	**1.46**	**3.53**	198.93
RMW-99	12/10/14	SoundEarth	**128**	<1.00	**1.60**	<1.00	<1.00	**75.8**	**1.61**	**3.70**	210.71

Table 1
Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[(1)] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RMW-04	06/05/15	SoundEarth	**128**	<1.00	**1.68**	<1.00	<1.00	**31.0**	**1.49**	**3.17**	165.34
RMW-99	06/05/15	SoundEarth	**127**	<1.00	**1.54**	<1.00	<1.00	**30.9**	**1.45**	**3.08**	163.97
RMW-04	12/10/15	SoundEarth	**97.1**	<1.00	**1.21**	<1.00	<1.00	**15.4**	<1.00	**2.39**	116.1
RMW-99	12/10/15	SoundEarth	**99.3**	<1.00	**1.21**	<1.00	<1.00	**16.1**	<1.00	**2.58**	119.19
RMW-04	6/17/16	SoundEarth	**96.0**	<1.00	**1.25**	<1.00	<1.00	**17.7**	<1.00	**2.34**	117.29
RMW-99	6/17/16	SoundEarth	**91.5**	<1.00	<0.500	<1.00	**1.2**	**16.4**	<1.00	**1.89**	110.99
RMW-05	05/01/08	LFR	**10.3**	**3.1**	**1.81**	<1	<1	**107**	**1,250**	**10**	1,382.21
RMW-05	05/22/08	LFR	**8.09**	<1	**1.32**	<1	<1	**478**	**531**	**5**	1,023.41
RMW-05	07/31/08	LFR	**3.01**	<1	**0.86**	<1	<1	**46.6**	**16.5**	**1.94**	70.90
RMW-05	12/10/08	LFR	**5.26**	<1	**0.92**	<1	<1	**161**	**59**	**2.09**	228.27
RMW-05	01/27/09	LFR	**3.66**	<1	**0.77**	<1	<1	**26.4**	**2.95**	**1.77**	35.55
RMW-05	04/07/09	LFR	**2.57**	<1	<0.5	<1	<1	**6.88**	**2.15**	**1.03**	12.63
RMW-05	07/15/09	LFR	**1.88**	<1	<0.5	<1	<1	**3.1**	**2.47**	<1	7.45
RMW-05	10/07/09	LFR	**1.43**	<1	<0.5	<1	<1	**4.06**	**2.64**	<1	8.13
RMW-05 (DUP-3)	10/07/09	LFR	**1.69**	<1	**0.55**	<1	<1	**3.37**	**2.89**	<1	8.50
RMW-05	01/26/10	LFR - ARCADIS	**1.93**	<1	<0.5	<1	<1	**2.9**	**2.32**	**1.09**	8.24
RMW-05	04/27/10	ARCADIS	<1	<1	<0.5	<1	<1	**9.35**	**7.84**	<1	17.19
RMW-05	07/12/10	ARCADIS	<1	<1	<0.5	<1	<1	**8.16**	**4.02**	**1**	13.18
RMW-05 (DUP-1)	07/12/10	ARCADIS	<1	<1	<0.5	<1	<1	**8.92**	**4.06**	**1.15**	14.13
RMW-05	10/11/10	ARCADIS	**1.19**	<1	<0.5	<1	<1	**8.74**	**4.29**	**1.17**	15.39
RMW-05	01/12/11	ARCADIS	**2**	<1	<0.5	<1	<1	**8.98**	**5.78**	**1.68**	18.44
RMW-05	04/05/11	ARCADIS	<1	<1	**0.96**	<1	**1.05**	<0.5	**6.41**	<1	8.42
RMW-05	07/07/11	ARCADIS	<1	<1	**1.29**	<1	**1.1**	**1.59**	**7.82**	<1	11.80
RMW-05	10/19/11	ARCADIS	<1	<1	**0.99**	<1	<1	**1.63**	**5.82**	<1	8.44
RMW-05 (DUP-3)	10/19/11	ARCADIS	<1	<1	**1.01**	<1	<1	**1.72**	**6.03**	<1	8.76
RMW-05	12/20/11	ARCADIS	**1.06**	<1	<0.5	<1	<1	**5.98**	**2.37**	**1.07**	10.48
RMW-05	03/14/12	ARCADIS	**1.41**	<1	<0.5	<1	<1	**11.6**	**9.09**	**1.65**	23.75
RMW-05	06/05/12	ARCADIS	<1	<1	<0.5	<1	<1	**9.44**	**6.84**	**1.66**	17.94
RMW-05	10/15/12	ARCADIS	**1.97**	<1	<0.5	<1	<1	**9.22**	**5.74**	**1.77**	21.57
RMW-05	06/20/13	SoundEarth	**1.06**	<1	<0.5	<1	<1	**19**	**16**	**1.46**	37.52
RMW-05	12/13/13	SoundEarth	**1.27**	<1	<0.5	<1	<1	**11.10**	**12.00**	**1.51**	25.88
RMW-05	06/02/14	SoundEarth	**1.05**	<1	<0.5	<1	<1	**10.30**	**13.20**	**1.16**	25.71
RMW-05	12/10/14	SoundEarth	**1.23**	<1.00	<0.500	<1.00	<1.00	**13.2**	**25.9**	**1.58**	41.91
RMW-05	06/04/15	SoundEarth	**1.50**	<1.00	<0.500	<1.00	<1.00	**10.3**	**30.3**	**2.07**	44.17
RMW-05	12/09/15	SoundEarth	<1.00	<1.00	<0.500	<1.00	<1.00	**2.08**	**10.3**	**1.06**	13.44
RMW-05	06/17/16	SoundEarth	**1.80**	<1.00	<0.500	<1.00	<1.00	**8.36**	**45.6**	**1.26**	57.02
RMW-06	05/02/08	LFR	**25**	<1	**7.81**	<1	<1	**362**	**195.00**	**3.95**	638.76
RMW-06	05/23/08	LFR	**25.3**	<1	**2.28**	<1	<1	**286**	**110**	**4.81**	466.99
RMW-06	07/31/08	LFR	**31.4**	<1	**3.54**	<1	**1.06**	**106**	**8.53**	**3.18**	174.21
RMW-06	12/09/08	LFR	**26**	<1	**0.98**	<1	<1	**11.8**	**1.76**	**3.21**	54.95
RMW-06	01/27/09	LFR	**41.1**	<1	**0.92**	<1	<1	**6.62**	**1.71**	**4.17**	69.22
RMW-06	04/07/09	LFR	**29.8**	<1	<0.5	<1	<1	**5.45**	**2.49**	**2.86**	51.30
RMW-06	07/14/09	LFR	**11.7**	<1	<0.5	<1	<1	**2.98**	**2.61**	<1	21.71
RMW-06 (DUP-2)	07/14/09	LFR	**9.69**	<1	<0.5	<1	<1	**2.92**	**2.54**	<1	18.76
RMW-06	10/07/09	LFR	**19.3**	<1	<0.5	<1	<1	**9.11**	**5.02**	**1.76**	41.08

Table 1
Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[1] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RMW-06	01/25/10	LFR - ARCADIS	**119**	<1	**0.61**	<1	<1	**1.95**	<1	**5.7**	134.77
RMW-06 (DUP-2)	01/25/10	LFR - ARCADIS	**119**	<1	**0.66**	<1	<1	**1.82**	<1	**6.04**	135.07
RMW-06	04/26/10	ARCADIS	**85.2**	<1	<0.5	<1	<1	**2.35**	**2.05**	**3.96**	98.28
RMW-06	07/12/10	ARCADIS	**22.7**	<1	<0.5	<1	<1	**6.07**	**10.2**	**1.3**	41.96
RMW-06	10/11/10	ARCADIS	**25.2**	<1	<0.5	<1	<1	**3.6**	**3.17**	**1.86**	35.11
RMW-06	01/11/11	ARCADIS	**43.7**	<1	<0.5	<1	<1	**2.25**	**1.26**	**3.09**	51.97
RMW-06	04/04/11	ARCADIS	**34.2**	<1	<0.5	<1	<1	**2.27**	**2.35**	**2.27**	42.45
RMW-06	07/07/11	ARCADIS	**10.9**	<1	<0.5	<1	<1	**6.59**	**8.02**	<1	25.51
RMW-06	10/18/11	ARCADIS	**7.47**	<1	<0.5	<1	<1	**6.8**	**7.86**	<1	22.13
RMW-06	12/19/11	ARCADIS	**11.7**	<1	<0.5	<1	<1	**1.44**	**5.03**	**1.26**	19.43
RMW-06	03/13/12	ARCADIS	**11.7**	<1	<0.5	<1	<1	<0.5	**2.27**	**1.13**	15.10
RMW-06	06/05/12	ARCADIS	**13.6**	<1	<0.5	<1	**1.30**	<0.5	**1.86**	<1	16.76
RMW-06	10/15/12	ARCADIS	**9.49**	<1	<0.5	<1	<1	**1.84**	**4.44**	**1.22**	19.99
RMW-06	06/20/13	SoundEarth	**25.4**	<1	<0.5	<1	**2.3**	<0.5	**1.02**	**2.03**	36.63
RMW-06	12/13/13	SoundEarth	**39.6**	<1	<0.5	<1	<1	**1.28**	**2.44**	**3.11**	49.78
RMW-06	06/03/14	SoundEarth	**37.8**	<1	<0.5	<1	**1.43**	**1.28**	**1.51**	**3.17**	45.19
RMW-06	12/08/14	SoundEarth	**24.4**	<1.00	<0.500	<1.00	2.15	**0.640**	**3.22**	**2.71**	33.12
RMW-06	06/03/15	SoundEarth	**11.3**	<1.00	<0.500	<1.00	**1.92**	**0.580**	**2.25**	**1.67**	17.72
RMW-06	12/09/15	SoundEarth	**5.65**	<1.00	<0.500	<1.00	**1.68**	**0.610**	**5.38**	**1.30**	14.62
RMW-06	06/17/16	SoundEarth	**2.85**	<1.00	<0.500	<1.00	**2.64**	<0.500	**7.08**	<1.00	12.57
RMW-07	05/02/08	LFR	**19.7**	<1	**9.34**	<1	<1	**25**	**21.7**	**1.81**	77.55
RMW-07	05/23/08	LFR	**24**	<1	**5.63**	<1	**1.08**	**13.1**	**13.1**	**1.33**	58.24
RMW-07	07/31/08	LFR	**19**	<1	**6.62**	<1	**1.14**	**12.9**	**10.6**	**1.1**	51.36
RMW-07	12/09/08	LFR	**10.2**	<1	**2.45**	<1	<1	**4.66**	**1.98**	<1	19.29
RMW-07	01/28/09	LFR	**7.61**	<1	<0.5	<1	<1	<0.5	<1	<1	7.61
RMW-07	04/07/09	LFR	**10.1**	<1	**1.3**	<1	<1	**3.33**	**1.38**	<1	16.11
RMW-07	07/14/09	LFR	**6.59**	<1	<0.5	<1	<1	**0.96**	<1	<1	7.55
RMW-07	10/07/09	LFR	**12.9**	<1	**8.84**	<1	<1	**22.2**	**8.5**	<1	52.44
RMW-07	01/25/10	LFR - ARCADIS	**10.2**	<1	**10.3**	<1	<1	**26.8**	**12.1**	<1	59.40
RMW-07	04/23/10	ARCADIS	**6.44**	<1	<0.5	<1	<1	**2.75**	<1	<1	9.19
RMW-07	07/13/10	ARCADIS	**6.19**	<1	<0.5	<1	<1	**2.6**	<1	<1	8.79
RMW-07 (DUP-2)	07/13/10	ARCADIS	**6.26**	<1	<0.5	<1	<1	**2.71**	<1	<1	8.97
RMW-07	10/11/10	ARCADIS	**7.07**	<1	**0.71**	<1	<1	**4.81**	**1.5**	<1	14.09
RMW-07	01/12/11	ARCADIS	**3.62**	<1	<0.5	<1	<1	**2.92**	<1	<1	6.54
RMW-07	04/04/11	ARCADIS	**5.09**	<1	<0.5	<1	<1	**3.59**	<1	<1	8.68
RMW-07	07/07/11	ARCADIS	**5.8**	<1	<0.5	<1	<1	**3.6**	<1	<1	9.40
RMW-07	10/18/11	ARCADIS	**5.7**	<1	<0.5	<1	<1	**5.55**	<1	<1	11.25
RMW-07	12/19/11	ARCADIS	**5.51**	<1	<0.5	<1	<1	**3.06**	<1	<1	8.57
RMW-07	03/14/12	ARCADIS	**9.19**	<1	**2.64**	<1	<1	**6.98**	**2.54**	<1	21.35
RMW-07 (DUP-2)	03/14/12	ARCADIS	**8.84**	<1	**1.58**	<1	<1	**6.16**	**2.08**	<1	18.66
RMW-07	06/06/12	ARCADIS	**9.08**	<1	**7.19**	<1	<1	**12.8**	**7.75**	<1	36.82
RMW-07	10/15/12	ARCADIS	**2.48**	<1	<0.5	<1	<1	<0.5	<1	<1	2.48
RMW-07	06/20/13	SoundEarth	**4.09**	<1	<0.5	<1	<1	<0.5	<1	<1	4.09
RMW-07	12/13/13	SoundEarth	**8.63**	<1	**0.81**	<1	<1	**3.11**	**1.20**	<1	13.75

Table 1
Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[1] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RMW-07	06/03/14	SoundEarth	**6.34**	<1	**0.6**	<1	<1	**2.06**	**1.00**	<1	10.00
RMW-07	12/09/14	SoundEarth	**2.27**	<1.00	<0.500	<1.00	<1.00	<0.500	<1.00	<1.00	2.27
RMW-07	06/02/15	SoundEarth	**4.48**	<1.00	<0.500	<1.00	<1.00	**0.600**	<1.00	<1.00	5.08
RMW-07	12/09/15	SoundEarth	**6.12**	<1.00	**2.29**	<1.00	<1.00	<0.500	**4.37**	<1.00	12.78
RMW-07	06/17/16	SoundEarth	**1.70**	<1.00	<0.500	<1.00	<1.00	<0.500	<1.00	<1.00	1.70
RMW-08	05/02/08	LFR	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	05/23/08	LFR	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	07/31/08	LFR	**18**	<1	**6.27**	<1	**1.12**	**14**	**9.84**	**1.02**	50.25
RMW-08	12/10/08	LFR	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	01/28/09	LFR	<1	<1	<0.5	<1	**1.47**	<0.5	<1	<1	1.47
RMW-08	04/07/09	LFR	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	07/14/09	LFR	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	10/08/09	LFR	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	01/25/10	LFR - ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	04/23/10	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	07/13/10	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	10/11/10	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	01/12/11	ARCADIS	<1	<1	<0.5	<1	<1	**0.5**	<1	<1	0.50
RMW-08	04/05/11	ARCADIS	<1	<1	<0.5	<1	<1	**2.39**	<1	<1	2.39
RMW-08 (DUP-2)	04/05/11	ARCADIS	<1	<1	<0.5	<1	<1	**2.99**	<1	<1	2.99
RMW-08	07/07/11	ARCADIS	<1	<1	<0.5	<1	<1	**0.9**	<1	<1	0.90
RMW-08 (DUP-2)	07/07/11	ARCADIS	<1	<1	<0.5	<1	<1	**0.97**	<1	<1	0.97
RMW-08	10/18/11	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08 (DUP-1)	10/18/11	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	12/19/11	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	03/14/12	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	06/06/12	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	10/15/12	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	06/20/13	SoundEarth	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	12/13/13	SoundEarth	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	06/03/14	SoundEarth	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RMW-08	12/09/14	SoundEarth	<1.00	<1.00	<0.500	<1.00	<1.00	<0.500	<1.00	<1.00	ND
RMW-08	06/03/15	SoundEarth	<1.00	<1.00	<0.500	<1.00	<1.00	<0.500	<1.00	<1.00	ND
RMW-08	12/10/15	SoundEarth	<1.00	<1.00	<0.500	<1.00	<1.00	<0.500	<1.00	<1.00	ND
RMW-08	06/17/16	SoundEarth	<1.00	<1.00	<0.500	<1.00	<1.00	<0.500	<1.00	<1.00	ND
RMW-09	05/02/08	LFR	**15.2**	<1	**1.43**	<1	<1	**7.22**	**46.3**	<1	70.15
RMW-09	05/23/08	LFR	**20.8**	<1	<0.5	<1	<1	**12**	**62.8**	**1.14**	96.74
RMW-09	07/31/08	LFR	**26**	**1.21**	**0.9**	<1	<1	**51**	**22.2**	<1	101.31
RMW-09	12/10/08	LFR	**30.6**	**2.88**	**0.67**	<1	<1	**133**	**2.12**	<1	169.27
RMW-09	01/28/09	LFR	**114**	**11.4**	**3.03**	<1	**1.77**	**517**	**8.29**	**2.53**	658.02
RMW-09	04/08/09	LFR	**139**	**12.6**	**3.59**	<1	**1.84**	**516**	**9.29**	**2.75**	685.07
RMW-09	07/15/09	LFR	**149**	**13.3**	**3.99**	<1	**1.88**	**256**	**12**	**3.58**	439.75
RMW-09	10/08/09	LFR	**39.8**	**1.72**	<0.5	<1	<1	**2.05**	**83.6**	**1.72**	129.98

Table 1
Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[(1)] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RMW-09	01/26/10	LFR - ARCADIS	**106**	<1	**0.54**	<1	<1	**2.55**	**103**	**2.71**	216.92
RMW-09	04/27/10	ARCADIS	**3.71**	<1	<0.5	**1.52**	<1	<0.5	**2**	<1	7.23
RMW-09	07/13/10	ARCADIS	**2.47**	<1	<0.5	**1.34**	<1	<0.5	<1	<1	3.81
RMW-09	10/12/10	ARCADIS	**33.9**	<1	<0.5	<1	<1	**4.32**	**26.6**	<1	66.25
RMW-09	01/12/11	ARCADIS	**1.92**	<1	<0.5	**1.04**	<1	<0.5	<1	<1	2.96
RMW-09	04/05/11	ARCADIS	**2.58**	<1	<0.5	**1.88**	<1	**0.69**	<1	<1	5.15
RMW-09	07/07/11	ARCADIS	**1.9**	<1	<0.5	<1	<1	<0.5	<1	<1	1.90
RMW-09	10/18/11	ARCADIS	**4.5**	<1	<0.5	<1	<1	**0.98**	<1	<1	5.48
RMW-09	12/19/11	ARCADIS	**5.81**	<1	<0.5	<1	<1	<0.5	<1	<1	5.81
RMW-09	03/14/12	ARCADIS	**43.8**	**3.25**	**1.01**	<1	<1	**14.3**	**1.85**	<1	76.51
RMW-09	06/06/12	ARCADIS	**26.1**	**1.27**	**0.510**	<1	<1	**1.22**	<1	<1	29.10
RMW-09	10/15/12	ARCADIS	**64.0**	**3.79**	**0.760**	<1	<1	**12.9**	**1.94**	<1	86.29
RMW-09	06/20/13	SoundEarth	**54.8**	**1.39**	**0.53**	<1	<1	<0.5	**1.25**	<1	57.97
RMW-09	12/13/13	SoundEarth	**61.8**	<1	<0.5	<1	<1	<0.5	**1.62**	<1	63.42
RMW-09	06/03/14	SoundEarth	**52.3**	<1	<0.5	<1	<1	<0.5	**1.39**	<1	53.69
RMW-09	12/09/14	SoundEarth	**46.1**	<1.00	<0.500	<1.00	<1.00	**0.740**	**1.37**	<1.00	48.21
RMW-09	06/03/15	SoundEarth	**53.3**	<1.00	<0.500	<1.00	<1.00	<0.500	**1.83**	<1.00	55.13
RMW-09	12/10/15	SoundEarth	**67.3**	<1.00	<0.500	<1.00	<1.00	**12.3**	**2.83**	<1.00	82.43
RMW-09	06/17/16	SoundEarth	**36.9**	<1.00	<0.500	<1.00	<1.00	<0.500	**1.22**	<1.00	38.12
RMW-10	03/02/16	SoundEarth	**149**	<1.00	**19.0**	**2.35**	**7.82**	**478**	**105**	**1.61**	**762.78**
RMW-11	03/01/16	SoundEarth	<1.00	<1.00	<0.500	<1.00	<1.00	<0.500	<1.00	<1.00	ND
RMW-12	03/02/16	SoundEarth	**3.85**	<1.00	<0.500	<1.00	**1.32**	**8.42**	**41.7**	<1.00	**55.29**
RMW-13	03/01/16	SoundEarth	<1.00	<1.00	<0.500	<1.00	**12.3**	**3.33**	**17.5**	<1.00	**33.13**
RW-01	10/19/12	LFR	**349**	<1	**18.5**	<1	**2.77**	**18.3**	**9.40**	**11.4**	414.85
RW-01	09/02/16	SoundEarth	**230**	<1.00	**0.57**	<1.00	<1.00	<0.500	**1.09**	**8.16**	**239.82**
RW-02	05/01/08	LFR	**353**	**21.9**	**1,770**	<1	**3.88**	**3,370**	**685**	**22.2**	6,230.67
RW-02	05/22/08	LFR	**351**	**7.8**	**432**	<1	**2.12**	**3,280**	**229**	**18.5**	4,321.69
RW-02	07/31/08	LFR	**175**	**14.5**	**470**	<1	**9.36**	**1,200**	**439**	**9.07**	2,318.54
RW-02	12/09/08	LFR	**37.9**	**1.76**	**14.4**	<1	**1.29**	**269**	**57.9**	**2.44**	384.69
RW-02	01/27/09	LFR	**128**	**10.2**	**133**	<1	**5.05**	**1,380**	**261**	**8.92**	1,926.17
RW-02	04/07/09	LFR	**15.7**	<1	**4.94**	<1	<1	**140**	**11.5**	**1.44**	173.58
RW-02	07/14/09	LFR	**28.5**	<1	**6.51**	<1	<1	**194**	**26**	**2.02**	257.03
RW-02	10/05/09	LFR	**116**	**3.22**	**50.9**	<1	**1.97**	**644**	**77.8**	**8.6**	914.29
RW-02 (DUP-1)	10/05/09	LFR	**117**	**3.67**	**55.4**	<1	**1.98**	**570**	**84.4**	**8.65**	853.60
RW-02	01/26/10	LFR - ARCADIS	**139**	<1	**0.88**	<1	<1	**287**	**17.2**	**10.3**	465.38
RW-02	04/27/10	ARCADIS	**29**	**2.06**	**19.2**	<1	**1.11**	**159**	**52.4**	**2.01**	266.59
RW-02 (DUP-2)	04/27/10	ARCADIS	**24.2**	**1.58**	**15.8**	<1	<1	**128**	**41.6**	**1.73**	214.24
RW-02	07/12/10	ARCADIS	**72.1**	**3.75**	**39.9**	<1	**1.7**	**296**	**108**	**4.88**	526.33
RW-02	10/11/10	ARCADIS	**67.4**	**1.86**	**10.1**	<1	<1	**212**	**51**	**3.9**	349.10
RW-02	01/11/11	ARCADIS	**64.6**	**1.66**	**8.23**	<1	<1	**180**	**35.7**	**3.97**	296.81
RW-02	04/04/11	ARCADIS	**3.68**	<1	**1.61**	<1	<1	**16.5**	**5.04**	<1	26.83
RW-02	07/06/11	ARCADIS	**15.1**	<1	**1.89**	<1	<1	**49.4**	**14.2**	<1	80.59
RW-02	10/18/11	ARCADIS	**48.7**	**2.05**	**3.18**	<1	<1	**255**	**44.2**	**3.52**	356.65
RW-02 (DUP-2)	10/18/11	ARCADIS	**48.3**	**1.86**	**3.22**	<1	<1	**266**	**44.5**	**3.46**	367.34
RW-02	12/20/11	ARCADIS	**60.7**	**2.01**	**2.54**	<1	<1	**212**	**45.6**	**4.18**	327.03
RW-02	03/13/12	ARCADIS	**49.8**	**1.37**	**1.93**	<1	<1	**89.9**	**32.3**	**3.44**	178.74
RW-02	06/05/12	ARCADIS	**52.9**	<1	**1.16**	<1	<1	**52.6**	**31.6**	**2.90**	141.16
RW-02	10/17/12	ARCADIS	**35.2**	<1	<0.5	<1	<1	**20.2**	**14.9**	**2.02**	72.32

Table 1
Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[(1)] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RW-03 (DUP-1)	10/17/06	LFR	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RW-03	05/01/08	LFR	**145**	<1	**1.46**	<1	<1	**413**	**3.74**	**3.54**	566.74
RW-03	05/22/08	LFR	**107**	<1	**1.4**	<1	<1	**251**	**4.18**	**2.43**	366.01
RW-03	07/31/08	LFR	**60.3**	<1	**0.55**	<1	<1	**91.9**	**1.06**	**1.6**	155.41
RW-03	12/09/08	LFR	**47**	<1	**0.85**	<1	<1	**67.9**	**1.26**	**1.33**	118.34
RW-03	01/27/09	LFR	**78.6**	<1	**1.34**	<1	<1	**139**	**2.68**	**2.41**	225.04
RW-03	04/07/09	LFR	**134**	<1	**3.03**	<1	<1	**147**	**4.15**	**4.13**	292.31
RW-03 (DUP-1)	04/07/09	LFR	**139**	<1	**3.28**	<1	<1	**159**	**4.57**	**4.42**	310.27
RW-03	07/14/09	LFR	**132**	<1	**2.54**	<1	<1	**161**	**5.38**	**3.03**	303.95
RW-03	10/07/09	LFR	**116**	<1	**0.73**	<1	<1	**328**	**1.14**	**3.05**	448.92
RW-03	01/26/10	LFR - ARCADIS	**165**	<1	**3.79**	<1	<1	**246**	**11**	**4.42**	430.21
RW-03	04/27/10	ARCADIS	**175**	<1	**3.34**	<1	<1	**162**	**10**	**4.89**	355.23
RW-03	07/12/10	ARCADIS	**102**	<1	**2.56**	<1	<1	**157**	**6.47**	**2.43**	270.46
RW-03	10/11/10	ARCADIS	**159**	<1	**3.81**	<1	<1	**248**	**3.32**	**4.48**	421.52
RW-03	01/11/11	ARCADIS	**182**	<1	**1.05**	<1	<1	**223**	**2.54**	**4.71**	413.30
RW-03	04/04/11	ARCADIS	**280**	<1	**1.24**	<1	<1	**373**	**2.65**	**7.5**	664.39
RW-03 (DUP-1)	04/04/11	ARCADIS	**267**	<1	**1.15**	<1	<1	**350**	**2.39**	**7.12**	627.66
RW-03	07/06/11	ARCADIS	**93.6**	<1	**3.98**	<1	<1	**157**	**7.9**	**2.6**	265.08
RW-03 (DUP-1)	07/06/11	ARCADIS	**98**	<1	**4.12**	<1	<1	**165**	**8.26**	**2.91**	278.29
RW-03	10/18/11	ARCADIS	**118**	<1	**0.69**	<1	<1	**439**	<1	**4.03**	561.72
RW-03	12/20/11	ARCADIS	**84.4**	<1	**0.7**	<1	<1	**230**	**1.8**	**2.63**	319.53
RW-03	03/13/12	ARCADIS	**73.7**	<1	**1.55**	<1	<1	**156**	**3.76**	**2.42**	237.43
RW-03	06/05/12	ARCADIS	**79.7**	<1	**1.50**	<1	<1	**50.7**	**3.65**	**2.04**	137.59
RW-03	10/16/12	ARCADIS	**78.5**	<1	**0.860**	<1	<1	**35.9**	**2.39**	**1.95**	119.60
RW-03	09/02/16	SoundEarth	**64.40**	<1.00	<0.500	<1.00	<1.00	<0.500	<1.00	**1.55**	**65.95**
RW-04	01/08/08	LFR	**79.7**	<1	**11.6**	<1	<1	**414**	**12.7**	**4.06**	522.06
RW-04	02/28/08	LFR	**72.9**	<1	**2.65**	<1	<1	**163**	**4.29**	**2.82**	245.66
RW-04	05/22/08	LFR	**351**	<1	**62.4**	<1	<1	**1,920**	**15.4**	**15.8**	2,364.60
RW-04	10/19/12	ARCADIS	**92.4**	<1	**4.71**	<1	**1.03**	**144**	**3.86**	**4.38**	250.38
RW-04	06/24/14	SoundEarth	**143**	<1	**1.51**	<1	<1	**96.2**	**1.92**	**3.56**	246.19
RW-04 DUP (RW-99)	06/24/14	SoundEarth	**129**	<1	**1.56**	<1	<1	**96.2**	**1.90**	**3.17**	231.83
RW-04	12/09/14	SoundEarth	**106**	<1.00	**3.20**	<1.00	<1.00	**1.51**	<1.00	**6.56**	117.27
RW-04	06/02/15	SoundEarth	**111**	<1.00	**4.43**	<1.00	<1.00	**19.9**	**1.86**	**6.14**	143.33
RW-4	09/02/16	SoundEarth	**100**	<1.00	**2.02**	<1.00	<1.00	<0.500	<1.00	**6.77**	**108.79**
RW-05	05/02/08	LFR	**533**	**2.46**	**688**	<1	**1.52**	**2,740**	**97.4**	**22.1**	4,092.32
RW-05	05/22/08	LFR	**484**	**1.05**	**301**	<1	<1	**3,210**	**53.1**	**22.3**	4,076.87
RW-05	07/31/08	LFR	**480**	**2.53**	**53.9**	<1	<1	**2,970**	**157**	**25.1**	3,688.53
RW-05	12/09/08	LFR	**121**	<1	**7.27**	<1	<1	**409**	**13**	**8.89**	559.16
RW-05	01/28/09	LFR	**152**	<1	**25.6**	<1	<1	**445**	**13.5**	**10.5**	646.60
RW-05	04/07/09	LFR	**132**	<1	**29.8**	<1	<1	**420**	**12.1**	**10.4**	604.30
RW-05	07/14/09	LFR	**147**	<1	**16.1**	<1	<1	**326**	**10.2**	**10.2**	509.50
RW-05	10/07/09	LFR	**157**	<1	**7.34**	<1	<1	**526**	**20.3**	**11.4**	722.04
RW-05	01/25/10	LFR - ARCADIS	**158**	<1	**0.72**	<1	<1	**479**	**55.8**	**10**	703.52
RW-05	04/23/10	ARCADIS	**97.1**	<1	**11.2**	<1	<1	**355**	**118**	**6.58**	587.88
RW-05	07/13/10	ARCADIS	**99.4**	<1	**14.6**	<1	<1	**267**	**54**	**7.03**	442.03
RW-05	10/11/10	ARCADIS	**104**	<1	**8.29**	<1	<1	**300**	**44.1**	**7.32**	467.08
RW-05	01/12/11	ARCADIS	**100**	<1	**24**	<1	<1	**366**	**45.4**	**7.92**	543.32

Table 1
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North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[(1)] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RW-05	04/04/11	ARCADIS	**62.1**	<1	**13.5**	<1	<1	**162**	**30**	**4.61**	272.21
RW-05	07/07/11	ARCADIS	**70.8**	<1	**11.5**	<1	<1	**207**	**29.4**	**5.64**	324.34
RW-05	10/18/11	ARCADIS	**65**	<1	**9.44**	<1	<1	**218**	**29**	**5.16**	326.60
RW-05	12/19/11	ARCADIS	**69.7**	<1	**6.93**	<1	<1	**145**	**22.3**	**4.94**	248.87
RW-05	03/13/12	ARCADIS	**62.8**	<1	**6.21**	<1	<1	**76.4**	**16.3**	**2.86**	164.57
RW-05	06/06/12	ARCADIS	**81.1**	<1	**10.3**	<1	<1	**125**	**20.7**	**4.39**	241.49
RW-05	10/17/12	ARCADIS	**61.8**	<1	**7.99**	<1	<1	**103**	**17.4**	**2.80**	194.53
RW-06	05/01/08	LFR	**160**	<1	**2.67**	<1	<1	**363**	**3.25**	**4**	532.92
RW-06	05/22/08	LFR	**249**	<1	**4.11**	<1	<1	**589**	**23**	**4.92**	870.03
RW-06	07/31/08	LFR	**80.1**	<1	**1.51**	<1	<1	**82.9**	**1.38**	**2.28**	168.17
RW-06	12/09/08	LFR	**55.6**	<1	**0.57**	<1	<1	**93.7**	<1	**1.56**	151.43
RW-06	01/27/09	LFR	**48.3**	<1	**3.52**	<1	<1	**63.7**	**3.55**	**1.36**	120.43
RW-06	04/07/09	LFR	**61.2**	<1	**3.05**	<1	<1	**93.5**	**2.45**	**1.52**	161.72
RW-06	07/13/09	LFR	**109**	<1	**2.94**	<1	<1	**161**	**8.19**	**2.16**	283.29
RW-06	10/07/09	LFR	**185**	<1	**3.46**	<1	<1	**27.6**	<1	**3.95**	222.02
RW-06	01/25/10	LFR - ARCADIS	**216**	<1	**0.99**	<1	<1	**65.4**	**1.22**	**3.44**	287.05
RW-06	04/26/10	ARCADIS	**183**	<1	<0.5	<1	<1	**4.88**	<1	**2.64**	190.52
RW-06	07/12/10	ARCADIS	**223**	<1	**0.87**	<1	<1	<0.5	<1	**3.86**	227.73
RW-06	10/11/10	ARCADIS	**243**	<1	**0.68**	<1	<1	**0.95**	<1	**4.3**	248.93
RW-06	01/11/11	ARCADIS	**208**	<1	**1.53**	<1	<1	**0.75**	**1.74**	**3.66**	215.68
RW-06	04/04/11	ARCADIS	**237**	<1	**0.86**	<1	<1	<0.5	<1	**3.9**	241.76
RW-06	07/06/11	ARCADIS	**351**	<1	**1.31**	<1	<1	<0.5	**1.19**	**5.25**	358.75
RW-06	10/18/11	ARCADIS	**318**	<1	**0.85**	<1	<1	<0.5	<1	**4.95**	323.80
RW-06	12/19/11	ARCADIS	**337**	<1	**0.98**	<1	<1	<0.5	**1.03**	**5.61**	344.62
RW-06 (DUP-1)	12/19/11	ARCADIS	**299**	<1	**0.92**	<1	<1	<0.5	<1	**5.48**	305.40
RW-06	03/13/12	ARCADIS	**221**	<1	**0.83**	<1	<1	<0.5	<1	**4.56**	226.39
RW-06	06/05/12	ARCADIS	**298**	<1	**0.950**	<1	<1	<0.5	<1	**4.15**	303.10
RW-06	10/17/12	ARCADIS	**90.7**	<1	<0.5	<1	<1	<0.5	**3.15**	**2.00**	99.62
RW-06	09/02/16	SoundEarth	**25.00**	<1.00	<0.500	<1.00	<1.00	<0.500	**1.52**	**1.15**	**27.67**
RW-07	01/08/08	LFR	**3.57**	**1.99**	**7.01**	**1.45**	<1	**56.5**	**31.7**	**1.25**	106.02
RW-07	02/28/08	LFR	**34.4**	**7.79**	**166**	**2.28**	**2.11**	**464**	**1510**	**9.48**	2,213.97
RW-07	05/22/08	LFR	**208**	**2.17**	**317**	<1	<1	**792**	**95.7**	**10.3**	1,427.45
RW-07	10/19/12	ARCADIS	**19.4**	<1	**2.96**	<1	<1	**196**	**5.27**	**2.71**	226.34
RW-07	09/02/16	SoundEarth	**20.80**	<1.00	**9.34**	<1.00	<1.00	**4.90**	**7.08**	**1.83**	**43.95**
RW-08	01/09/08	LFR	**240**	<1	**4.34**	<1	<1	**1040**	**42.7**	**8.05**	1,335.09
RW-08	02/28/08	LFR	**6.18**	**2.13**	**10.3**	**4.7**	**3.05**	**109**	**78.5**	**1.82**	226.58
RW-08	05/22/08	LFR	**79.4**	<1	**2.66**	<1	<1	**29.2**	**17.5**	**1.79**	133.43
RW-08	10/16/12	ARCADIS	**11.3**	<1	<0.5	<1	<1	**5.68**	<1	<1	16.98
RW-08 (DUP-2)	10/16/12	ARCADIS	**11.5**	<1	<0.5	<1	<1	**5.52**	<1	<1	17.02
RW-09	01/08/08	LFR	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RW-09	02/28/08	LFR	**3.38**	<1	<0.5	<1	<1	**1.28**	**1.43**	<1	6.09
RW-09	05/22/08	LFR	**68.6**	<1	**2.82**	<1	<1	**86.8**	**3.93**	**1.21**	163.36
RW-09	10/16/12	ARCADIS	**259**	<1	**0.950**	<1	<1	<0.5	<1	**4.01**	263.96
RW-11	01/08/08	LFR	**22.6**	<1	**10.4**	<1	<1	**127**	**41.4**	<1	201.40
RW-11	02/29/08	LFR	**36.1**	<1	**23.3**	<1	<1	**206**	**76.5**	<1	346.24
RW-11	05/23/08	LFR	**82.6**	<1	**26.5**	<1	<1	**348**	**33.8**	**1.83**	492.73
RW-11	10/17/12	ARCADIS	**51.6**	<1	**2.48**	<1	<1	**2.81**	<1	**1.03**	57.92

Table 1
Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[1] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RW-12	01/08/08	LFR	**640**	<5	**34.8**	<5	<5	**495**	**62.6**	**5.5**	1,237.90
RW-12	02/29/08	LFR	**15.9**	<1	**1.63**	**3.45**	**4.02**	**37.1**	**113**	**1.35**	189.05
RW-12	05/23/08	LFR	**72.2**	<1	**1.83**	<1	<1	**35.7**	**45.7**	**1.24**	156.67
RW-12	08/01/08	LFR	**339**	<1	**11.7**	<1	<1	**135**	**36.5**	**2.75**	524.95
RW-12	10/17/12	LFR	<1	<1	<0.5	<1	<1	**41.5**	**10.8**	**1.28**	53.58
RW-13	01/09/08	LFR	**93.6**	<1	**1.9**	**3.19**	<1	**71**	**13.1**	**2.4**	185.19
RW-13	02/29/08	LFR	**11.2**	<1	**3.07**	**2.16**	**3.02**	**8.55**	**7.61**	<1	35.61
RW-13	05/23/08	LFR	**130**	<1	**1.78**	<1	<1	**97.2**	**5.02**	**3.46**	238.67
RW-13	10/17/12	ARCADIS	**123**	<1	<0.5	<1	<1	**174**	**1.12**	**2.32**	300.44
RW-13	06/03/14	SoundEarth	**24**	<1	<0.5	**1.48**	**1.17**	**6.17**	**1.41**	**2.32**	36.55
RW-13	12/09/14	SoundEarth	**27.1**	<1.00	<0.500	<1.00	<1.00	**5.81**	**1.83**	<1.00	34.74
RW-13	06/03/15	SoundEarth	**29.7**	<1.00	<1	<1.00	**1.01**	**15.3**	**2.55**	**1.08**	49.64
RW-14 (DUP-3)	10/18/06	LFR	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RW-14	05/02/08	LFR	**80.2**	<1	**0.91**	<1	<1	**132**	**39.4**	**2.12**	254.63
RW-14	05/23/08	LFR	**3.14**	<1	<0.5	<1	<1	**5.56**	**2.03**	<1	10.73
RW-14	07/31/08	LFR	**13.1**	<1	**0.75**	<1	<1	**31.9**	**3.89**	<1	49.64
RW-14	12/10/08	LFR	**32.8**	<1	**0.71**	<1	<1	**114**	**5.03**	**1.4**	153.94
RW-14	01/28/09	LFR	**33.8**	<1	<0.5	<1	<1	**110**	**2.83**	**1.33**	147.96
RW-14	04/08/09	LFR	**27.4**	<1	**1.74**	<1	<1	**88.1**	**2.51**	**1.09**	120.84
RW-14 (DUP-3)	04/08/09	LFR	**24.8**	<1	**1.81**	<1	<1	**82.9**	**2.47**	**1.1**	113.08
RW-14	07/15/09	LFR	**18.4**	<1	<0.5	<1	<1	**89.6**	**1.28**	<1	109.28
RW-14	10/08/09	LFR	**54.2**	<1	**6.36**	<1	<1	**88.9**	**1.21**	**1.42**	155.54
RW-14	01/26/10	LFR - ARCADIS	**52.2**	<1	**3.27**	<1	<1	**117**	**1.81**	**1.46**	175.74
RW-14 (DUP-3)	01/26/10	LFR - ARCADIS	**42.1**	<1	**2.86**	<1	<1	**90.3**	**1.31**	**1.16**	137.73
RW-14	04/27/10	ARCADIS	**27.7**	<1	**0.52**	<1	<1	**41.1**	**1.57**	<1	70.89
RW-14	07/13/10	ARCADIS	**14**	<1	<0.5	<1	<1	**65.3**	**1.2**	<1	80.50
RW-14	10/12/10	ARCADIS	**11.2**	<1	**0.58**	<1	<1	**71.1**	**2.28**	<1	85.16
RW-14	01/12/11	ARCADIS	**13.1**	<1	**0.66**	<1	<1	**60.8**	**4.02**	<1	78.58
RW-14	04/05/11	ARCADIS	**7.83**	<1	<0.5	<1	<1	**56.7**	**2.64**	<1	67.17
RW-14	07/07/11	ARCADIS	**47.2**	<1	**0.58**	<1	<1	**129**	**5.69**	**1**	183.47
RW-14	10/18/11	ARCADIS	**9.57**	<1	**0.83**	<1	<1	**85.4**	**5.82**	<1	101.62
RW-14	12/20/11	ARCADIS	**14.3**	<1	<0.5	<1	<1	**52.4**	**6.98**	<1	73.68
RW-14	03/14/12	ARCADIS	**17.2**	<1	<0.5	<1	<1	**61**	**3.51**	<1	81.71
RW-14	06/06/12	ARCADIS	**12.8**	<1	<0.5	<1	<1	**90.2**	**1.74**	<1	104.74
RW-14 (DUP-2)	06/06/12	ARCADIS	**17.0**	<1	<0.5	<1	<1	**91.6**	**2.88**	<1	111.48
RW-14	10/16/12	ARCADIS	**15.9**	<1	<0.5	<1	<1	**89**	**5.43**	<1	110.33
RW-14	03/02/16	SoundEarth	**3.44**	<1.00	<0.500	<1.00	<1.00	**18.0**	<1.00	<1.00	**21.44**
RW-15	01/09/08	LFR	**65.4**	<1	**1.65**	<1	<1	**96.3**	**9.59**	<1	172.94
RW-15	02/29/08	LFR	**30**	<1	**4.31**	<1	**1.15**	**121**	**22.2**	<1	184.16
RW-15	05/23/08	LFR	**58.4**	**9.73**	**671**	<1	**8.59**	**322**	**522**	**3.56**	1,595.28
RW-15	10/18/12	ARCADIS	**20.2**	<1	**0.530**	<1	<1	**198**	**1.89**	**1.67**	222.29
RW-15	09/02/16	SoundEarth	**14.30**	<1.00	<0.500	<1.00	<1.00	**1.14**	<1.00	<1.00	**15.44**

Table 1
Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[1] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RW-16	05/02/08	LFR	**74.5**	<1	**3.67**	<1	<1	**40.9**	**82**	**1.14**	202.21
RW-16	05/23/08	LFR	**214**	<1	**16.1**	<1	<1	**404**	**163**	**3.06**	800.16
RW-16	08/01/08	LFR	**521**	**1.44**	**47**	<1	<1	**882**	**314**	**5.93**	1,771.37
RW-16	12/05/08	LFR	**641**	**3.03**	**25.7**	<1	**1.34**	**2,170**	**638**	**7.66**	3,486.73
RW-16	01/28/09	LFR	**486**	<5	**20.9**	<5	<5	**1040**	**300**	**5.6**	1,852.50
RW-16	04/08/09	LFR	**80.9**	<1	**2.28**	<1	**1.07**	**298**	**58.9**	<1	441.15
RW-16	07/15/09	LFR	**592**	**1.68**	**21.1**	<1	**1.13**	**1,180**	**303**	**5.85**	2,104.76
RW-16	10/06/09	LFR	**533**	**1.54**	**22.8**	<1	**1.28**	**1,090**	**236**	**6.25**	1,890.87
RW-16	01/26/10	LFR - ARCADIS	<1	<1	<0.5	**1.06**	<1	**32.3**	**6.91**	**11.3**	51.57
RW-16	04/27/10	ARCADIS	**1.15**	<1	<0.5	**1.31**	<1	<0.5	<1	<1	2.46
RW-16	07/13/10	ARCADIS	**11.6**	<1	<0.5	**1.04**	<1	**25**	**4.28**	<1	41.92
RW-16	10/12/10	ARCADIS	**452**	<1	**2.22**	<1	<1	**1,010**	**39.2**	**4.41**	1,507.83
RW-16	01/13/11	ARCADIS	**433**	**1.33**	**8.78**	<1	<1	**1,420**	**246**	**4.53**	2,113.64
RW-16	04/06/11	ARCADIS	**35.9**	<1	<0.5	**1.32**	<1	**13.4**	**8.06**	<1	58.68
RW-16	07/08/11	ARCADIS	**143**	<1	**2.73**	**1.13**	<1	**343**	**46.5**	**1.48**	537.84
RW-16	10/19/11	ARCADIS	**228**	<1	**6.28**	**1.06**	<1	**528**	**91.4**	**2.49**	857.23
RW-16	12/21/11	ARCADIS	**387**	**1.29**	**8.76**	<1	<1	**935**	**192**	**4.36**	1,528.41
RW-16	03/15/12	ARCADIS	**392**	**1.09**	**5.72**	<1	<1	**1,230**	**152**	**4.88**	1,785.69
RW-16	06/07/12	ARCADIS	**542**	**1.40**	**7.27**	<1	<1	**1,360**	**182**	**5.81**	2,098.48
RW-16	10/19/12	ARCADIS	**317**	<1	**5.32**	**1.52**	<1	**464**	**98.2**	**2.35**	888.39
RW-16 (DUP-4)	10/19/12	ARCADIS	**315**	<1	**5.47**	**1.57**	<1	**476**	**98.1**	**2.34**	898.48
RW-16	06/03/14	SoundEarth	**457**	<1	**2.01**	<1	<1	**864**	**12.00**	**3.86**	1,338.87
RW-16	12/08/14	SoundEarth	**346**	<1.00	**1.32**	<1.00	<1.00	**1,910**	**35.4**	**4.75**	2,297.47
RW-99	12/08/14	SoundEarth	**330**	<1.00	**1.39**	<1.00	<1.00	**1,880**	**34.8**	**4.79**	2,250.98
RW-16	06/04/15	SoundEarth	**497**	<1.00	**2.62**	<1.00	<1.00	**1300**	**18.7**	**4.35**	1,822.67
RW-99	06/04/15	SoundEarth	**500**	<1.00	**2.54**	<1.00	<1.00	**1330**	**18.7**	**4.57**	1,855.81
RW-16	03/01/16	SoundEarth	**433**	<1.00	**2.13**	<1.00	<1.00	**1,000**	**5.47**	**3.40**	**1,444**
RW-99 (DUP-1)	03/01/16	SoundEarth	**399**	<1.00	**2.05**	<1.00	<1.00	**918**	**4.88**	**3.00**	**1,326.93**
RW-17	01/08/08	LFR	**206**	**12.8**	**5.55**	**10.4**	**13.2**	**1,440**	**1070**	**8.9**	2,766.85
RW-17	02/28/08	LFR	<1	<1	**0.85**	**12.2**	**8.41**	**81**	**3.41**	<1	105.87
RW-17	05/23/08	LFR	**168**	**6.68**	**9.06**	<1	**1.65**	**443**	**450**	**6.67**	1,085.06
RW-17	10/18/12	ARCADIS	**24.9**	<1	<0.5	<1	**1.58**	**40.5**	**2.20**	<1	69.18
RW-17	03/02/16	SoundEarth	**9.80**	<1.00	<0.500	<1.00	**1.32**	<0.500	<1.00	<1.00	**11.12**
RW-18	05/02/08	LFR	**112**	<1	<0.5	<1	<1	**14.7**	**6.22**	**3.85**	136.77
RW-18	05/23/08	LFR	**118**	**1.81**	**8.04**	<1	**5.24**	**137**	**92.7**	**4.68**	369.19
RW-18	08/01/08	LFR	**2.2**	<1	**19.2**	**13**	**14.2**	**3.35**	**33.1**	<1	85.05
RW-18	12/05/08	LFR	**5.76**	<1	**73.2**	**4.58**	**34.8**	**5.3**	**209**	<1	337.33
RW-18	01/28/09	LFR	**5.4**	<1	**10.2**	<1	**11.2**	**4**	**28.8**	<1	65.36
RW-18	04/08/09	LFR	**3.47**	<1	**38.1**	**4.81**	**37.8**	**3.02**	**200**	<1	288.75
RW-18	07/15/09	LFR	**4.88**	**1.65**	**30**	**1.22**	**29.8**	**39.7**	**602**	**3.67**	712.92
RW-18	10/06/09	LFR	**9**	<1	**8.28**	<1	**1.36**	**172**	**420**	**4.85**	615.49
RW-18	01/26/10	LFR - ARCADIS	**25.3**	<1	**6.11**	<1	<1	**84.3**	**61.7**	**2.58**	179.99
RW-18	04/27/10	ARCADIS	**17.9**	<1	**5.66**	<1	<1	**72.3**	**69.7**	**2.25**	167.81
RW-18	07/13/10	ARCADIS	**2.85**	<1	**1.09**	<1	**6.84**	**18.2**	**31.6**	<1	60.58

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Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[(1)] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RW-18	10/12/10	ARCADIS	**4.71**	<1	**2.21**	<1	<1	**163**	**50.2**	**6.07**	226.19
RW-18	01/13/11	ARCADIS	**2.34**	<1	**5.14**	<1	**12.1**	**57.4**	**132**	**2.19**	211.17
RW-18	04/06/11	ARCADIS	<1	<1	<0.5	**3.38**	**8.15**	**0.96**	**10.9**	<1	23.39
RW-18	07/08/11	ARCADIS	**7.06**	<1	**2.34**	<1	<1	**67.7**	**13.3**	**3.61**	94.01
RW-18	10/19/11	ARCADIS	**3.12**	<1	**1.83**	<1	**7.38**	**15.2**	**22.4**	**3.08**	53.01
RW-18	12/21/11	ARCADIS	**5.28**	<1	**4.32**	<1	**7.79**	**11.4**	**49.3**	**4.7**	82.79
RW-18	03/15/12	ARCADIS	**3.11**	<1	**1.94**	<1	<1	**2.34**	**9.44**	**6.7**	23.53
RW-18	06/07/12	ARCADIS	**2.78**	<1	**8.70**	<1	**11.9**	**8.94**	**93.5**	**4.13**	129.95
RW-18	10/16/12	ARCADIS	**2.53**	<1	**11.2**	<1	**21.1**	**72.3**	**212**	**7.62**	326.75
RW-18	06/24/14	SoundEarth	**8.84**	<1	<0.5	<1	<1	**2.86**	<1	**1.88**	13.58
RW-18	12/08/14	SoundEarth	**24.2**	<1.00	<0.500	<1.00	<1.00	**21.3**	<1.00	**1.56**	47.06
RW-18	06/03/15	SoundEarth	**3.33**	<1.00	<0.500	<1.00	<1.00	<0.500	<1.00	**5.31**	8.64
RW-19	05/01/08	LFR	**44.7**	<1	<0.5	<1	<1	**3.86**	**21.4**	**1.68**	71.64
RW-19	05/22/08	LFR	**31**	<1	<0.5	<1	<1	**4.9**	**15.2**	<1	51.10
RW-19	08/01/08	LFR	**141**	<1	**1.34**	**1.82**	**2.32**	**238**	**36.2**	**3.15**	439.53
RW-19	12/08/08	LFR	**56.6**	<1	**1.54**	<1	**1.37**	**93.2**	**16.6**	**1.49**	177.57
RW-19	01/26/09	LFR	**35.8**	<1	**2.56**	<1	<1	**72.1**	**18**	**1.39**	135.99
RW-19	04/06/09	LFR	**18.6**	<1	**2.07**	<1	<1	**60.1**	**23.6**	**1.05**	109.67
RW-19	07/13/09	LFR	**10.8**	<1	**0.82**	<1	<1	**32.2**	**9.44**	<1	54.39
RW-19	10/05/09	LFR	**44**	<1	**0.83**	<1	<1	**78.9**	**9.7**	**1.41**	138.72
RW-19	01/25/10	LFR - ARCADIS	**117**	<1	<0.5	<1	<1	**101**	**5.77**	**2.61**	230.52
RW-19	04/26/10	ARCADIS	**3.95**	<1	**11**	<1	**4.84**	**9.38**	**4.12**	<1	33.29
RW-19	07/13/10	ARCADIS	<1	**5.22**	**3.63**	<1	**2.5**	**9.73**	**4.12**	<1	25.20
RW-19 (DUP-3)	07/13/10	ARCADIS	**12**	<1	**3.12**	<1	**2.53**	**13.4**	**5.02**	<1	36.07
RW-19	10/12/10	ARCADIS	**29.6**	<1	**0.91**	<1	<1	**28**	**4.58**	<1	63.09
RW-19	01/13/11	ARCADIS	**4.27**	<1	**7.62**	<1	**2.36**	**4.05**	**2.54**	<1	20.84
RW-19	04/05/11	ARCADIS	**3.4**	<1	**12.7**	<1	**4.62**	**4.63**	**9.74**	<1	35.09
RW-19	07/07/11	ARCADIS	**9.53**	<1	**9.3**	<1	<1	**8.65**	**12.2**	<1	39.68
RW-19	10/19/11	ARCADIS	**2.75**	<1	**7.97**	<1	<1	**14.2**	**12.1**	<1	37.02
RW-19	12/21/11	ARCADIS	**49.1**	<1	**2.7**	<1	<1	**9.6**	**2.77**	**1.26**	69.15
RW-19	03/14/12	ARCADIS	**13.8**	<1	<0.5	<1	<1	**7.33**	**1.7**	<1	22.83
RW-19	06/06/12	ARCADIS	**27.6**	<1	<0.5	<1	<1	**9.95**	**1.79**	<1	39.34
RW-19	10/16/12	ARCADIS	**11.2**	<1	<0.5	<1	<1	**9.63**	**1.40**	<1	22.23
RW-19	09/02/16	SoundEarth	**89.80**	<1.00	<0.500	<1.00	<1.00	**6.30**	<1.00	**1.84**	**97.94**
RW-20	01/08/08	LFR	**58.3**	**1.07**	**17.4**	**6.37**	**6**	**20.9**	**37.8**	<1	147.84
RW-20	02/28/08	LFR	**11.1**	<1	**5.94**	**14.3**	**4.96**	**2.78**	**4.77**	<1	45.45
RW-20	05/23/08	LFR	**286**	**4.83**	**19.8**	<1	**20.3**	**344**	**202**	**7.88**	891.38
RW-20	10/17/12	ARCADIS	**85.3**	<1	**1.13**	<1	**1.10**	**62.1**	**1.62**	**1.31**	152.56
RW-21	05/01/08	LFR	**317**	<1	**3.08**	**2.21**	**1.63**	**57.9**	**5.92**	**4.8**	395.33
RW-21	05/22/08	LFR	**449**	<1	**1.83**	<1	<1	**114**	**8.25**	**8.42**	581.50
RW-21	08/01/08	LFR	**156**	<1	**4.47**	**2.59**	**2.77**	**83.1**	**31.7**	**3.35**	286.27
RW-21	12/08/08	LFR	**276**	<1	**10.8**	**1.81**	**4.9**	**236**	**64.2**	**8.08**	605.54
RW-21	01/26/09	LFR	**189**	<1	**5.23**	**1.53**	**2.4**	**62.1**	**23.9**	**3.63**	289.68
RW-21	04/06/09	LFR	**15.3**	<1	**0.62**	**3.5**	<1	**2.01**	**1.82**	<1	23.25
RW-21	07/15/09	LFR	**79.8**	<1	**2.69**	**4.97**	**2.64**	**26.6**	**11.2**	**1.48**	130.67
RW-21	10/06/09	LFR	**616**	<1	**10.2**	<1	**1.92**	**1,090**	**34.9**	**11**	1,766.60

Table 1
Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[1] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RW-21	01/25/10	LFR - ARCADIS	**449**	<1	**9.47**	<1	**2.02**	**527**	**53.4**	**10.8**	1,051.69
RW-21	04/26/10	ARCADIS	**430**	<1	**6.35**	<1	**1.33**	**458**	**28.8**	**6.97**	931.45
RW-21 (DUP-1)	04/26/10	ARCADIS	**404**	<1	**5.6**	**1.02**	**1.31**	**422**	**24.6**	**6.02**	864.55
RW-21	07/13/10	ARCADIS	**223**	<1	**3.57**	**2.95**	**1.82**	**218**	**13**	**4.19**	466.53
RW-21	10/12/10	ARCADIS	**365**	<1	**4.82**	<1	**1.32**	**417**	**11**	**7.63**	806.77
RW-21	01/13/11	ARCADIS	<1	**6.84**	<0.5	**2.24**	<1	**7.93**	<1	<1	17.01
RW-21	04/06/11	ARCADIS	**300**	<1	**4.03**	<1	**1.01**	**183**	**4.32**	**6.45**	498.81
RW-21	07/08/11	ARCADIS	**70.9**	<1	**1.32**	**4.27**	**1.51**	**17.8**	<1	**1.14**	96.94
RW-21	10/19/11	ARCADIS	**409**	<1	**2.66**	**1.66**	**1.37**	**212**	**2.04**	**8.22**	636.95
RW-21	12/21/11	ARCADIS	**310**	<1	**1.59**	**1.93**	**1.76**	**124**	**2.27**	**6.6**	448.15
RW-21	03/15/12	ARCADIS	**316**	<1	**1.57**	<1	**1.1**	**150**	**1.68**	**7.05**	477.40
RW-21	06/07/12	ARCADIS	**294**	<1	**1.21**	<1	**1.13**	**95.6**	**1.35**	**4.24**	397.53
RW-21 (DUP-3)	06/07/12	ARCADIS	**304**	<1	**1.09**	<1	**1.15**	**89.5**	**1.64**	**4.34**	401.72
RW-21	10/17/12	ARCADIS	**239**	<1	**1.06**	**1.28**	**1.91**	**103**	**1.24**	**4.17**	351.66
RW-21 (DUP-3)	10/17/12	ARCADIS	**242**	<1	**1.08**	**1.30**	**1.98**	**80.4**	**1.19**	**4.14**	332.09
RW-21	06/24/14	SoundEarth	**217**	<1	<0.5	<1	<1	**87.2**	**1.19**	**4.03**	309.42
RW-21	12/08/14	SoundEarth	**127**	<1.00	<0.500	<1.00	<1.00	**78.2**	<1.00	**2.59**	207.79
RW-21	06/02/15	SoundEarth	**268**	<1.00	**0.700**	<1.00	**1.21**	**59.1**	<1.00	**4.42**	333.43
RW-21	09/02/16	SoundEarth	**196**	<1.00	<0.500	<1.00	<1.00	**34.80**	<1.00	**4.31**	**235.11**
RW-22	05/01/08	LFR	**172**	**2.85**	**14.3**	<1	**5.73**	**211**	**188**	**4.57**	601.72
RW-22	05/22/08	LFR	**157**	<1	**4.08**	<1	**1.53**	**173**	**75.6**	**3.5**	416.17
RW-22	08/01/08	LFR	**82.5**	<1	**5.11**	<1	<1	**23.6**	**36.7**	**1.27**	149.18
RW-22	12/08/08	LFR	**80.9**	<1	**4.58**	<1	<1	**21.6**	**27.9**	**1.31**	136.29
RW-22	01/27/09	LFR	**97.1**	<1	**5.22**	<1	<1	**27.5**	**28.6**	**1.46**	159.88
RW-22	04/07/09	LFR	**143**	<1	**8.37**	<1	<1	**49.5**	**30.9**	**2.03**	233.80
RW-22	07/13/09	LFR	**87.2**	<1	**5.92**	<1	<1	**29.1**	**13.8**	**1.41**	137.43
RW-22	10/05/09	LFR	**114**	<1	**5.89**	<1	<1	**26.1**	**9.98**	**1.75**	157.72
RW-22	01/25/10	LFR - ARCADIS	**158**	<1	**13.8**	<1	<1	**8.87**	**3.02**	**2.44**	187.19
RW-22	04/26/10	ARCADIS	**90.1**	<1	**3.44**	<1	<1	**19.5**	**7.17**	**1.16**	121.37
RW-22	07/13/10	ARCADIS	**111**	<1	**3.15**	<1	<1	**17.2**	**4.27**	**1.25**	137.92
RW-22	10/12/10	ARCADIS	**120**	<1	**2.87**	<1	<1	**21.6**	**3.62**	**1.65**	154.20
RW-22	01/12/11	ARCADIS	**108**	<1	**3.12**	<1	<1	**33.3**	**7.19**	**1.82**	161.48
RW-22	04/05/11	ARCADIS	**159**	<1	**5.61**	<1	<1	**4.39**	**7.09**	**2.91**	182.36
RW-22	07/07/11	ARCADIS	**146**	<1	**1.73**	<1	<1	**27.8**	**1.64**	**2.9**	193.87
RW-22	10/19/11	ARCADIS	**170**	<1	**1.57**	<1	<1	**26.8**	**1.11**	**3.98**	231.56
RW-22	12/20/11	ARCADIS	**152**	<1	**1.92**	<1	<1	**15.9**	**1.22**	**3.28**	194.92
RW-22	03/14/12	ARCADIS	**129**	<1	**1.05**	<1	<1	**9.5**	<1	**2.61**	157.06
RW-22	06/06/12	ARCADIS	**186**	<1	**1.90**	<1	<1	**9.77**	<1	**2.82**	208.81
RW-22	10/17/12	ARCADIS	**168**	<1	**0.600**	<1	<1	**19.2**	<1	**3.77**	193.65
RW-22	09/02/16	SoundEarth	**46.70**	<1.00	<0.500	<1.00	<1.00	**6.25**	**1.01**	**1.97**	**55.93**
RW-23	01/08/08	LFR	**77.8**	**2.47**	**4.98**	**1.37**	<1	**513**	**2070**	**33**	2,702.62
RW-23	02/28/08	LFR	<1	<1	<0.5	<1	<1	**16.3**	**8.28**	<1	24.58
RW-23	05/22/08	LFR	**23**	<1	**2.02**	<1	<1	**96.8**	**358**	**12.5**	492.32
RW-23	10/17/12	ARCADIS	**8.09**	<1	<0.5	<1	<1	**34.6**	**3.61**	**1.07**	47.37

Table 1
Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[(1)] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RW-24	05/01/08	LFR	**115**	**2.31**	**57**	<1	**2.08**	**376**	**180**	**4.18**	737.60
RW-24	05/22/08	LFR	**18.2**	<1	**1.23**	<1	<1	**99.9**	**159**	**3.15**	281.48
RW-24	07/31/08	LFR	**25.6**	<1	**3.54**	<1	<1	**115**	**124**	**2.76**	270.90
RW-24	12/08/08	LFR	**12.1**	<1	**0.75**	<1	**1.01**	**134**	**190**	**4.52**	342.38
RW-24	01/27/09	LFR	**14.7**	<1	**2.18**	<1	**1.09**	**155**	**364**	**8.09**	545.06
RW-24	04/07/09	LFR	**16.5**	<1	**4.62**	<1	**1.14**	**106**	**312**	**6.17**	446.43
RW-24	07/15/09	LFR	**15.1**	<1	**1.54**	<1	<1	**118**	**114**	**5.02**	253.66
RW-24	10/06/09	LFR	**17.1**	<1	**1.11**	<1	<1	**213**	**95.5**	**4.72**	331.43
RW-24	01/25/10	LFR - ARCADIS	**18**	<1	**0.65**	<1	<1	**121**	**123**	**4.36**	267.01
RW-24	04/26/10	ARCADIS	**15.9**	<1	<0.5	<1	<1	**91**	**39.7**	**3.03**	149.63
RW-24	07/13/10	ARCADIS	**19.6**	<1	**0.83**	<1	<1	**72.2**	**30.2**	**3.53**	126.36
RW-24	10/12/10	ARCADIS	**16.1**	<1	**0.74**	<1	<1	**56.8**	**27.4**	**2.84**	103.88
RW-24	01/13/11	ARCADIS	**17.3**	<1	**0.83**	<1	<1	**60.7**	**46.6**	**2.86**	128.29
RW-24	04/06/11	ARCADIS	**19.4**	<1	**1.08**	<1	<1	**32.4**	**40.6**	**2.87**	96.35
RW-24	07/08/11	ARCADIS	**16.9**	<1	**1.2**	<1	<1	**20.7**	**23.3**	**2.53**	64.63
RW-24	10/19/11	ARCADIS	**16**	<1	**1.09**	<1	<1	**15.1**	**18.4**	**2.6**	53.19
RW-24	12/21/11	ARCADIS	**15.4**	<1	**0.54**	<1	<1	**25.6**	**48.3**	**2.17**	92.01
RW-24	03/15/12	ARCADIS	**15.1**	<1	**0.65**	<1	<1	**39.5**	**61.4**	**2.71**	119.36
RW-24	06/07/12	ARCADIS	**14.3**	<1	**0.900**	<1	<1	**31.2**	**58.0**	**1.79**	106.19
RW-24	10/16/12	ARCADIS	**25.7**	<1	<0.5	<1	<1	**55**	**149**	**4.17**	238.74
RW-24	09/02/16	SoundEarth	<1.00	13.00	**0.59**	<1.00	<1.00	**1.39**	**10.40**	<1.00	**25.38**
RW-25 (DUP-2)	10/17/06	LFR	<1	<1	<0.5	<1	<1	<0.5	<1	<1	0.00
RW-25	05/01/08	LFR	**31.8**	<1	**5.66**	<1	<1	**96.3**	**28.1**	**1.68**	170.08
RW-25	05/22/08	LFR	**104**	<1	<0.5	<1	<1	**71.7**	**39.7**	**2.29**	217.69
RW-25	07/30/08	LFR	**167**	<1	<0.5	<1	<1	**205**	**7.59**	**7.61**	387.20
RW-25	12/10/08	LFR	**155**	<1	<0.5	<1	<1	**411**	**4.7**	**7.82**	578.52
RW-25	01/27/09	LFR	**284**	<1	<0.5	<1	<1	**482**	**8.75**	**12.6**	787.35
RW-25	04/07/09	LFR	**334**	<1	<0.5	<1	<1	**190**	**27.4**	**16.4**	567.80
RW-25 (DUP-2)	04/07/09	LFR	**337**	<1	<0.5	<1	<1	**201**	**27**	**15.7**	580.70
RW-25	07/15/09	LFR	**211**	<1	<0.5	<1	<1	**66.3**	**11.3**	**12.2**	300.80
RW-25 (DUP-3)	07/15/09	LFR	**215**	<1	<0.5	<1	<1	**51.8**	**10.1**	**12.2**	289.10
RW-25	10/07/09	LFR	**293**	<1	<0.5	<1	<1	**63.8**	**18**	**13.2**	388.00
RW-25	01/26/10	LFR - ARCADIS	**304**	<1	**0.55**	<1	<1	**27.1**	**8.73**	**11.7**	353.16
RW-25	04/27/10	ARCADIS	**441**	<1	<0.5	<1	<1	**21**	**20.4**	**15.7**	498.10
RW-25 (DUP-3)	04/27/10	ARCADIS	**419**	<1	<0.5	<1	<1	**23.7**	**22.2**	**16**	480.90
RW-25	07/12/10	ARCADIS	**325**	<1	<0.5	<1	<1	**17**	**16**	**13.9**	371.90
RW-25	10/11/10	ARCADIS	**244**	<1	<0.5	<1	<1	**4.97**	**26.7**	**9.58**	288.09
RW-25	01/12/11	ARCADIS	**412**	<1	<0.5	<1	<1	**2.39**	**2.06**	**16.6**	433.05
RW-25	04/05/11	ARCADIS	**322**	<1	<0.5	<1	<1	**1.59**	**8.15**	**11.5**	343.24
RW-25	07/07/11	ARCADIS	**352**	<1	<0.5	<1	<1	**3.23**	**8.48**	**13**	376.71
RW-25	10/19/11	ARCADIS	**261**	<1	<0.5	<1	<1	**4.41**	**5.89**	**13.7**	285.00
RW-25	12/20/11	ARCADIS	**148**	<1	<0.5	<1	<1	**53.2**	**34.5**	**10.8**	246.50
RW-25	03/14/12	ARCADIS	**81.2**	<1	<0.5	<1	<1	**114**	**40.9**	**6.21**	242.31
RW-25	06/05/12	ARCADIS	**94.8**	<1	<0.5	<1	<1	**128**	**25.2**	**5.46**	253.46
RW-25	10/17/12	ARCADIS	**122**	<1	<0.5	<1	<1	**174**	**13.3**	**4.81**	314.11
RW-25	09/02/16	SoundEarth	**97.50**	<1.00	<0.500	<1.00	<1.00	**52.00**	**4.63**	**3.32**	**157.45**

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Groundwater Analytical Results - Chlorinated Volatile Organic Compounds
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well Identification	Sample Date	Sampled By	Analytical Results[1] (micrograms per liter)								
			1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Tetrachloroethene	Trichloroethene	Vinyl chloride (Chloroethylene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Total CVOCs
RW-26	01/08/08	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
RW-26	02/28/08	ARCADIS	<1	<1	**1.01**	<1	**1.64**	<0.5	**3.04**	<1	5.69
RW-26	05/22/08	ARCADIS	**24.3**	**2.68**	<0.5	<1	<1	**372**	**880**	**6.66**	1,285.64
RW-27	01/08/08	ARCADIS	**37.5**	<1	**7.63**	<1	**3.39**	**123**	**106**	**2.83**	280.35
RW-27	02/28/08	ARCADIS	**11.4**	<1	**65.2**	**9.26**	**54.5**	**0.53**	**27.8**	<1	170.31
RW-27	05/22/08	ARCADIS	**38.9**	<1	**1.48**	<1	<1	**599**	**158**	**5.25**	802.63
RW-27	10/17/12	ARCADIS	**42.5**	<1	**0.840**	<1	**1.13**	**243**	**50.1**	**2.99**	340.56
RW-27	09/02/16	SoundEarth	**9.68**	<1.00	<0.500	<1.00	<1.00	**11.60**	**18.50**	<1.00	**39.78**
SCA-02	03/01/16	SoundEarth	<1.00	**6.42**	<0.500	<1.00	**286**	**1.80**	**40.40**	**3.42**	**338.04**
MB-HP-01	10/15/12	ARCADIS	**2.08**	<1	**4.61**	<1	<1	<0.5	**1.44**	<1	10.88
MB-HP-02	10/15/12	ARCADIS	**126**	**1.23**	**9.02**	**1.63**	**2.49**	**556**	**236**	**3.28**	938.28
MB-HP-03	10/15/12	ARCADIS	**33.7**	<1	**12.1**	<1	<1	**18.3**	**4.85**	<1	71.61
MB-HP-04	10/16/12	ARCADIS	**38.9**	<1	<0.5	<1	<1	**29.3**	**11.9**	<1	82.65
MB-HP-05	10/16/12	ARCADIS	**310**	<1	**24.1**	<1	<1	**616**	**34.2**	**3.36**	990.35
MB-HP-06	10/16/12	ARCADIS	**128**	<1	**38.5**	<1	<1	**159**	**21.5**	**1.66**	357.17
MB-HP-07	10/16/12	ARCADIS	**228**	<1	**1.10**	<1	<1	**4.15**	**1.05**	<1	237.01
MB-HP-08	10/16/12	ARCADIS	**329**	<1	**6.78**	<1	<1	**132**	**1.80**	<1	472.37
MB-HP-08 (MB-HP-DUP-1)	10/16/12	ARCADIS	**239**	<1	**5.43**	<1	<1	**103**	**1.41**	<1	351.55
MB-HP-09	10/15/12	ARCADIS	**48.3**	<1	**4.67**	<1	<1	**10.9**	**1.14**	<1	67.85
MB-HP-10	10/15/12	ARCADIS	**25.1**	<1	**1.19**	<1	<1	**31.3**	<1	<1	57.59
MB-HP-11	10/16/12	ARCADIS	**15.6**	<1	<0.5	**17.4**	**1.97**	**20.7**	**24.3**	**6.97**	91.17
MB-HP-12	10/18/12	ARCADIS	<1	<1	<0.5	<1	<1	**31.4**	**46.9**	<1	78.30
MB-HP-13	10/18/12	ARCADIS	**1.60**	<1	<0.5	<1	<1	<0.5	<1	<1	1.60
Trip Blank	06/05/12	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
Trip Blank	06/06/12	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
Trip Blank	06/07/12	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
Trip Blank	10/15/12	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
Trip Blank	10/16/12	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
Trip Blank	10/17/12	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
Trip Blank	10/18/12	ARCADIS	<1	<1	<0.5	<1	<1	<0.5	<1	<1	ND
Trip Blank	03/01/16	SoundEarth	<1.00	<1.00	<0.500	<1.00	<1.00	<0.500	<1.00	<1.00	ND

Notes:
Samples analyzed at Positive Lab Service of Los Angeles, California.
BOLD indicates a concentration detected above the laboratory reporting limit.
Total CVOCs = sum of detected concentrations of CVOCs.
Yellow deontes latest sampling event.
[1]Analyzed by U.S. Environmental Protection Agency Method 8260B.

< = not detected at a concentration exceeding the laboratory reporting limit
ARCADIS = ARCADIS U.S. Inc.
CVOCs = carcinogenic volatile organic compounds
LFR = LFR Inc.
ND = not detected above the laboratory reporting limit
SoundEarth = SoundEarth Strategies California, Inc.

Table 2
Monitoring Well Network Construction Details
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well ID	Top of Casing Elevation[(1)] (feet msl)	Northing	Easting	Total Depth (feet below TOC)	Bottom of Casing Elevation (feet msl)	Well Diameter (inches)	Screen Length	Screened Interval (feet bgs)		Historical Monitoring Frequency (in 2010)	Monitoring Frequency
RW-01	17.05	1898910.936	6186577.651	32.48	-15.37	6	20	10	30	Quarterly Hydraulic Monitoring	Biennially (every other year)
RW-02	21.44	1898843.766	6186678.725	35.6	-14.10	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RW-03	20.08	1898795.366	6186806.835	35.45	-15.27	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RW-04	22.71	1898826.003	6186548.628	36.24	-13.51	6	20	10	30	Quarterly Hydraulic Monitoring	To be abandoned
RW-05	16.88	1898767.765	6186548.047	32.54	-15.59	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RW-06	16.83	1898692.405	6186738.677	31.98	-15.08	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RW-07	18.20	1898727.097	6186507.391	31.71	-13.57	6	20	10	30	Quarterly Hydraulic Monitoring	Annually
RW-08	21.26	1898682.729	6186613.359	35.15	-13.88	6	20	10	30	Quarterly Hydraulic Monitoring	To be abandoned
RW-09	14.21	1898660.253	6186446.483	30.32	-14.33	6	20	10	30	Quarterly Hydraulic Monitoring	To be abandoned
RW-11	25.69	1898598.047	6186446.717	39.57	-13.74	6	20	10	30	Quarterly Hydraulic Monitoring	To be abandoned
RW-12	23.48	1898294.511	6186456.727	33.92	-10.20	6	20	10	30	Quarterly Hydraulic Monitoring	Quarterly during MRP monitoring, Annually for long-term monitoring.
RW-13	26.05	1898514.931	6186435.159	40.85	-14.70	6	20	10	30	Quarterly Hydraulic Monitoring	To be abandoned
RW-14	24.61	1898457.968	6186434.299	40.08	-15.47	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	Quarterly during MRP monitoring, Annually for long-term monitoring.
RW-15	26.54	1898451.449	6186339.044	39.8	-13.11	6	20	10	30	Quarterly Hydraulic Monitoring	To be abandoned
RW-16	24.22	1898298.383	6186384.323	39.88	-15.51	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	Quarterly during MRP monitoring, Annually for long-term monitoring.
RW-17	23.62	1898368.434	6186505.503	41.03	-17.29	6	20	10	30	Quarterly Hydraulic Monitoring	Quarterly during MRP monitoring, Annually for long-term monitoring.
RW-18	22.48	1898334.254	6186562.123	36.15	-13.56	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RW-19	18.81	1898241.204	6186673.127	32.75	-13.84	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RW-20	23.04	1898387.169	6186656.744	35.6	-12.45	6	20	10	30	Quarterly Hydraulic Monitoring	To be abandoned
RW-21	19.11	1898319.598	6186782.200	33.06	-13.84	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	Biennially (every other year)
RW-22	19.74	1898405.805	6186739.428	30.03	-13.67	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	Biennially (every other year)
RW-23	22.11	1898420.535	6186838.387	32.95	-10.70	6	20	10	30	Quarterly Hydraulic Monitoring	To be abandoned
RW-24	16.46	1898549.836	6186786.049	31.5	-14.87	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RW-25	20.02	1898331.578	6186893.722	34.91	-14.77	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	Annually
RW-26	15.83	1898605.415	6186934.749	32.03	-13.02	6	20	10	30	Not monitored, blockage in well prevents sampling and hydraulic measurements	To be abandoned
RW-27	20.86	1898678.184	6186903.863	36.1	-15.16	6	20	10	30	Quarterly Hydraulic Monitoring	Annually
RMW-02	19.15	1898135.111	6186544.063	31.8	-12.55	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RMW-03	18.69	1898170.876	6186584.436	30.91	-12.06	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RMW-04	21.20	1898787.355	6186896.085	28.76	-14.23	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	Biennially (every other year)
RMW-05	19.98	1898498.494	6186895.962	33.25	-13.12	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	Biennially (every other year)
RMW-06	16.98	1898742.902	6186626.056	31.9	-14.89	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RMW-07	16.42	1898786.350	6186407.425	33.33	-15.54	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RMW-08	19.83	1898591.479	6186247.404	36.95	-17.14	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RMW-09	25.87	1898426.929	6186291.691	41.11	-15.09	6	20	10	30	Quarterly Sampling and Hydraulic Monitoring	To be abandoned
RMW-10	20.80	1898234.366	6186230.467	35.5	-6.20	6	20	10	30	Quarterly	Quarterly during MRP monitoring, Annually for long-term monitoring.

Table 2
Monitoring Well Network Construction Details
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Well ID	Top of Casing Elevation[(1)] (feet msl)	Northing	Easting	Total Depth (feet below TOC)	Bottom of Casing Elevation (feet msl)	Well Diameter (inches)	Screen Length	Screened Interval (feet bgs)		Historical Monitoring Frequency (in 2010)	Monitoring Frequency
RMW-11	23.57	1896808.680	6186458.075	35.5	-7.43	6	20	10	30	Quarterly	Quarterly during MRP monitoring, Annually for long-term monitoring.
RMW-12	26.23	1897659.714	6186311.990	37	-6.77	6	20	10	30	Quarterly	Quarterly for one year, then annually
RMW-13	21.92	1896898.128	6186452.050	34	-8.08	6	20	10	30	Quarterly	Quarterly during MRP monitoring, Annually for long-term monitoring.
SCA-01	23.83	1897462.894	6186216.663	31.5	-10.93	2	15	15	30	Quarterly, semiannually, and annually	Annually
SCA-02	25.25	1896867.089	6186535.970	36.5	-14.05	2	15	20	35	Quarterly, semiannually, and annually	Quarterly during MRP monitoring, Annually for long-term monitoring.
SCA-03	23.36	1897268.114	6187032.734	31.5	-10.94	2	15	15	30	Quarterly, semiannually, and annually	Annually
SCA-04	17.15	1896849.698	6187388.956	26.5	-12.24	2	15	10	25	Quarterly, semiannually, and annually	Annually
SCA-05	22.90	1898889.141	6185494.454	31.5	-11.61	2	15	15	30	Quarterly, semiannually, and annually	Annually
SCA-06	24.99	1899161.593	6185925.398	31.5	-9.55	2	15	15	30	Quarterly, semiannually, and annually	Annually
SCA-07	20.57	1897634.336	6186666.172	30	-12.53	2	15	15	30	Quarterly, semiannually, and annually	Annually
PMW-1	31.19	1897412.114	6186614.079	46	-14.46	2	30	16	46	Quarterly Hydraulic Monitoring	Annually
PMW-2	34.66	1897129.855	6186722.945	47	-11.73	2	30	17	47	Quarterly Hydraulic Monitoring	Not sampled
PMW-3	28.70	1897035.066	6186524.449	45	-16.09	2	30	15	45	Quarterly Hydraulic Monitoring	Not sampled
PMW-4	28.41	1897172.983	6186440.927	45	-16.38	2	30	12	42	Quarterly Hydraulic Monitoring	Not sampled
PMW-5	32.14	1897370.90	6186487.16	43	-10.51	2	25	17	43	Quarterly Hydraulic Monitoring	Not sampled

Notes:
[(1)]Stantec completed survey for PMW, RW, RMW, and SCA wells on September 9, 2016.
bgs = below ground surface
MRP = monitoring and reporting program
msl = mean sea level
TOC = top of casing

Table 3
Soil Gas Baseline Monitoring Results and Risks
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Sample Location	Area	Well Type	Sample Type	Depth	Date	PCE[2]	TCE[2]	Vinyl Chloride[2]	Benzene[2]	trans 1,2-DCE[2]	cis 1,2-DCE[2]	1,1- DCA[2]	1,1-DCE[2]	1,2- DCA[2]	TPHv (C5-C8) aliphatic low[3]	TPHv (C9-C12) aliphatic medium[3,4]	TPHv (C6-C8) aromatic low[3,5]	TPHv (C9-C10) aromatic medium[3,6]	Risk Total (cancer)	Haz Total
						(µg/L)														
P-SG-01	A	triple	Unique	5	4/22/2015	0.42	0.39	0.33	0.02	0.10	0.45	0.41	ND	0.17	NA	NA	NA	NA	1.2E-05	2.1E-01
	A	triple	Confirmation[3]	5	4/23/2015	0.45	0.53	0.64	0.02	0.14	0.52	0.56	0.042	0.15	1.2	ND	1.4	ND	2.1E-05	3.1E-01
	A	triple	Replicate	5	4/22/2015	0.60	0.55	0.48	0.03	0.15	0.66	0.62	ND	0.25	NA	NA	NA	NA	1.8E-05	3.0E-01
	A	triple	Unique	10	4/22/2015	0.18	1.2	4.4	0.05	0.58	2.2	1.3	0.18	0.24	NA	NA	NA	NA	9.9E-05	5.2E-01
	A	triple	Unique	15	4/22/2015	0.13	0.97	3.7	0.05	0.47	1.8	1.0	0.15	0.19	NA	NA	NA	NA	6.5E-05	3.3E-01
P-SG-02	A	dual	Unique	5	4/21/2015	0.02	ND	0.03	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	9.1E-07	6.5E-04
	A	dual	Unique	15	4/21/2015	ND	0.02	2.2	0.14	0.18	ND	2.1	ND	0.07	NA	NA	NA	NA	4.3E-05	2.6E-02
P-SG-03	A	dual	Unique	5	4/21/2015	0.20	0.12	0.06	ND	ND	ND	0.21	ND	0.06	NA	NA	NA	NA	2.8E-06	5.3E-02
	A	dual	Unique	15	4/21/2015	ND	0.08	30	0.34	0.40	0.77	5.4	ND	1.9	NA	NA	NA	NA	5.2E-04	3.6E-01
	A	dual	Confirmation	15	4/23/2015	0.51	1.2	58	0.35	0.76	0.82	5.7	ND	1.0	NA	NA	NA	NA	9.9E-04	6.8E-01
P-SG-04	A	dual	No sample	5	WATER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	A	dual	Unique	15	4/21/2015	ND	0.03	4.1	0.07	0.18	1.3	0.12	ND	ND	NA	NA	NA	NA	7.0E-05	1.0E-01
P-SG-05	A	dual	Unique	5	4/21/2015	0.02	ND	0.38	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.1E-05	3.7E-03
	A	dual	No sample	15	NO FLOW	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P-SG-06	A	triple	No sample	7.5	WATER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	A	triple	Unique	12.5	4/21/2015	0.25	0.06	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	3.7E-07	1.9E-02
P-SG-07	A	dual	Unique	5	4/21/2015	0.03	ND	0.03	0.02	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.1E-06	1.3E-03
	A	dual	Unique	15	4/21/2015	0.06	0.33	3.8	0.09	0.16	1.2	ND	0.14	ND	NA	NA	NA	NA	6.5E-05	1.6E-01
P-SG-08	A	dual	Unique	5	4/22/2015	0.68	6.3	0.16	0.05	0.68	7.8	ND	0.14	ND	NA	NA	NA	NA	1.6E-05	2.9E+00
	A	dual	Replicate	5	4/22/2015	0.80	6.2	0.08	0.05	0.55	7.6	ND	ND	ND	NA	NA	NA	NA	1.3E-05	2.8E+00
	A	dual	Unique	15	4/21/2015	0.04	0.11	0.91	0.24	0.25	2.0	0.58	ND	ND	NA	NA	NA	NA	1.7E-05	1.4E-01
P-SG-09	A	triple	Unique	5.5	4/21/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
	A	triple	Replicate	5.5	4/21/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
	A	triple	No sample	10.5	WATER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P-SG-10	A	dual	Unique	5	4/23/2015	0.32	2.0	53	0.11	1.5	4.3	2.7	0.64	2.5	NA	NA	NA	NA	1.5E-03	1.9E+00
	A	dual	Replicate	5	4/23/2015	0.50	2.7	44	0.17	2.1	6.0	3.7	0.87	2.5	NA	NA	NA	NA	1.3E-03	2.2E+00
	A	dual	No sample	15	WATER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P-SG-11	A	dual	No sample	5	WATER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	A	dual	Unique	15	4/22/2015	0.17	0.81	85	0.38	0.88	6.1	4.7	0.50	2.7	NA	NA	NA	NA	1.5E-03	1.2E+00
P-SG-12	A	dual	No sample	5	WATER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	A	dual	Unique	15	4/22/2015	ND	0.18	29	0.28	ND	ND	3.3	ND	ND	NA	NA	NA	NA	4.9E-04	1.9E-01
P-SG-13	A	dual	Unique	5	4/22/2015	0.1	0.36	7.1	0.08	ND	0.88	1.5	ND	0.53	NA	NA	NA	NA	2.1E-04	3.4E-01
	A	dual	Unique	15	4/22/2015	ND	ND	58	0.30	ND	0.63	4.9	ND	0.14	NA	NA	NA	NA	9.8E-04	3.6E-01
P-SG-14	A	dual	Unique	5	4/22/2015	0.16	ND	0.02	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	8.3E-07	3.1E-03
	A	dual	Confirmation[3]	5	4/23/2015	0.15	0.010	ND	0.004	ND	ND	ND	ND	ND	1.0	ND	1.4	ND	3.0E-07	5.3E-02
	A	dual	Unique	15	4/22/2015	0.13	0.31	72	0.37	0.15	2.3	8.0	ND	0.23	NA	NA	NA	NA	1.2E-03	6.0E-01
P-SG-15	A	triple	Unique	5	4/22/2015	0.29	0.11	0.03	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.5E-06	4.3E-02
	A	triple	Unique	10	4/22/2015	0.11	0.7	68	0.53	0.62	2.2	6.6	0.29	5.4	NA	NA	NA	NA	1.5E-03	1.3E+00
	A	triple	Unique	15	4/22/2015	0.12	0.27	130	0.25	1.3	2.1	3.3	0.13	0.32	NA	NA	NA	NA	2.2E-03	8.8E-01
P-SG-16	A	triple	Unique	5	4/24/2015	0.04	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	6.6E-08	7.3E-04
	A	triple	Unique	10	4/24/2015	0.03	0.04	ND	0.02	ND	0.17	0.43	ND	0.05	NA	NA	NA	NA	6.4E-07	2.8E-02
	A	triple	Unique	15	4/24/2015	0.07	0.32	0.30	ND	ND	1.1	2.0	ND	0.37	NA	NA	NA	NA	7.7E-06	1.6E-01
	A	triple	Replicate	15	4/24/2015	0.06	0.26	0.24	ND	ND	0.90	1.7	ND	0.31	NA	NA	NA	NA	6.2E-06	1.3E-01
P-SG-17	A	triple	Unique	5	4/23/2015	0.05	0.15	0.08	0.06	ND	0.83	ND	ND	ND	NA	NA	NA	NA	3.1E-06	1.3E-01
	A	triple	Unique	10	4/23/2015	0.24	1.5	2.2	0.21	0.60	5.7	ND	ND	ND	NA	NA	NA	NA	5.1E-05	8.0E-01
	A	triple	Confirmation[3]	10	4/23/2015	0.16	1.1	1.6	0.12	0.49	4.6	0.036	0.37	ND	36.0	2.3	0.2	ND	3.7E-05	7.0E-01
	A	triple	Unique	15	4/23/2015	0.85	2.3	13	0.30	1.2	7.6	ND	ND	1.0	NA	NA	NA	NA	2.3E-04	1.0E+00
P-SG-18	A	triple	Unique	5	4/23/2015	ND	ND	0.03	0.03	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.1E-06	1.0E-03
	A	triple	Unique	10	4/23/2015	0.05	0.35	1.8	0.07	0.59	3.5	ND	0.60	ND	NA	NA	NA	NA	4.0E-05	3.5E-01
	A	triple	Unique	15	4/23/2015	0.16	0.78	190	0.08	1.1	7.4	0.60	0.28	ND	NA	NA	NA	NA	3.2E-03	1.6E+00
P-SG-19	A	triple	Unique	5	4/23/2015	0.13	0.45	0.03	0.04	ND	0.33	ND	ND	ND	NA	NA	NA	NA	2.1E-06	1.9E-01
	A	triple	Unique	10	4/23/2015	0.06	0.46	0.22	0.03	0.17	1.4	ND	0.15	ND	NA	NA	NA	NA	5.5E-06	2.2E-01
	A	triple	Unique	15	4/23/2015	ND	0.59	7.2	0.16	0.78	6.3	ND	ND	ND	NA	NA	NA	NA	1.2E-04	5.1E-01
	A	triple	Confirmation	15	4/23/2015	ND	0.36	6.5	ND	0.52	4.0	ND	ND	ND	NA	NA	NA	NA	1.1E-04	3.3E-01

Table 3
Soil Gas Baseline Monitoring Results and Risks
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Sample Location	Area	Well Type	Sample Type	Depth	Date	PCE[2]	TCE[2]	Vinyl Chloride[2]	Benzene[2]	trans 1,2-DCE[2]	cis 1,2-DCE[2]	1,1- DCA[2]	1,1-DCE[2]	1,2- DCA[2]	TPHv (C5-C8) aliphatic low[3]	TPHv (C9-C12) aliphatic medium[3,4]	TPHv (C6-C8) aromatic low[3,5]	TPHv (C9-C10) aromatic medium[3,6]	Risk Total (cancer)	Haz Total
						(µg/L)														
P-SG-20	A	triple	Unique	5	4/24/2015	0.35	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	5.7E-07	6.4E-03
	A	triple	Replicate	5	4/24/2015	0.38	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	6.2E-07	6.9E-03
	A	triple	Unique	10	4/24/2015	0.27	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	3.3E-07	3.6E-03
	A	triple	Unique	15	4/24/2015	0.33	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	3.1E-07	3.5E-03
P-SG-21	A	triple	No sample	7	WATER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	A	triple	No sample	12	WATER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P-SG-22	A	triple	Unique	5	4/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
	A	triple	Unique	10	4/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
	A	triple	Unique	15	4/23/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
P-SG-23	A	triple	Unique	5	4/23/2015	0.75	0.25	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.6E-06	9.9E-02
	A	triple	Confirmation[3]	5	4/23/2015	0.64	0.24	ND	0.0038	ND	ND	0.0057	ND	ND	0.9	2.3	ND	ND	1.4E-06	1.2E-01
	A	triple	Unique	10	4/23/2015	3.5	2.6	0.05	ND	ND	ND	0.23	ND	0.02	NA	NA	NA	NA	8.4E-06	7.1E-01
	A	triple	Replicate	10	4/23/2015	5.0	3.6	0.08	0.03	ND	ND	0.34	ND	0.04	NA	NA	NA	NA	1.2E-05	9.9E-01
P-SG-24	B	dual	Unique	5	4/15/2015	1.6	0.04	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	2.8E-06	4.4E-02
	B	dual	Unique	15	4/15/2015	0.09	0.07	0.05	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.1E-06	1.7E-02
P-SG-25	B	dual	1 Purge Volume	5	4/15/2015	0.91	0.06	0.23	0.04	ND	ND	ND	ND	ND	NA	NA	NA	NA	8.7E-06	4.1E-02
	B	dual	3 Purge Volumes	5	4/15/2015	0.39	0.03	0.10	0.03	ND	ND	ND	ND	ND	NA	NA	NA	NA	3.9E-06	2.0E-02
	B	dual	10 Purge Volumes	5	4/15/2015	0.63	0.05	0.15	0.03	ND	ND	ND	ND	ND	NA	NA	NA	NA	5.8E-06	3.2E-02
	B	dual	1 Purge Volume	15	4/15/2015	ND	ND	1.4	ND	0.13	0.16	ND	ND	ND	NA	NA	NA	NA	2.6E-05	1.8E-02
	B	dual	3 Purge Volumes	15	4/15/2015	ND	ND	1.2	ND	0.10	0.13	ND	ND	ND	NA	NA	NA	NA	2.3E-05	1.5E-02
	B	dual	10 Purge Volumes	15	4/15/2015	ND	ND	1.9	ND	0.17	0.23	ND	ND	ND	NA	NA	NA	NA	3.6E-05	2.5E-02
P-SG-26	B	dual	Unique	5	4/15/2015	1.0	1.0	ND	0.03	ND	ND	ND	ND	ND	NA	NA	NA	NA	3.5E-06	3.7E-01
	B	dual	Unique	15	4/15/2015	ND	0.03	1.2	ND	0.12	0.15	ND	ND	ND	NA	NA	NA	NA	2.3E-05	2.3E-02
	B	dual	Replicate	15	4/15/2015	ND	0.03	1.4	ND	0.13	0.17	ND	ND	ND	NA	NA	NA	NA	2.6E-05	2.5E-02
P-SG-27	B	triple	Unique	5	4/17/2015	0.07	0.05	0.51	0.03	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.5E-05	2.4E-02
	B	triple	Unique	10	4/17/2015	0.04	0.03	0.73	0.03	ND	0.22	ND	ND	ND	NA	NA	NA	NA	1.6E-05	2.9E-02
	B	triple	No sample	15	NO FLOW	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P-SG-28	B	dual	Unique	5	4/15/2015	310	300	0.39	0.03	40	14	ND	ND	ND	NA	NA	NA	NA	9.7E-04	1.1E+02
	B	dual	Unique	15	4/15/2015	0.33	5.4	650	0.19	79	42	0.16	1.6	ND	NA	NA	NA	NA	1.1E-02	6.8E+00
	B	dual	Confirmation	15	4/22/2015	ND	4.6	810	ND	68	36	ND	ND	ND	NA	NA	NA	NA	1.4E-02	7.2E+00
P-SG-29	B	triple	Unique	5	4/16/2015	3700	450	0.88	0.07	16	27	0.20	ND	ND	NA	NA	NA	NA	6.8E-03	2.2E+02
	B	triple	Replicate	5	4/16/2015	3500	450	ND	ND	ND	29	ND	ND	ND	NA	NA	NA	NA	6.4E-03	2.2E+02
	B	triple	No sample	10	NO FLOW	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	B	triple	Unique	15	4/16/2015	90	6.4	770	ND	21	ND	ND	ND	ND	NA	NA	NA	NA	1.3E-02	6.3E+00
	B	triple	Confirmation	15	4/22/2015	4.2	4.9	740	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.3E-02	4.9E+00
P-SG-30	B	dual	Unique	5	4/16/2015	23	1.5	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	4.1E-05	9.6E-01
	B	dual	Unique	15	4/16/2015	6.3	6.8	ND	ND	ND	0.56	ND	ND	ND	NA	NA	NA	NA	1.3E-05	1.6E+00
P-SG-31	B	dual	Unique	5	4/16/2015	68	53	18	ND	21	42	ND	ND	ND	NA	NA	NA	NA	7.2E-04	2.4E+01
	B	dual	Unique	15	4/16/2015	49	80	530	ND	240	130	ND	ND	ND	NA	NA	NA	NA	1.0E-02	2.9E+01
P-SG-32	B	dual	Unique	5	4/24/2015	120	440	57	ND	61	230	ND	ND	ND	NA	NA	NA	NA	2.5E-03	1.8E+02
	B	dual	Unique	15	4/24/2015	210	640	930	ND	420	340	ND	ND	ND	NA	NA	NA	NA	1.8E-02	1.7E+02
	B	dual	Confirmation	15	4/24/2015	140	500	1000	ND	330	230	ND	ND	ND	NA	NA	NA	NA	1.9E-02	1.3E+02
P-SG-33	B	dual	Unique	5	4/16/2015	21	50	0.64	ND	5.6	1.4	ND	ND	ND	NA	NA	NA	NA	1.3E-04	1.8E+01
	B	dual	Unique	15	4/16/2015	1.3	2.3	37	ND	4.5	1.0	ND	ND	ND	NA	NA	NA	NA	6.3E-04	7.3E-01
P-SG-34	B	dual	Unique	5	4/16/2015	0.37	3.5	4.5	0.10	0.91	3.2	ND	0.60	ND	NA	NA	NA	NA	1.3E-04	1.6E+00
	B	dual	Unique	15	4/16/2015	4.9	9.4	63	0.25	1.7	11	ND	1.9	ND	NA	NA	NA	NA	1.1E-03	2.9E+00
	B	dual	Confirmation	15	4/22/2015	140	220	470	ND	17	130	ND	19	ND	NA	NA	NA	NA	8.3E-03	5.6E+01
P-SG-35	B	dual	Unique	5	4/16/2015	0.11	2.8	9.9	0.12	1.1	4.3	ND	2.0	ND	NA	NA	NA	NA	2.9E-04	1.5E+00
	B	dual	No sample	15	NO FLOW	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P-SG-36	B	dual	Unique	5	4/17/2015	56	2.7	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	9.6E-05	1.9E+00
	B	dual	Unique	15	4/17/2015	0.48	ND	120	0.14	2.0	6.8	ND	ND	ND	NA	NA	NA	NA	2.0E-03	1.0E+00
	B	dual	Replicate	15	4/17/2015	0.58	ND	110	ND	ND	7.4	ND	ND	ND	NA	NA	NA	NA	1.9E-03	9.9E-01
P-SG-37	B	dual	Unique	5	4/17/2015	110	8.1	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	2.0E-04	4.9E+00
	B	dual	Unique	15	4/17/2015	2.4	ND	140	ND	2.2	18	ND	ND	ND	NA	NA	NA	NA	2.6E-03	1.9E+00
	B	dual	Replicate	15	4/17/2015	2.5	ND	150	ND	2.5	19	ND	ND	ND	NA	NA	NA	NA	2.8E-03	2.0E+00

Table 3
Soil Gas Baseline Monitoring Results and Risks
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Sample Location	Area	Well Type	Sample Type	Depth	Date	PCE[2]	TCE[2]	Vinyl Chloride[2]	Benzene[2]	trans 1,2-DCE[2]	cis 1,2-DCE[2]	1,1- DCA[2]	1,1-DCE[2]	1,2- DCA[2]	TPHv (C5-C8) aliphatic low[3]	TPHv (C9-C12) aliphatic medium[3,4]	TPHv (C6-C8) aromatic low[3,5]	TPHv (C9-C10) aromatic medium[3,6]	Risk Total (cancer)	Haz Total
						(µg/L)														
P-SG-38	B	dual	Unique	5	4/17/2015	150	6.9	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	2.6E-04	5.1E+00
	B	dual	Unique	15	4/17/2015	1.0	ND	130	ND	4.2	2.7	ND	ND	ND	NA	NA	NA	NA	2.2E-03	8.4E-01
P-SG-39	B	dual	Unique	5	4/17/2015	ND	ND	61	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.7E-03	5.3E-01
	B	dual	Unique	15	4/17/2015	0.22	0.32	40	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	6.8E-04	2.8E-01
P-SG-40	B	dual	No sample	5	WATER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	B	dual	Unique	15	4/17/2015	ND	ND	5.8	0.25	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.1E-04	3.8E-02
P-SG-41	B	dual	Unique	5	4/21/2015	9.2	0.52	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.6E-05	3.4E-01
	B	dual	Replicate	5	4/21/2015	6.1	0.31	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.0E-05	2.2E-01
	B	dual	Unique	15	4/17/2015	0.11	ND	0.09	0.03	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.8E-06	2.1E-03
P-SG-42	C	triple	Unique	5	4/24/2015	3.8	0.24	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	6.8E-06	1.6E-01
	C	triple	Unique	10	4/24/2015	6.0	0.40	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	8.2E-06	1.9E-01
	C	triple	Confirmation[3]	10	4/24/2015	6.3	0.39	ND	0.0045	ND	ND	ND	ND	ND	ND	1.0	ND	ND	8.6E-06	2.1E-01
	C	triple	Unique	15	4/24/2015	6.6	0.39	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	7.3E-06	1.6E-01
NS-11	B	dual	Unique	5	4/29/2015	0.42	0.74	0.02	ND	ND	0.15	ND	ND	ND	NA	NA	NA	NA	2.4E-06	2.8E-01
	B	dual	Unique	15	4/29/2015	ND	ND	3.9	0.05	0.10	0.88	ND	ND	ND	NA	NA	NA	NA	7.4E-05	7.6E-02
	B	dual	Confirmation[3]	15	4/29/2015	0.036	0.70	0.22	0.0058	0.033	0.19	0.030	0.13	ND	2.6	1.5	ND	ND	4.9E-06	1.9E-01
MB-96	A	triple	Unique	5	4/29/2015	0.53	0.26	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.3E-06	9.9E-02
	A	triple	Unique	10	4/29/2015	0.88	0.24	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	1.3E-06	7.3E-02
	A	triple	Unique	15	4/29/2015	0.83	0.18	ND	ND	ND	ND	0.13	ND	ND	NA	NA	NA	NA	9.8E-07	4.6E-02
	A	triple	Confirmation[3]	15	4/29/2015	1.2	0.31	2.4	0.0074	0.16	0.56	0.15	ND	ND	0.12	0.7	ND	ND	4.2E-05	1.3E-01
MB-103	A	triple	No sample	5	NOT Located	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	A	triple	No sample	10	NOT Located	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	A	triple	No sample	15	NOT Located	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MB-120	A	triple	Unique	5	4/30/2015	0.58	0.13	ND	ND	ND	ND	0.23	ND	0.06	NA	NA	NA	NA	1.7E-06	6.2E-02
	A	triple	Unique	10	4/30/2015	0.13	0.06	0.02	ND	ND	ND	4.0	ND	ND	NA	NA	NA	NA	1.8E-06	2.0E-02
	A	triple	Replicate	10	4/30/2015	0.12	0.06	0.02	ND	ND	ND	3.7	ND	ND	NA	NA	NA	NA	1.7E-06	2.0E-02
	A	triple	Unique	15	4/30/2015	0.43	0.14	ND	ND	ND	ND	1.6	ND	0.08	NA	NA	NA	NA	1.3E-06	4.0E-02
MB-53	C	triple	Unique	5	4/29/2015	18	0.19	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	3.1E-05	4.1E-01
	C	triple	Replicate	5	4/29/2015	18	0.20	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	3.1E-05	4.1E-01
	C	triple	Unique	10	4/29/2015	41	0.45	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	5.4E-05	7.1E-01
	C	triple	Unique	15	4/29/2015	5.5	1.6	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	7.3E-06	4.2E-01
MB-11	B	dual	Unique	5	4/29/2015	4.6	3.4	ND	ND	0.71	ND	ND	ND	ND	NA	NA	NA	NA	1.3E-05	1.2E+00
	B	dual	Unique	15	4/29/2015	ND	0.15	2.3	ND	ND	1.0	ND	ND	ND	NA	NA	NA	NA	3.9E-05	9.8E-02
MB-29	B	dual	Unique	5	4/29/2015	1500	280	ND	ND	13	11	ND	ND	ND	NA	NA	NA	NA	2.9E-03	1.2E+02
	B	dual	Unique	15	4/29/2015	76	42	590	ND	130	300	ND	ND	ND	NA	NA	NA	NA	1.0E-02	2.9E+01
DTSC-Modified Residential Air Screening Level (HI=1)						0.037	0.0021	0.10	0.031	NA	0.0073	0.7300	0.0730	0.0073	0.63	0.1	0.031	0.00031		
DTSC-Modified Residential Air Screening Level (1 x 10^{-5})						0.0041	0.0048	0.00031	0.00084	NC	NC	0.018	NC	0.0011	NC	NC	NC	NC		
Subslab screening Level (10^{-5} with AF of 0.05)						0.082	0.096	0.0062	0.0168	NC	NC	0.36	NC	0.022	NC	NC	NC	NC		
Site-specific near-slab Soil-Gas Screening Level (10^{-5} or HI=1)						1.71	2.00	0.13	0.35	NC	NC	7.5	NC	0.5	630	100	31	0.31		

Notes:

Sample analysis performed by H&P.

Samples collected April 15 through 30, 2015.

[1]From Exponent (2013).

[2]Analyzed by H&P 8260SV.

[3]Analyzed by EPA Method TO-15.

(4)EPA RSL defines medium aliphatic range as C9-C18. RSL was applied to C9-C12 aliphatics as reported by analytical laboratory.

(5)EPA RSL defines low aromatic range as C5-C8. RSL was applied to C6-C8 aromatics as reported by analytical laboratory.

(6)EPA RSL defines medium aromatic range as C9-C16. RSL was applied to C9-C10 aromatics as reported by analytical laboratory.

Risk (or Hazard)
≤10-5 (or ≤1)
>10-5 (or >1)
>10-4 (or >10)

µg/L = micrograms per liter

AF = attenuation factor

DCA = dichloroethane

DCE = dichloroethylene

DTSC = Department of Toxic Substances Control

EPA = U.S. Environmental Protection Agency

H&P = H&P Mobile Geochemistry Inc. of Carlsbad, California

Haz = hazardous

HI = hazard index

NA = not analyzed, not applicable due to non-detect, or no applicable RSL

ND = not detected

NC = not calculated

NO FLOW = unable to collect a sample due to no flow

PCE = tetrachloroethylene

RSL = regional screening level

TCE = trichloroethylene

TPHv = total petroleum hydrocarbons as gasoline

WATER = unable to collect a sample due to water in tubing

Table 4. SCA Material Volumes
Operation and Maintenance Plan
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

Area/Material	**Estimated Volume** (cubic yards)
Northeast Land Farm Fill/cap	163,129
Northeast Land Farm Mixed	206,288
Southwest Land Farm Mixed	457,321
Total Soil/Materials Consolidated	**826,738**

Table 5. Summary of Cap Systems
Operation and Maintenance Plan
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

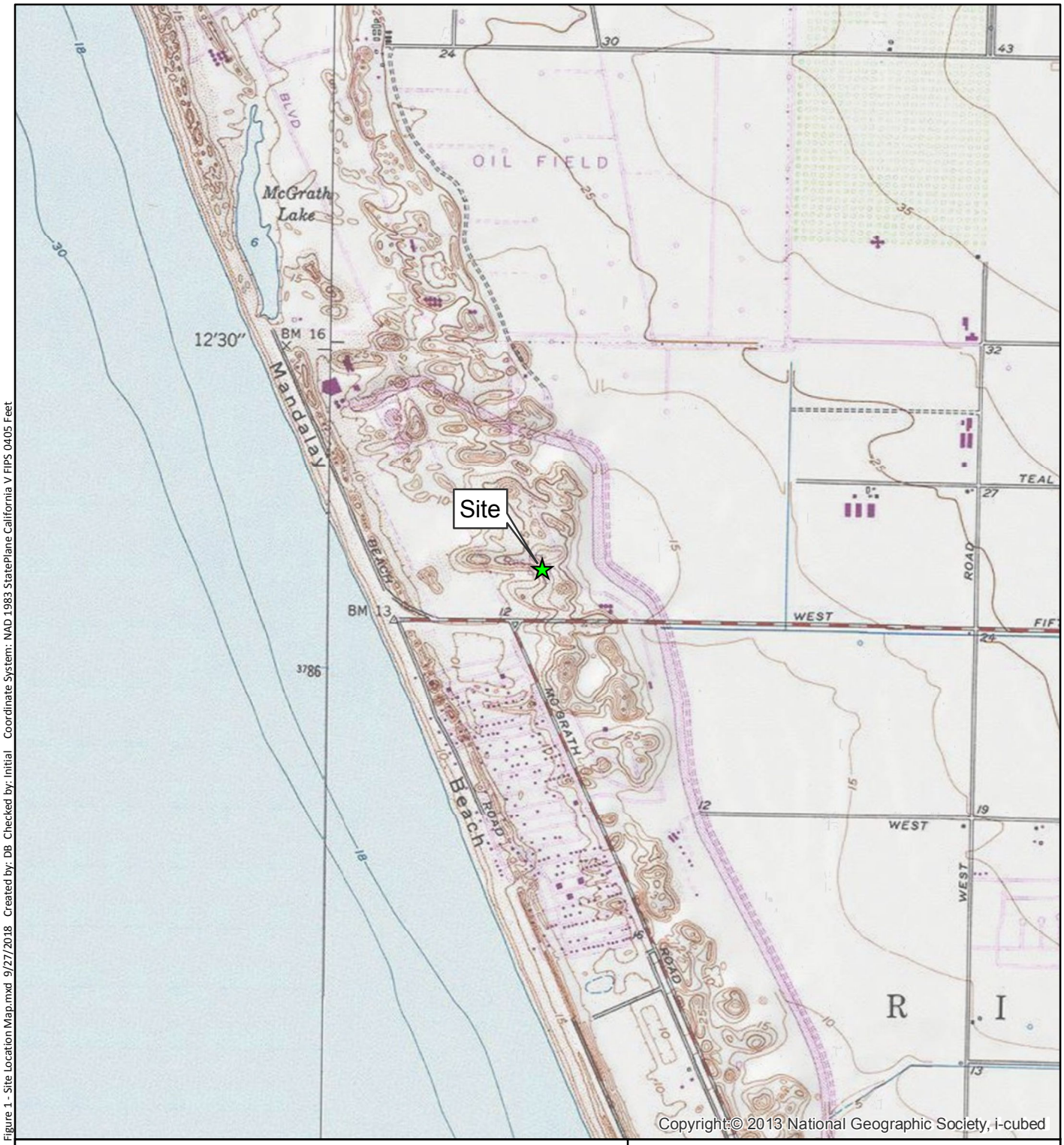
Area (description)	**Material**	**Extent** (acres)	**Thickness** (feet)
North SCA	Soil	2.6	3 to 6
South SCA	Soil	15.6	3 to 6

Table 6. Routine SCA O&M Inspection Activities
Operation and Maintenance Plan
North Shore at Mandalay Bay
198 South Harbor Boulevard, Oxnard, California

	Cap	Surface Water Drainage	Vegetation	Fence	Monitoring Well Network
Frequency	**May and November**				**May**
Routine	Observe evidence of slope failure, cracks or rills that penetrate or threaten to violate the cap integrity; animal burrows which would violate cap integrity; seepage or ponding; erosional damage or sloughing of edge materials; and excessive or uneven settlement. Measure cap thickness.	Evaluate surface water drainage patterns to ensure that the erosion control measures at the Site remain free of damage and obstructions, are providing adequate runoff, and do not have excessive erosion. Conduct water quality inspections.	Survey the cap vegetation to evaluate whether there is stressed or missing vegetation, deep-rooted plants that could penetrate the cap, or dry grass that could pose a fire hazard.	Evaluate the perimeter fence to identify any damage or the need to replace or repair fence elements or posted signs.	Collect groundwater samples from 8 wells plus 1 duplicate and analyze for PCBs, TPH, VOCs, metals, alkalinity, dissolved ions, and field parameters.
Unplanned	In the event of earthquake, flood, or fire, notify DTSC with 48 hours and conduct inspection. Document inspection on the Emergency Response Inspection Form (Appendix C).				
Maintenance and Repair	Backfill rodent burrows with clean soil, remove burrowing animals, fill or regrade depressions, and revegetate or mulch eroded areas.	Remove debris, silt, or other obstructions from the surface water drainage system.	Maintain in accordance with CDP.	Repair damage within 1 week.	Record damage to monitoring well protective casings, locks, lids and other parts during routine inspections and replace or repair within 30 days.
	In the event that erosional forces degrade the cap to less than a 3-foot thickness based on surveyed depth measurements, implement measures to restore the cap in these degraded areas to its original approximate 6-foot thickness. Plants or other features shall be installed to stabilize the soils to prevent future erosion which threatens cap effectiveness.				

Notes:
CDP = Coastal Development Permit
PCB = polychlorinated biphenyls
TPH = total petroleum hydrocarbons
VOC = volatile organic compound

FIGURES



0 2,000 4,000 Feet

1 inch = 2,000 feet

N

Legend

Site Location

Base Map: USGS Oxnard, CA (1967) 7.5 Minute Quadrangle.

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CLIENT: MPL Property Holdings, LLC

PROJECT: North Shore at Mandalay Bay

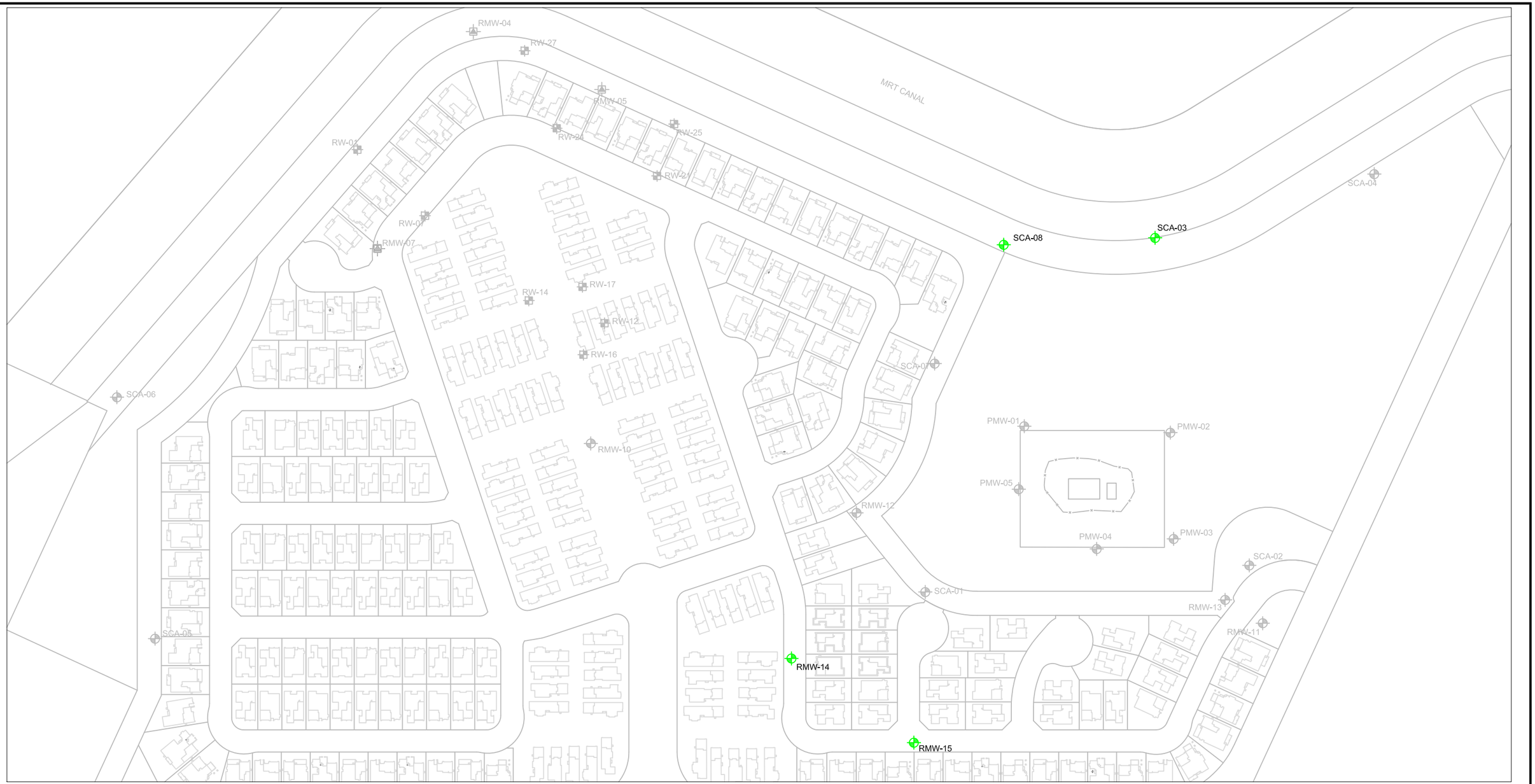
PROJECT NUMBER: S041.001.001

Site Location Map

FIGURE 1

File: K:\GIS\Prj\S041.001 MPL Holdings LLC\MXDs\(20180927) Figure 1 - Site Location Map.mxd 9/27/2018 Created by: DB Checked by: Initial Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet

R:\Projects\S041 - MPL Property Holdings LLC\Mandalay Bay\Technical\CAD files\2018 O&M Plan\(20181023) Figure 2 - Site Map with Wells.dwg Drawn by: DB ; Checked by: XXX



Legend

RMW-03	REMEDIAL MONITORING WELL (LFR, 2008)
RW-18	TEMPORARY REMEDIAL PUMPING & MONITORING WELL (LFR, 2006)
SCA-1	SOIL CONSOLIDATION AREA MONITORING WELL (SOUNDEARTH, 2014)
RMW-10	PROPOSED MONITORING WELL LOCATION

NOTE: ALL MONITORING WELLS ARE MONITORED ANNUALLY EXCEPT RMW-04, RMW-05, RW-01, RW-21, AND RW-24, WHICH ARE MONITORED BIENNIALLY (EVERY OTHER YEAR).

N

0' 100' 200' 400'

Approximate Scale in Feet

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CLIENT: MPL Property Holdings, LLC

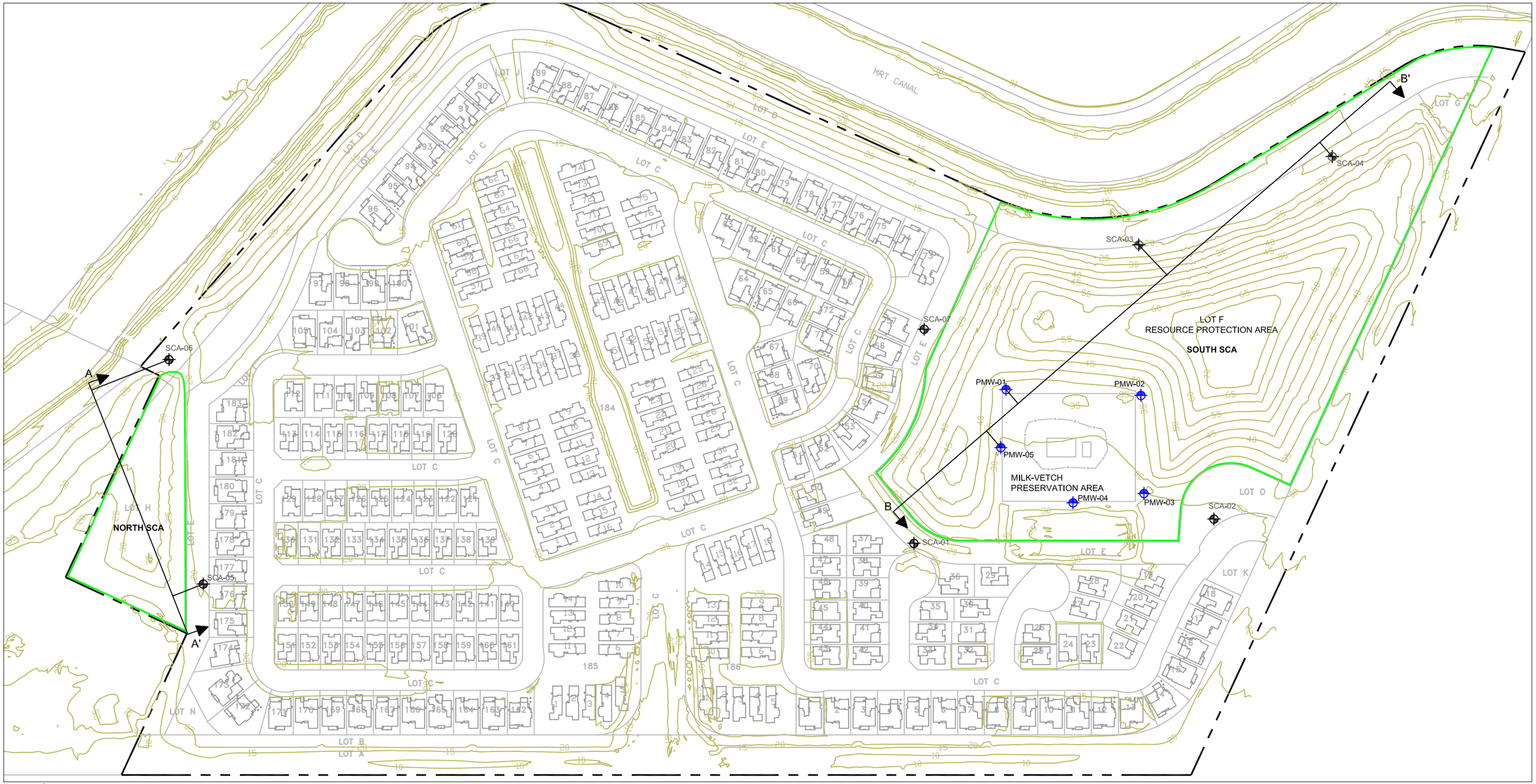
PROJECT: North Shore at Mandalay Bay

PROJECT NUMBER: S041.001.001

Site Plan Showing Monitoring Well Network

Figure 2

R:\Projects\S041 - MPL Property Holdings LLC\Mandalay Bay\Technical\CAD files\2018 O&M Plan\(20180927) Figure 3 - Site Map with SCA detail.dwg Drawn by: XXX ; Checked by: XXX



Legend

- PROPERTY BOUNDARY
- EXTENT OF SCA AREAS
- CONTOURS DEPICTING FINAL SITE TOPOGRAPHY
- SCA-7 — SCA MONITORING WELL LOCATION
- PMW-5 — PERMANENT MONITORING WELL LOCATION
- B B' — CROSS SECTION LINE
- SCA — SOIL CONSOLIDATION AREA

NOTE: ALL WELLS ARE MONITORED ANNUALLY WITH THE EXCEPTION OF PMW-02 THROUGH PMW-05

N

0' 110' 220' 440'

Approximate Scale in Feet

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terraphase engineering

CLIENT: MPL Property Holdings, LLC

PROJECT: North Shore at Mandalay Bay

PROJECT NUMBER: S041.001.001

Site Plan Showing SCAs and SCA Monitoring Well Network

Figure 3

R:\Projects\S041 - MPL Property Holdings LLC\Mandalay Bay\Technical\CAD files\2018 O&M Plan\(20180927) Figure 4 - SVE Well and Gas Probes.dwg Drawn by: DB ; Checked by: XXX

REVISED REMEDIAL AREA A

PRACR REMEDIAL AREA A

24 VERTICAL SVE WELLS

SOUTHERN SCA BOUNDARY

NORTHERN SCA BOUNDARY

SOUTHERN SCA BOUNDARY

REMEDIAL AREA B
17 VERTICAL SVE WELLS

AREA C

MB-103 MB-120 MB-96 MB-53 MB-29 MB-11

NS-01 NS-02 NS-03 NS-04 NS-05 NS-06 NS-07 NS-08 NS-09 NS-10 NS-11 NS-12 NS-13

LOT D LOT E LOT J LOT C LOT H LOT N LOT B LOT K LOT G LOT O

UNDERWAY PLACE
CAYMAN ISLAND WAY
BARNACLE CIRCLE
CARDIFF PLACE
DRAWBRIDGE DRIVE
BULKHEAD STREET
EDDY PLACE
FREEBOARD PLACE
ENDEAVOR DRIVE
FIN CIRCLE
HARPOON LANE
DRYDOCK PARKWAY
ALLEY "A"
ALLEY "B"
ALLEY "C"
ALLEY "D"
ALLEY "E"
ALLEY "F"
ALLEY "G"
ALLEY "H"
ALLEY "I"
ALLEY "J"
ALLEY "K"

LOT F
RESOURCE PROTECTION AREA/
REMEDIATION AREA
SUBJECT TO CHANGE

N

0' 100' 200' 400'

Approximate Scale in Feet

LEGEND

P-SG-42	PERMANENT MULTIDEPTH SOIL GAS MONITORING PROBE LOCATION (SOUNDEARTH, APRIL 2015)
MB-103	PERMANENT MULTIDEPTH SOIL GAS MONITORING WELL LOCATION (ARCADIS, 2012)
NS-13	CHARACTERIZATION SOIL VAPOR MONITORING PROBE AND POSSIBLE GRAB GROUNDWATER SAMPLE LOCATION
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
SCA	SOIL CONSOLIDATION AREA
SVE	SOIL VAPOR EXTRACTION
A-VSVE-01	VERTICAL SOIL VAPOR EXTRACTION WELL WITH 65-FOOT RADIAL ZONE OF INFLUENCE
	REMEDIAL AREA
	RESIDENTIAL HOUSING AREA REQUIRING 40 MILS GEOMEMBRANE CONSISTING OF VERY FLEXIBLE, LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) GEO BARRIER™ Y-SERIES, Y40BAC, BY GEOCHECK, OR APPROVED EQUAL (109 RESIDENTIAL LOTS)
	RESIDENTIAL HOUSING AREA REQUIRING 15 MILS, ASTM E 1725 CLASS A VAPOR BARRIER, STEGO® WRAP, OR APPROVED EQUAL (183 RESIDENTIAL LOTS)
	SOIL VAPOR EXTRACTION COMPOUND AREA, INCLUDING BLOWERS, FILTRATION, SAMPLE PORTS, VENT STACKS, ETC.

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CLIENT:	MPL Property Holdings
PROJECT:	North Shore at Mandalay Bay
PROJECT NUMBER:	S041.001.001

Site Plan Showing Location of SVE Wells and Soil Gas Monitoring Probes

Figure 4

R:\Projects\S041 - MPL Property Holdings LLC\Mandalay Bay\Technical\CAD files\2018 O&M Plan\(20181001) Figure 5 - Showing Soil Gas Risks.dwg Drawn by: DB ; Checked by: XXX

LEGEND

- PMW-5 — PERMANENT MONITORING WELL LOCATION (2006)
- RMW-3 — REMEDIAL MONITORING WELL LOCATION (LFR, 2007)
- RW-18 — TEMPORARY REMEDIAL PUMPING & MONITORING WELL LOCATION (LFR, 2007)
- SCA-2 — SCA MONITORING WELL LOCATION
- MB-100 — SOIL GAS MONITORING POINT LOCATION (ARCADIS, 2012)
- MB-29 — PERMANENT MULTIDEPTH SOIL GAS MONITORING PROBE LOCATION (ARCADIS, 2012)
- MB-4 — PERMANENT 5-FOOT SOIL GAS MONITORING PROBE (ARCADIS, 2012)
- P-SG-42 — PERMANENT MULTIDEPTH SOIL GAS MONITORING PROBE LOCATION (SOUNDEARTH, APRIL 2015)
- NS-13 — CHARACTERIZATION SOIL VAPOR MONITORING PROBE (MARCH, 2015)
- SCA — SOIL CONSOLIDATION AREA
- RESIDENTIAL HOUSING AREA REQUIRING 40 MILS GEOMEMBRANE CONSISTING OF VERY FLEXIBLE, LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) GEO BARRIER™ Y-SERIES, Y40BAC, BY GEOCHECK, OR APPROVED EQUAL (109 RESIDENTIAL LOTS)
- RESIDENTIAL HOUSING AREA REQUIRING 15 MILS, ASTM E 1725 CLASS A VAPOR BARRIER, STEGO® WRAP, OR APPROVED EQUAL (183 RESIDENTIAL LOTS)

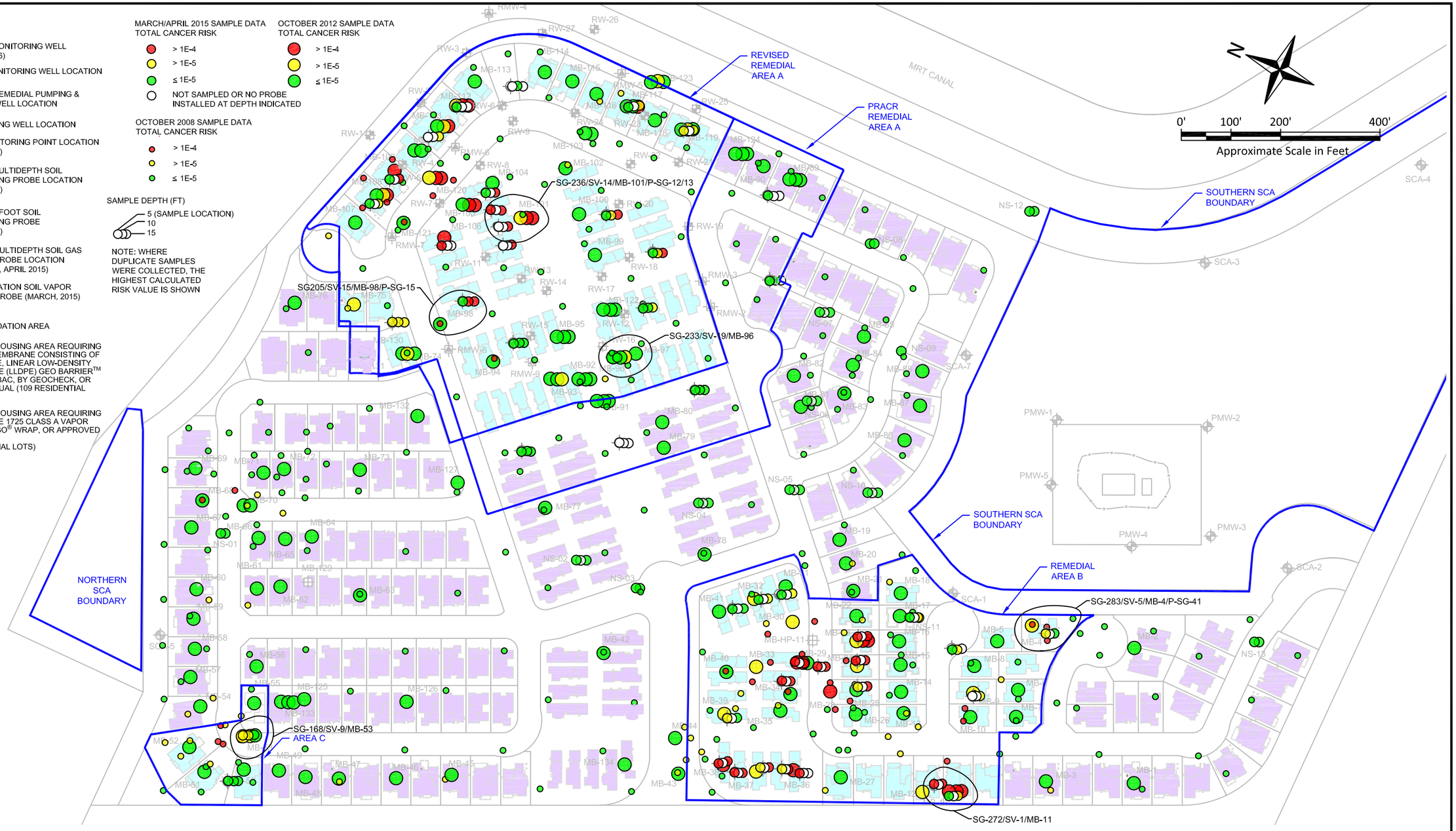
MARCH/APRIL 2015 SAMPLE DATA TOTAL CANCER RISK
- > 1E-4
- > 1E-5
- ≤ 1E-5
- NOT SAMPLED OR NO PROBE INSTALLED AT DEPTH INDICATED

OCTOBER 2012 SAMPLE DATA TOTAL CANCER RISK
- > 1E-4
- > 1E-5
- ≤ 1E-5

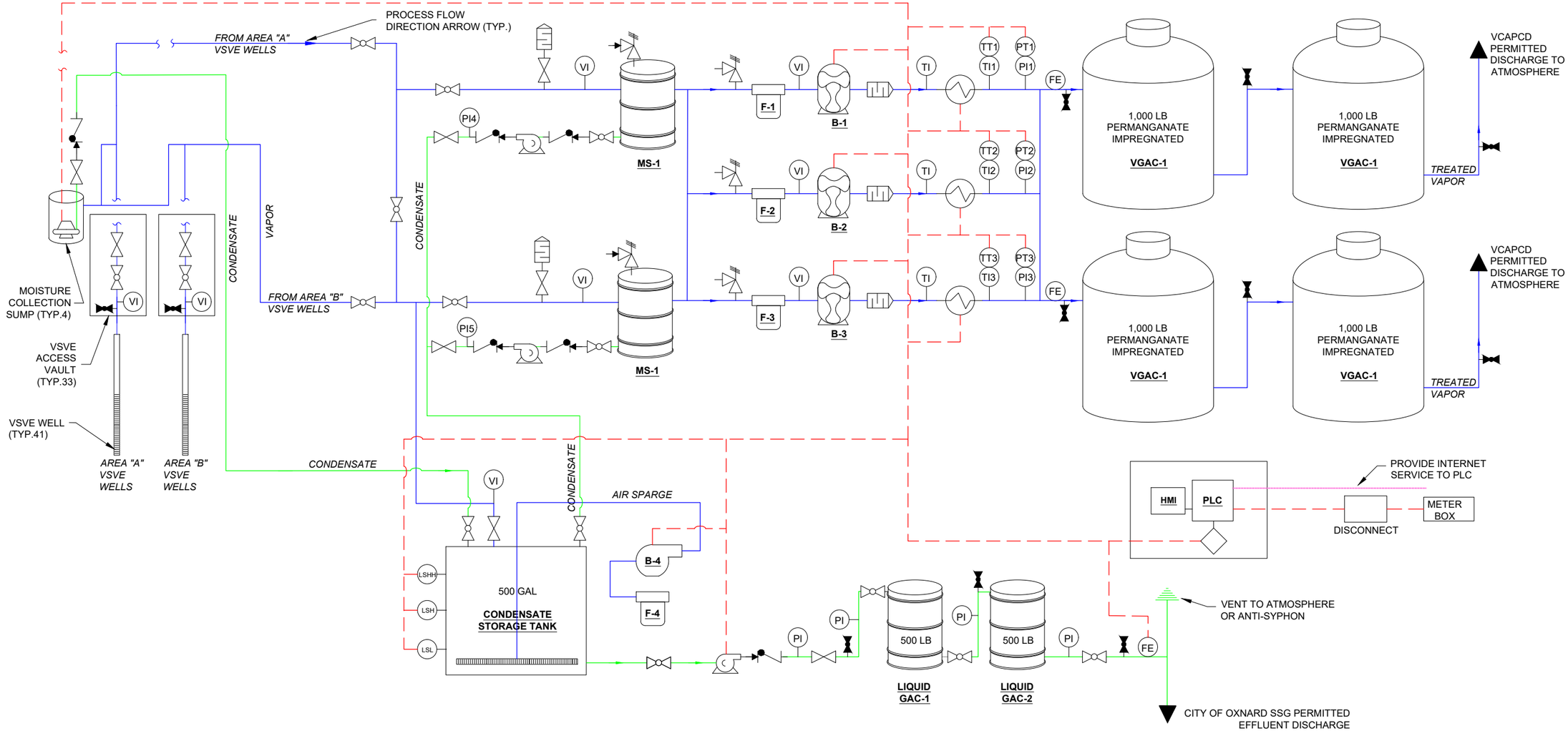
OCTOBER 2008 SAMPLE DATA TOTAL CANCER RISK
- > 1E-4
- > 1E-5
- ≤ 1E-5

SAMPLE DEPTH (FT)
- 5 (SAMPLE LOCATION)
- 10
- 15

NOTE: WHERE DUPLICATE SAMPLES WERE COLLECTED, THE HIGHEST CALCULATED RISK VALUE IS SHOWN



SAFETY FIRST	CLIENT: MPL Property Holdings, LLC	Site Plan Showing Soil Gas Risks- 2008 to 2015
terraphase engineering	PROJECT: North Shore at Mandalay Bay	
	PROJECT NUMBER: S041.001.001	Figure 5



LEGEND

FE	FLOW ELEMENT	PLC	PROCESS LOGIC CONTROLLER
GAC	GRANULAR ACTIVATED CARBON	VCAPCD	VENTURA COUNTY AIR POLLUTION CONTROL DISTRICT
HMI	HUMAN MACHINE INTERFACE	VI	VACUUM INDICATOR
HSVE	HORIZONTAL SOIL VAPOR EXTRACTION	VSVE	VERTICAL SOIL VAPOR EXTRACTION
LB	POUND	MS	MOISTURE SEPARATOR
LSL	LEVEL SWITCH LOW	SSG	SANITARY SEWER
LSH	LEVEL SWITCH HIGH	TI	TEMPERATURE INDICATOR
LSHH	LEVEL SWITCH HIGH HIGH	TYP	TYPICAL
PI	PRESSURE INDICATOR		

BALL VALVE
CHECK VALVE
GATE VALVE
SAMPLE PORT
RELIEF VALVE
SILENCER
FILTER
VACUUM BLOWER (REGENERATIVE)
VACUUM BLOWER (ROTARY LOBE)
AIR TO AIR HEAT EXCHANGER
CENTRIFUGAL PUMP
SUBMERSIBLE PUMP
LIQUID PROCESS LINE
VACUUM PROCESS LINE
ELECTRIC/SIGNAL
COMMUNICATION

SAFETY FIRST

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CLIENT: MPL Property Holdings, LLC

PROJECT: North Shore at Mandalay Bay

PROJECT NUMBER: S041.001.001

Soil Vapor Extraction Process and Instrumentation Diagram

Figure 6

R:\Projects\S041 - MPL Property Holdings LLC\Mandalay Bay\Technical\CAD files\2018 O&M Plan\(20181002) Figure 6 - SVE Process.dwg Drawn by: DB ; Checked by: XXX

R:\Projects\S041 - MPL Property Holdings LLC\Mandalay Bay\Technical\CAD files\2018 O&M Plan\(20181002) Figure 7 - Consolidation Area.dwg Drawn by: DB ; Checked by: XXX

MRT CANAL

LOT D

LOT E

LOT C

LOT O

B'

B

SCA-01

SCA-02

SCA-03

SCA-04

SCA-07

PMW-01

PMW-02

PMW-03

PMW-04

PMW-05

LOT D
RESOURCE PROTECTION AREA

MILK-VETCH
PRESERVATION AREA

LEGEND

- PROPERTY BOUNDARY
- THE TOP OF THE AFFECTED SOILS (FILL LAYER 2)
- THE TOP OF THE FILL/CAP SOILS (FILL LAYER 1)
- SCA-07 — SCA MONITORING WELL LOCATION
- B ▲ B' — CROSS-SECTION LOCATION
- SCA — SOIL CONSOLIDATION AREA

N

0' 75' 150' 300'

Approximate Scale in Feet

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CLIENT: MPL Property Holdings, LLC

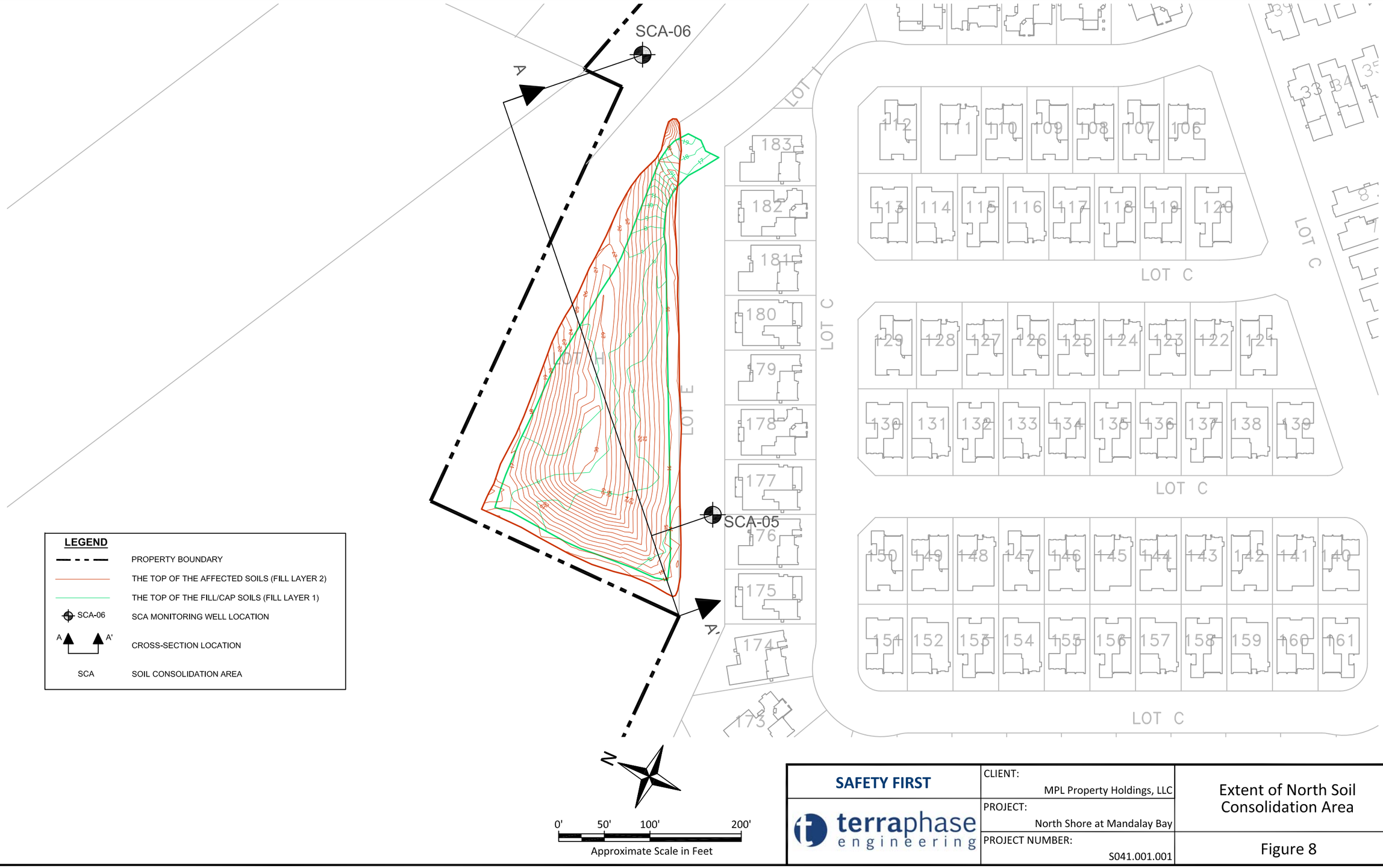
PROJECT: North Shore at Mandalay Bay

PROJECT NUMBER: S041.001.001

Extent of South Soil Consolidation Area

Figure 7

R:\Projects\S041 - MPL Property Holdings LLC\Mandalay Bay\Technical\CAD files\2018 O&M Plan\(20181002) Figure 8 - S Consolidation Area.dwg Drawn by: DB ; Checked by: XXX



LEGEND

	PROPERTY BOUNDARY
	THE TOP OF THE AFFECTED SOILS (FILL LAYER 2)
	THE TOP OF THE FILL/CAP SOILS (FILL LAYER 1)
SCA-06	SCA MONITORING WELL LOCATION
A A'	CROSS-SECTION LOCATION
SCA	SOIL CONSOLIDATION AREA

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CLIENT: MPL Property Holdings, LLC

PROJECT: North Shore at Mandalay Bay

PROJECT NUMBER: S041.001.001

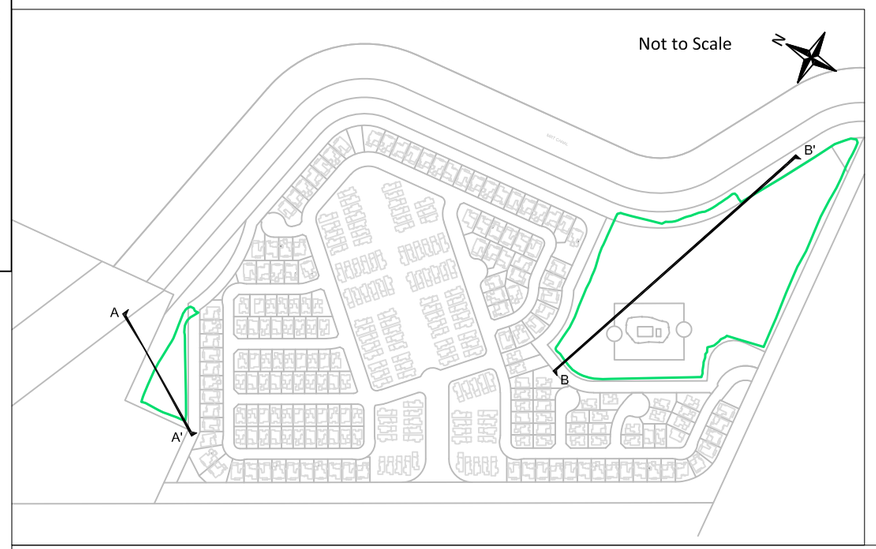
Extent of North Soil Consolidation Area

Figure 8

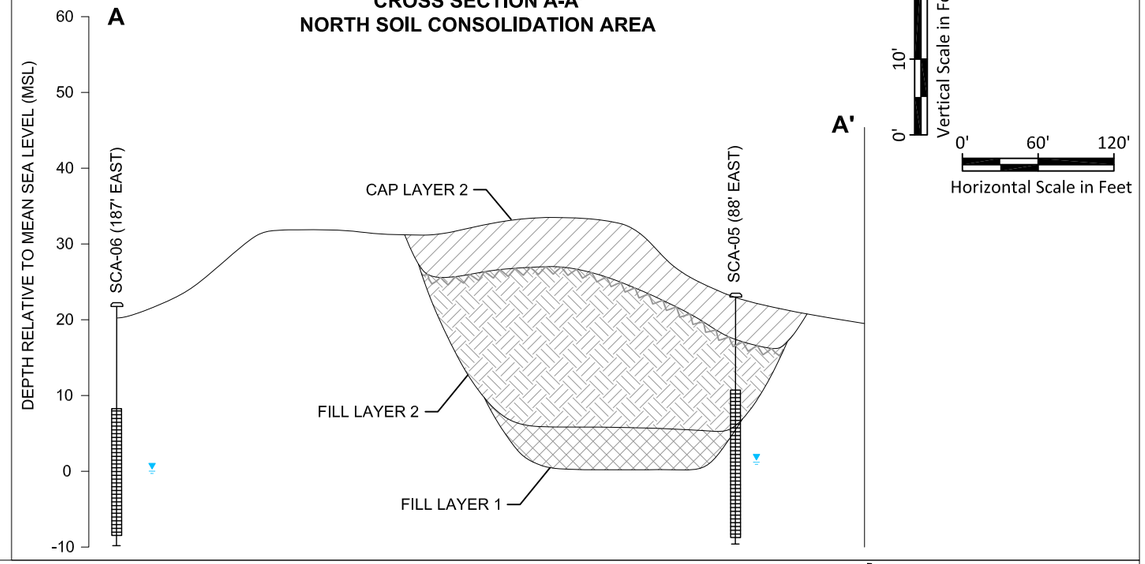
LEGEND

- FILL LAYER 1 (FILL CAP MATERIALS)
- FILL LAYER 2 (SLUDGE AND NATIVE MATERIAL)
- CAP LAYER 1 (GEOTEXTILE FELT)
- CAP LAYER 2 (VEGETATED SOIL COVER)
- APPROXIMATE GROUNDWATER ELEVATION
- A — A' CROSS SECTION LINE

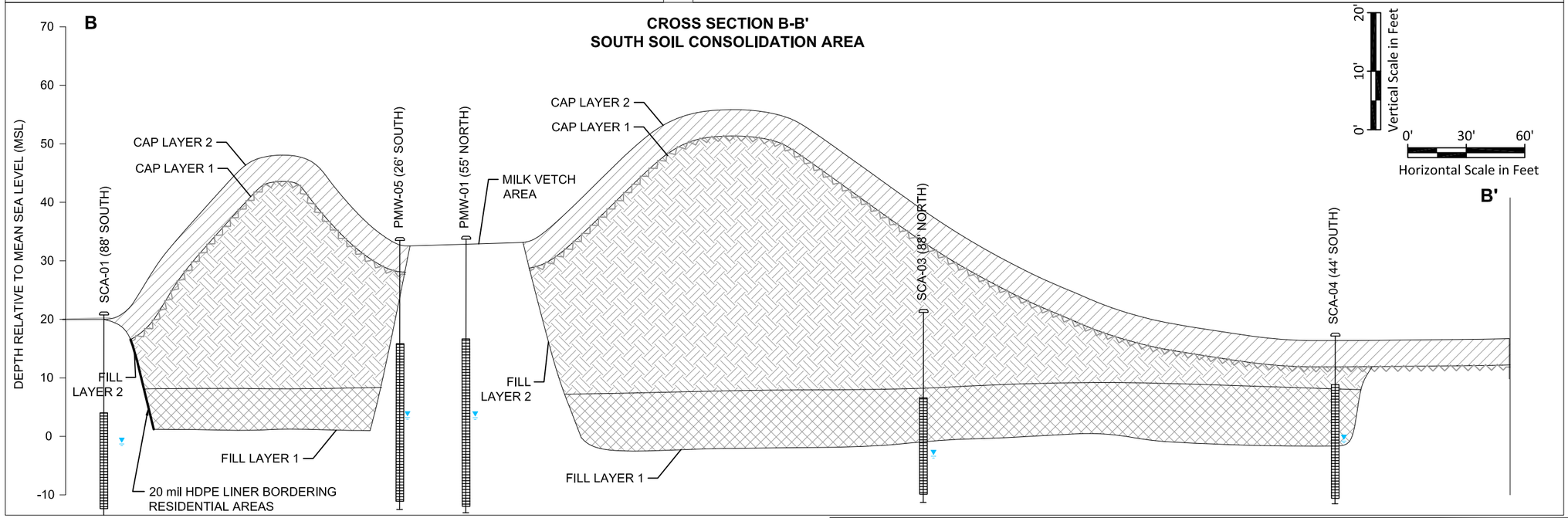
CROSS SECTION LOCATIONS



CROSS SECTION A-A'
NORTH SOIL CONSOLIDATION AREA



CROSS SECTION B-B'
SOUTH SOIL CONSOLIDATION AREA



SAFETY FIRST	CLIENT: MPL Property Holdings, LLC	Cross Section A-A' and B-B' Showing Final Construction of The Soil Consolidation Areas
terraphase engineering	PROJECT: North Shore at Mandalay Bay	
	PROJECT NUMBER: S041.001.001	Figure 9

R:\Projects\S041 - MPL Property Holdings LLC\Mandalay Bay\Technical\CAD files\2018 O&M Plan\(20181002) Figure 9 - Cross Sections.dwg Drawn by: DB ; Checked by: XXX

APPENDIX A
CONTINGENCY PLAN

CONTINGENCY PLAN
NORTH SHORE AT MANDALAY BAY
198 SOUTH HARBOR BOULEVARD
OXNARD, CALIFORNIA

Prepared for

MPL Property Holdings, LLC
2392 Morse Avenue
Irvine, California 92614

Prepared by

Terraphase Engineering Inc.
18401 Von Karman Avenue, Suite 410
Irvine, California 92612

October 12, 2018

Project Number S041.001.001

terraphase engineering

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CONTENTS

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1.0 INTRODUCTION

This Contingency Plan describes contingency actions that may be required in the event of unexpected or unforeseen developments that indicate remedial action objectives established in the Site Feasibility Study and Remedial Action Plan and clarified in the Response Plan (RP) are not being met. This Contingency Plan discusses the types of possible contingency actions that the California Department of Toxic Substances Control (DTSC) may require, in accordance with California Health and Safety Code Section 25395.96(a)(8) (further response actions). This Contingency Plan presents activities and procedures for the Site Responsible Party (SRP) to evaluate whether further response actions beyond the ongoing operation and maintenance (O&M) efforts are appropriate and needed to achieve the goals and objectives outlined in the RP.

This Contingency Plan describes the following potential further response actions that might be considered in the future to achieve the RP goals:

- **Groundwater Monitoring and Natural Attenuation**. As described in the O&M Plan, the groundwater data will be evaluated to confirm that groundwater goals continue to be met within the context of the primary Applicable or Relevant and Appropriate Requirement—State Water Resources Control Board (SWRCB) Resolution No. 92-49. Testing and analytical procedures are described in the O&M Plan and multiple methods are used to evaluate water quality data over time. Those analyses will provide direction for monitoring frequency change (increased or decreased) or other further response actions including enhanced attenuation efforts, if needed.

- **Soil Vapor Extraction System Operation and Maintenance**. As described in the O&M Plan, monitoring will be used to determine when to shut down or pulse-operate the short-term Soil Vapor Extraction (SVE) System. The SVE contingency plan provides for a Further Response Action in the form of additional SVE operations and possible expansion in the event that it is required.

- **Vapor Intrusion Mitigation Operation and Maintenance.** As described in the O&M Plan, vapor intrusion mitigation (VIM) measures are incorporated into the foundation design of each residential building as required by the RP. Further response actions such as repairs or system modifications could be necessary if the VIM becomes damaged or ineffective.

- **Soil Consolidation Areas Operation and Maintenance**. In the event that future groundwater monitoring data indicate that an unacceptable release from the Soil Consolidation Area (SCA) occurred, then a Further Response Action similar to the Groundwater further response actions, including soil cap enhancements or other SCA improvements will be evaluated and potentially implemented. To address potential erosion, there are other contingencies that will be evaluated, including repairs to the cap.

This Contingency Plan will be reviewed annually and during 5-year reviews (as discussed in the O&M Plan), and updated, if necessary, to protect public health and the environment.

2.0 GROUNDWATER MONITORING AND NATURAL ATTENUATION CONTINGENCY PLAN

As outlined in the RP, the Site is under a state of natural attenuation (in the monitored natural attenuation [MNA] phase of the Site's selected remedy). However, if a future evaluation of groundwater concentration trends indicates that the natural attenuation of chemicals of concern (COCs) in the groundwater would not reach water quality objectives within a reasonable time frame as described in the Groundwater Conceptual Site Model and Remedial Status report (SoundEarth 2018), further response actions could be implemented with agency review and approval. Such actions may include an additional round of substrate injection and additional monitoring.

The Site-wide groundwater contingency procedures are discussed below:

1. In accordance with the O&M Plan, individual well data will be evaluated following the collection of the annual or biennial groundwater sampling events.

2. Monitoring data concentration trends will be evaluated in monitoring wells as described in the O&M Plan. With the monitoring program included in the O&M Plan, monitoring well data will be evaluated to track the degradation of remaining chemicals and determine whether there is any additional impairment of groundwater resources caused by the presence of chemicals from the Site and determine if further response actions are needed.

3. If the multiple lines of evidence show total chlorinated volatile organic compound (CVOC) concentrations are increasing, evidence of an additional release, or changes in VOC distribution, then a further evaluation will be conducted to determine whether groundwater resources are being impaired or if receptor risks are unacceptable (including surface water and vapor intrusion pathways). If needed, further response actions will be considered in consultation with DTSC. First steps will include increasing the scope or frequency of groundwater monitoring with more-detailed analysis of possible actions following confirmation of the trend.

4. Based on the above analyses, if future monitoring data indicate that natural attenuation progress has unacceptably stalled or reversed, or there is some new unanticipated impact to groundwater resources, a detailed evaluation will be conducted.

    a. If any of the above conditions were to occur, specific geochemical and biochemical MNA parameters beyond those collected as part of the annual or biennial monitoring events will be evaluated.

    b. If after these analyses, it is determined that a Further Response Action is required, the contingency may include an additional enhanced attenuation event similar to the enhanced attenuation event conducted in December 2016.

It is not anticipated that chemical concentrations in groundwater will increase to such magnitude that it would not achieve water quality objectives within a reasonable time frame or that further response actions would be necessary based on groundwater monitoring in the past several years. However, this Contingency Plan is in place for such an unforeseen, unanticipated occurrence as required by California Health and Safety Code Section 25395.96(a)(8). Consequently, if there is a significant increase in chemical concentrations that requires an enhanced attenuation event, a Further Response Action would be appropriate and needed.

3.0 SOIL VAPOR EXTRACTION SYSTEM CONTINGENCY PLAN

MPL constructed and started operating the required SVE system in late 2016. During its projected operation, the O&M Plan data will be collected, and then used to manage the operation of the SVE system. With concurrence from DTSC, the O&M Plan data will be evaluated to assess whether the system should be modified, shut down in one or more areas where it is operating, or pulse-operated in order to reach CVOC concentrations acceptable to DTSC. Any and all of these outcomes are potential SVE Contingencies described in this section.

The SVE contingency procedures are discussed below:

1. The SVE System will operate with monitoring as described in the O&M Plan.

2. Following a shutdown of the SVE System as described in Section 5.6.4 of the O&M Plan, soil gas concentrations would be measured annually using sub-slab or the multi-depth soil probes to gain multiple lines of evidence to evaluate achievement of acceptable criteria. Observed concentrations will be compared to Regional Screening Levels for residential indoor air after considering attenuation.

3. If sub-slab concentrations were to exceed response plan objectives , the potential for increased monitoring or monitoring frequency will be discussed with DTCS. The SVE System will be restarted if sub-slab concentrations consistently exceed response plan objectives. Soil vapor concentrations will also be considered in the decision to restart the system. This contingency ensures that the SVE System remains functional as long as it is technically and economically feasible and reasonable to continue running this system.

4. If restarting and operating the SVE System as described in the preceding paragraph does not sufficiently reduce CVOC concentrations, the SVE System will be modified and/or expanded, as appropriate, in the affected area in consultation with DTSC to address increased concentrations. SVE will continue, as indicated in the O&M Plan, until acceptable risk levels have been achieved.

It is reasonable to expect that the operation of the SVE System will remove the largest remaining fractions of CVOCs and that the increase in air and oxygen flow through the subsurface will further degrade residual or daughter chlorinated compounds such as vinyl chloride, which is a major component of the estimated vapor intrusion risks at the Site. In the unlikely event that the current SVE System may need future modification, the further response actions, described above, would address such a need.

4.0 VAPOR INTRUSION MITIGATION CONTINGENCY PLAN

As described in the RP, active sub-slab de-pressurization and other foundation enhancements will interrupt a potential exposure pathway and thereby further reduce potential vapor risks to acceptable levels. As noted in the O&M Plan, the VIM will be tested and operational after completion of the liner and foundation system and before the vertical construction of the home. The testing will ensure that there is effective sub-slab depressurization to interrupt the potential pathway of exposure from the observed soil vapors to the residential area. This depressurization effectively eliminates the vapor exposure pathway from subsurface chemicals.

The VIM contingency procedures are described below:

1. If the VIM components become compromised for any reason including but not limited to differential settlement, earthquakes, fire, inappropriate SRP or home owner action, or third party action and appears ineffective, repairs to the VIM components would be appropriate to ensure the ongoing effectiveness of the VIM.

2. An evaluation of the pressure differential between the sub-slab and above-ground area will be conducted to evaluate system operational effectiveness. This work may include the collection of pressure/vacuum measurements at different parts of the sub-slab or home to verify ongoing effectiveness of the sub-slab depressurization system.

3. If it is shown that the sub-slab depressurization system is no longer effective as a result of slab damage, the sub-slab depressurization system will be repaired and retested prior to being put back into service. The SRP will conduct or administer testing and (if necessary) repairs to the sub-slab depressurization systems.

4. The SRP will provide documentation of these efforts to the DTSC for their concurrence as part of the annual reporting.

The vapor barrier foundations are designed so that the sizing of the fan follows accepted engineering practices and the system is properly installed and tested before occupancy of a home. Additionally, the O&M Plan calls for real-time monitoring and replacement/maintenance of the system. Furthermore, foundation damage that may impair the performance of the sub-slab depressurization system will be addressed by the above contingency plan.

5.0 SOIL CONSOLIDATION AREAS CONTINGENCY PLAN

The O&M of the SCAs, as described in the O&M Plan, is expected to maintain the integrity and utility of the SCA caps and, consequently, protect the SCA containment features that prevent any exposure of SCA compounds to receptors. The further response actions presented in this section address the potential future possibility of migration of SCA chemicals into groundwater and address the potential for losses of SCA cap material (such as caused by a significant storm event or earthquake) or other unforeseen reasons for compromising the soil cap's effectiveness.

To date, no SCA chemicals have been observed in the groundwater at concentrations that indicate a release of chemicals from the SCA, indicating that the SCAs currently operate as intended. With proper O&M Plan implementation to maintain the cap, as well as the Land Use Covenants to protect the cap and restrict access, it is not expected that future failures of the SCA containment system would occur.

The SCAs are currently under a detection monitoring program in general accordance with SWRCB Title 27, as approved and implemented by the DTSC. If annual inspections and monitoring indicate a release from the SCAs, an evaluation monitoring program will be instituted. Significant physical evidence of a release could include unexplained stress in biological communities, unexplained changes in soil characteristics, visible signs of leachate migration, observed groundwater resource degradation, and unexplained water table mounding beneath or adjacent to the SCAs and other change to the environment that could reasonably be expected to be the result of a release from the SCAs.

The SCA contingency procedures are discussed below:

1. As described in the O&M Plan, individual well data from the SCA monitoring wells will be evaluated following the collection of the annual groundwater sampling event and compared against the SCA-specific COCs to determine whether there has been a release of chemicals from the SCA or Milk-vetch protection area into the groundwater. The well trends for the SCA-specific COCs will be evaluated to determine whether there are significant changes in the SCA wells water quality relative to previous monitoring events. Multiple lines of evidence will be used to analyze trends in data over time to evaluate whether there is a release or an increasing trend in COC concentrations.

    a. In those wells that show a statistical increase in COCs associated with the SCAs, groundwater monitoring will be evaluated for the value of more frequent sampling. Other nearby wells will additionally be considered for increased monitoring to better evaluate the potential changes in groundwater chemistry. This increased monitoring frequency will continue until the multiple lines of evidence analysis yields insignificant value or no longer shows groundwater resource impacts.

    b. If the increasing trend has been confirmed and the concentrations are above background levels (pre-SCA construction groundwater concentrations), then there may be an installation of additional groundwater monitoring wells to better define the extent of the exceedance.

    c. If the exceedance identified in the preceding paragraph persists, then localized impacted soil and/or groundwater removal or treatment will be evaluated and implemented if deemed appropriate.

    d. DTSC-sanctioned groundwater monitoring will be continued until the multiple lines of evidence no longer indicate value to ongoing monitoring or that concentrations are above background or the best water quality that is reasonable. Afterwards, groundwater monitoring on an annual basis will be resumed as appropriate.

2. In the event of significant storm event erosion or earthquake, as described in Section 9.0 – Response for Unplanned Events of the O&M Plan, the SCA caps will be evaluated to determine whether there is excessive loss of cap material or whether the cap has been compromised.

    a. If damage is detected, the cap will be repaired to its pre-damaged condition. The likely repairs will be replacement of missing cap material in the event of loss of material along with implementation of best management practices to prevent future damage. In the event of a more-serious repair (such as damage that may cause the cap to shift after an earthquake), the SRP will develop a more-extensive repair plan and repair the damages under the oversight of the DTSC.

6.0 VARIANCE FROM, OR MODIFICATION TO, CONTINGENCY PLAN

The SRP may seek variance and/or modification to the Contingency Plan upon a written application to DTSC at any time during the life cycle of the remedy. “Variance” refers to possible release from specific individual contingency measures for a limited time period, while “modification” refers to permanent revision of specific individual contingency measures. DTSC will evaluate each application for a variance or modification and may grant a variance or modification after determining that such a request would be protective of human health and the environment.

7.0 REPORTING AND CONSIDERATION

The contingency evaluations included herein shall be used in the O&M Plan reporting. The activities described herein shall be considered and specifically reported in the annual reporting as required in the O&M Plan.

APPENDIX B
MILKVETCH PRESERVE PLAN

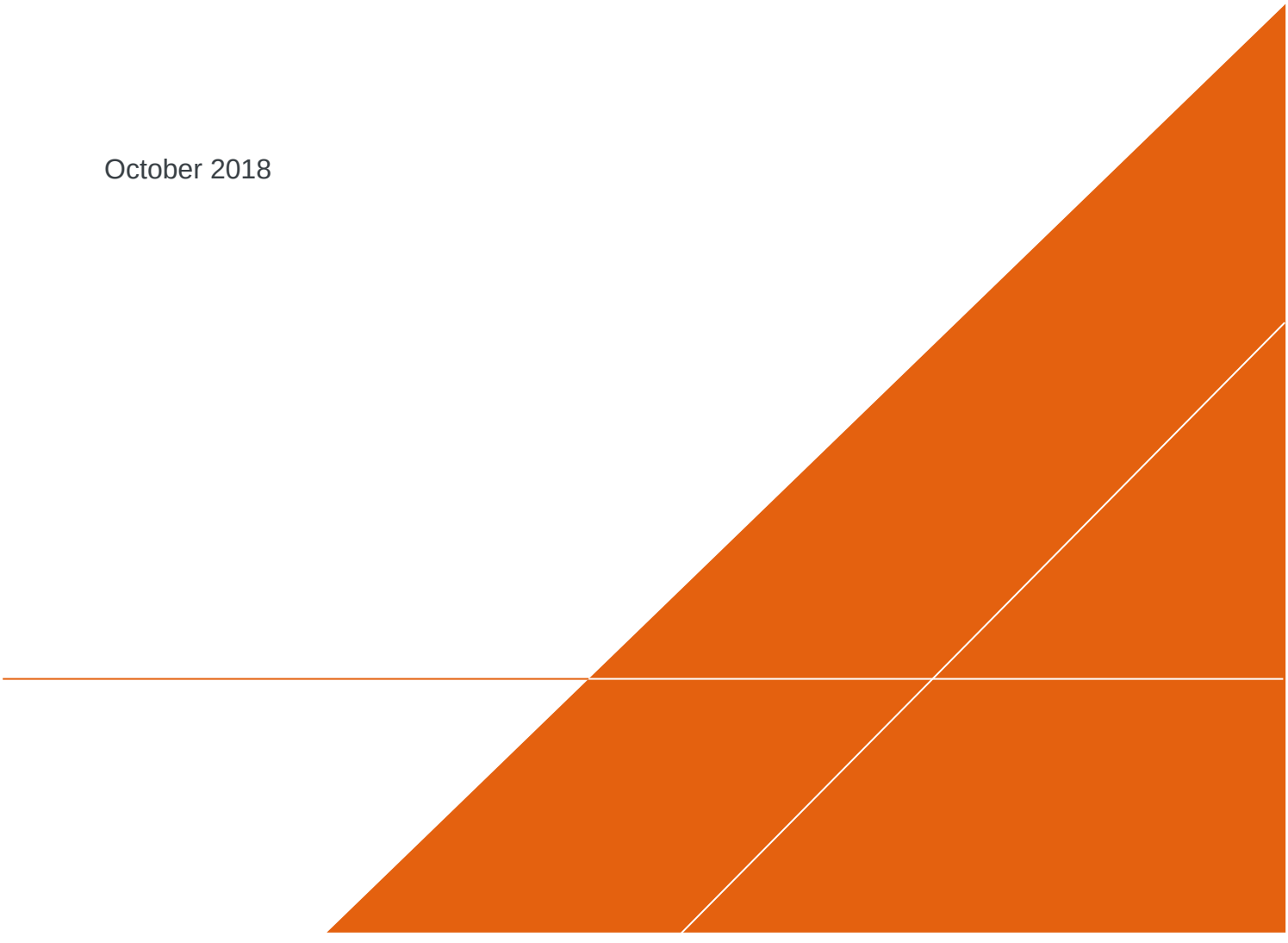
ARCADIS Design & Consultancy for natural and built assets

MPL Property Holdings LLC

LONG TERM PRESERVATION PLAN

Ventura Marsh Milkvetch Preserve,
North Shore at Mandalay Bay, Oxnard California

October 2018



Mary Carroll
Senior Ecologist

LONG TERM PRESERVATION PLAN

Ventura Marsh Milkvetch Preserve,
North Shore at Mandalay Bay
Oxnard, California

Prepared for:

MPL Property Holdings, LLC

Prepared by:

Arcadis U.S., Inc.
735 Tank Farm Road
Suite 150
San Luis Obispo
California 93401
Tel 805 706 2805
Fax 805 782 9273

Our Ref.:

MANDALAY.2017

Date:

October 2018

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CONTENTS

FIGURES

ACRONYMS AND ABBREVIATIONS

Arcadis	Arcadis U.S., Inc
bgs	below ground surface
CDFW	California Department of Fish and Wildlife (formerly CDFG)
CNPS	California Native Plant Society
cm	centimeters
EIR	Environmental Impact Report
ha	hectare
km	kilometers
kph	kilometers per hour
m	meters
Owner	The fee title holder of the legal parcel (Tract 5592 - Lot F - APN 183-0-010-805) containing the VMMVP
PVC	polyvinyl chloride
RPA	Resource Protection Area
SCA	Soil Consolidation Area
TAC	Ventura Marsh Milkvetch Technical Advisory Committee
USFWS	United States Fish and Wildlife Service
VMMV	Ventura Marsh Milkvetch
VMMVB	Ventura Marsh Milkvetch Buffer Area
VMMVP	Ventura Marsh Milkvetch Preserve

1 INTRODUCTION

This document represents the current amended Ventura Marsh Milkvetch Preservation Plan (the Plan) for the Ventura Marsh Milkvetch (*Astragalus pycnostachyus* var. *lanosissimus*; VMMV) growing in the VMMV Preserve (VMMVP) located within the North Shore at Mandalay Bay project area in Oxnard, Ventura County, California (Figure 1). This plan contains management, monitoring and protection measures for the VMMV located within the VMMVP, as defined in the 2009 Conservation Easement Deed made by Mandalay Bay Development LLC in favor of the City of Oxnard (City of Oxnard 2009a).

These management guidelines for the VMMVP management culminate 20 years of studies, recommendations, entitlements, and agreements for the VMMV at the North Shore site. For the last 10 years Arcadis U.S., Inc. (Arcadis) has actively performed regular monitoring and adaptive management measures in the VMMVP, in cooperation with representatives of the California Department of Fish and Wildlife (CDFW) and the VMMV Technical Advisory Committee (TAC).

2 VENTURA MARSH MILKVETCH PRESERVE (VMMVP) SPECIES MANAGEMENT

VMMV is currently listed by the United States Fish and Wildlife Service (USFWS) as Federally Endangered, pursuant to the Federal Endangered Species Act of 1973 (FESA; as amended - 16 U.S.C. § 1531 et seq), and by the CDFW as California Endangered, pursuant to the California Endangered Species Act (CESA; CFG Code § 2050, et seq). The life history and status of the VMMV at the North Shore site is summarized in both the Final Rule for the species listing as Federally Endangered (Department of the Interior 2001), the Final Rule designating critical habitat for the species (Department of the Interior 2004).

The only known “naturally occurring population” of VMMV is located within the VMMVP at the North Shore site. In accordance with the Coastal Commission approved City of Oxnard Local Coastal Plan policy 10.1.b and consequently the Conservation Easement Deed (City of Oxnard 2009a) the property owner (Owner) of the parcel containing the VMMVP is required to protect the extant population and habitat of this endangered species. The VMMVP is legally described in the Conservation Easement Deed (City of Oxnard 2009a) as a rectangle, 299 feet (91.1 meters [m]) by approximately 242 feet (73.8 m), or 1.66 acres (0.67 hectare [ha]) in size. The VMMVP is surrounded and buffered on all four sides by the Resource Protection Area (RPA), a 24-acre (9.7 ha) natural habitat open space area separately designated under the Conservation Easement (City of Oxnard 2009b).

No natural soil or sand profiles occur on most of the VMMVP due to the historic oil field waste disposal activities. Natural soils that do occur and are underlying the VMMVP generally consist of silty sand, silt and clay, and poorly graded sand. Where dense vegetation cover occurs, the resulting plant litter may have contributed organic matter to upper soil layers. The previously occurring natural soils were excavated, manipulated and then excavated pits were filled with contaminated brine oil waste material that evaporated and infiltrated to leave waste sediments. These “sludge” materials were later “capped” and/or mixed with Bentonite and other compounds, potentially incorporating onsite sands and soils.

Over time soil has accumulated over the Bentonite cap, with greater accumulations near colonizing plants. The clay/sludge layer present within the silty sand/clayey zone that occurs across much of the VMMVP varies in thickness from 1 to 10 feet (0.3 - 3 m). The sludge layer is primarily at a depth of 1 to 15 feet (0.3 – 4.6 m) below the ground surface. Sand is present beneath the sludge layer to a depth of approximately 20 feet (6.1 m). The onsite population of VMMV occurs in soils above the sludge layer. In adopting the Revised Preservation Alternative of the certified EIR, it was decided that the land under the VMMVP would not be remediated.

3 VMMP MANAGEMENT MEASURES

The VMMVP is a fenced compound that is surrounded on four sides by the RPA (Figure 2), which is protected under a separate Grant of Conservation Easement (City of Oxnard 2009b) as well as City of Oxnard Local Coastal Plan zoning (RP - Coastal Resource Protection Zone). This Plan delineates the VMMV Buffer (VMMVB), which includes the VMMV fenced compound and extends into portions of the RPA surrounding the VMMVP and connects with Fifth Street, thereby providing habitat and pollinator connectivity with the dune vegetation to the east. This VMMVB encompasses a total of approximately 10.1 acres (4.1 ha), as shown on Figure 2.

The only known “wild” population of VMMV occurs within the VMMVP and has recovered from a low of 21 individuals in late 2009 to 264 individuals by late 2017. During this time, adaptive management measures were implemented, including artificial year-round irrigation to facilitate recovery of the North Shore population, under the oversight of CDFW and the VMMV TAC.

The population size of VMMV, a short-lived perennial, is dependent on seedling germination and survival, which in turn is governed by successful flowering and fruit production during summer and fall. Seeds reside in a seed bank within the soil profile and are likely to exhibit different dormancy mechanisms (Meyer, personal communication; Wall, personal communication). Some seeds likely exhibit long term dormancy while others germinate more readily following soaking winter rain events (Meyer 2008). Management of this seed bank is important for maintaining the long-term viability and genetic resilience of the VMMV population.

Active management of the VMMV population at North Shore is necessary to prevent extinction of the species in the wild. Routine monitoring enables adequate assessment of population size, native plant growth, herbivore activity, pathogens, and the overall health of the VMMV. During each visit, the VMMVP should be checked for irrigation system condition and functioning, vandalism, safety concerns, survival, and health of all native species, weed infestations, the need for supplemental irrigation, and potential remediation efforts.

The following VMMV management measures are required to maintain self-sustaining colonies of VMMV within the VMMVP. The management measures for the outplanting areas offsite are prescribed separately in the Ventura Marsh Milkvetch Outplanting Plan (Arcadis 2016a).

3.1 Lead Biologist

The Lead Biologist conducting VMMV monitoring should be approved by CDFW. The Lead Biologist should be a trained botanist with at least two years of experience working with federal-listed and/or state-

listed plants and California vegetation. The Lead Biologist must have a college degree in biological sciences and may not be a landscape ecologist or architect. The Lead Biologist should obtain and maintain an active Scientific Study Research and Collecting Permit from CDFW prior to working in the VMMVP.

3.2 VMMV Technical Advisory Committee (TAC)

Ongoing maintenance and monitoring of the VMMV population has greatly benefited from the scientific expertise of those participating in the VMMV TAC, which is currently coordinated by Arcadis (the current Lead Botanist) to address conservation issues and remedial approaches for this rare plant. Occasional conference calls, written updates, and consultations should be continued on an as-needed basis

Members of the TAC may include the Lead Biologist (TAC Coordinator) and representatives of the CDFW, USFWS, California Native Plant Society (CNPS), Santa Barbara Botanic Garden, and biologists assisting the Lead Biologist with ongoing monitoring. Meetings are held as needed with minutes produced and distributed by the Lead Biologist. All management proposals and decisions affecting the health and vigor of VMMV on site and in future offsite plantings are discussed with the TAC.

There are no financial obligations to the Owner associated with the involvement of the TAC or any experts who may be consulted.

3.3 Routine VMMV Monitoring

VMMV health, population size, and age class structure are assessed on a routine basis, with the goal of maintaining self-sustaining populations of VMMV within the VMMVP.

In general, a complete census of all VMMV in the preserve is made on a monthly basis between February and August, with an additional census in October and December or January.

Each VMMV in the census is assigned a unique identification number, which is written on a tag placed in front of each VMMV plant or group of nearby plants. Seedlings and juveniles receive a numbered tag when they reach 6 inches (15.2 centimeters [cm]) in height and have at least 5 leaves. Young seedlings that have recently germinated and/or are less than 6 inches (15.2 cm) tall or with four or fewer leaves are censused in clusters and recorded as total number of seedlings per cluster, noting the tag number from the nearest adult VMMV.

Data collected by individual plant and location are recorded on an excel spreadsheet on a tablet and saved at the end of each site visit; a copy of the census data file should be provided to CDFW and USFWS on an annual basis along with the annual report.

Collected data for tagged individuals include:

- Overall plant size and vigor
    - number of stems
    - length of stems (by size class -- 0 to 3 inches [0-7.6 cm], 3 to 6 inches [7.6-15.2 cm], 6 to 12 inches [15.2-30.5 cm], 1 to 2 feet [30.5-61 cm], 2 to 3 feet [61-92 cm], 3 to 4 feet [0.9-1.2 m], 4 to 5 feet [1.2-1.5 m], 5 to 6 feet [1.5-1.8 m], 6 to 7 feet [1.8-2.1 m])

  - presence and quantity of basal shoots
  - any notes on herbivory, pathogens, or other health issues
- Reproductive health
  - presence of reproductive structures on a given plant (buds, flowers/inflorescences, and fruits/infructescenses)

More detailed information on reproductive status will be collected every few years in either summer or fall. Measurements of each plant by location include:

- number of stems
- stem length, by size class
- number of stems producing flowers and/or fruits (inflorescences)
- number of inflorescences per stem
- total number of inflorescences per plant
- overall health of reproductive structures (e.g., plump fruits, presence of disease and/or weevils, etc)

If VMMV are observed growing outside of the VMMVP (i.e., in the VMMVB), those individuals should be tagged and monitored; additional fencing may be installed if herbivory or trampling is an issue.

3.4 Biological Diversity

Observations of plant and wildlife species will be recorded on a routine basis, including documentation of species composition, abundance, relative distribution, and vegetation types. Observed plant and wildlife species are recorded, as needed, and lists, data logs, and photographic files are updated regularly.

Changes in cover by native dominant species in vegetation types within the VMMVP should also be monitored and reported.

Wildlife species observed or assumed present from sign (e.g., tracks, burrows, scat, nests) at the VMMVP will also be recorded.

3.5 VMMV Management

Active monitoring and maintenance practices include checking the VMMVP for irrigation system condition and function, assessing the need for supplemental irrigation, vandalism, safety, survival, and health of all native species, weed infestations, and potential adaptive management efforts.

3.5.1 Ensure Adequate Soil Moisture

Adequate soil moisture appears to be the most important variable contributing to the recovery of VMMV (Meyer 2008, Arcadis unpublished data). Soil moisture can be affected by seasonal rainfall, the subsurface unremediated oil lenses, and soil texture. Several strategies are currently employed to address these variables including: monthly soil moisture monitoring during the active growing season (February – August); bimonthly soil moisture monitoring from September – January; review of data to

inform irrigation frequency and duration, as described below; monitoring of adjacent vegetation to observe signs of stress or wilting (this is especially visible in mulefat [*Baccharis salicifolia*] individuals).

3.5.1.1 Soil Moisture Monitoring

Measurements of soil moisture in the VMMVP are made monthly using an Aqua-Pro© Sensor and moisture tube system. Permanent 3.3-foot (1-m) deep soil moisture tubes are located throughout the VMMVP to carefully document moisture availability at different soil depths (Figure 3). In the VMMVP, tubes are located as follows: 1) upslope (east) of each VMMV area; 2) downslope (west) of each VMMV area; and 3) cross-gradient (north and south) of each VMMV area. Each of the three VMMV areas has five to seven soil moisture tubes in the surrounding vicinity, and additional tubes are located in other parts of the VMMVP as controls.

The capacitance-type soil moisture sensor (www.aquapro-sensors.com) measures average soil moisture in a roughly 3-inch (7.6 cm) diameter sphere around the sensor head. Measurements of soil moisture (percentage) are made with the sensor head at 4.5 inches (11.4 cm) below ground surface (bgs), 7.5 inches (19.1 cm) bgs, 10.5 inches (26.7 cm) bgs, 16.5 inches (41.9 cm) bgs, 22.5 inches (57.2 cm) bgs, 28.5 inches (72.4 cm) bgs, and 30 inches (76.2 cm) bgs.

Soil moisture data document between 70 percent and 100 percent soil moisture at 18 inches (46 cm) bgs or deeper near healthy VMMV. Collected data are used to determine when to provide supplemental irrigation, as described below.

3.5.1.2 Irrigation System for VMMVP

Two types of irrigation systems have been installed to help boost survival and health of existing VMMV. At the VMMVP, subterranean irrigation system provides supplemental water for the roots of mature plants without wetting the stem base or root crown, which can cause rot. Additionally, surface drip irrigation is provided to newly germinated seedlings and plantings to foster root growth and survival. Both irrigation systems are examined on a routine basis to ensure proper functionality and are repaired, as needed.

Subterranean irrigation system: The water delivery system for the VMMVP is supplied by a 1-inch (2.5 cm water meter located near Lot O (494 Harpoon Lane, Figure 2). One-inch (2.5 cm) polyvinyl chloride (PVC) mainline pipes convey water to the VMMVP. Inside the VMMVP fence, the 1-inch (2.5-cm) pipe feeds into a shutoff valve and pressure regulator, from which a 2-inch (6-cm) pipe extends north across the east side of the VMMVP (roughly paralleling the old access road). Three lateral 1-inch (2.5-cm) diameter lines extend from the main 2-inch header, one to each of the three VMMV colonies. Each lateral is individually valve-controlled. At the end of each lateral, a perforated pipe, with soaker hose inside, is buried approximately 1 foot (3 m) below grade and approximately 15 feet (4.6 m) upslope of each of the three colonies. All piping was installed on the surface with the exception of the perforated pipe/soaker hose apparatus that was trenched in to avoid surface flow toward the VMMV. The alignment of all pipes, including the trenched portion, was designed to avoid existing plants.

Irrigation water is applied in the buried perforated pipe and then ponds above the buried oil layers and percolates laterally underground. The distance the water must percolate to reach all VMMV plants is approximately 15 to 75 feet (4.6 to 23 m). To speed this percolation, irrigation water is applied at a rate that fills the perforated pipe without allowing water to rise above the top of the pipe. In practice, this has

resulted in flow rates at each watering that initially start high but soon stabilize around 0.6 to 1.3 gallons (2.3 to 5 liters) per minute.

The Lead Biologist's scientists routinely monitor, measure, and ensure 70 to 100 percent soil moisture at 18 inches (46 cm) or more bgs near healthy VMMV. The Lead Biologist's scientists also check for system leaks and make repairs as necessary.

Drip irrigation system for watering seedlings and juveniles: The goal of the drip irrigation system for seedling establishment is to wet only the area immediately around a VMMV seedling so that the roots can elongate, grow, and eventually reach subterranean moisture. A 5/8-inch (1.75-cm) length of tubing is placed between living VMMV, with smaller ¼-inch tubing providing water to the soil near each seedling. The tubing is removed once VMMV plants reach mature size or die.

Recent soil moisture data suggest that surface moisture should be applied to seedlings and juveniles during the spring and summer months in 5-minute pulses at 10-minute intervals repeated three to five times during each watering session whenever surface soils drop below 70% soil moisture (Arcadis unpublished data). During warmer months this translates into once every 2-3 days. More frequent application is necessary during hot, dry, windy spells.

3.5.1.3 Adult VMMV Soil Moisture and Irrigation Guidance

Soil moisture measurements provide data on overall VMMV soil moisture relations as well as guidance for when supplemental irrigation is required. Adult VMMV exhibit higher survival rates if soil moisture remains at 70 percent or greater 12 to 18 inches (30 to 46 cm) bgs during summer months (Arcadis unpublished soil moisture data 2009-2018).

To ensure an adequate moisture supply to adult VMMV, soil moisture should be monitored on a routine basis, at least monthly and more frequently in spring when VMMV seedlings appear. If soil moisture drops below 70% at or above 12 to 18 inches (46 to 69 cm) bgs, subterranean irrigation should be provided until soil moisture levels reaches a minimum of 70% at 12 to 18 inches (46 to 69 cm) bgs. Surface watering instead of subterranean irrigation is not appropriate to meet this water need as the volume required to provide the necessary moisture level below ground may have a deleterious impact on the existing adult VMMV (Arcadis unpublished soil moisture data 2009-2018).

3.5.1.4 Seedling and Juvenile VMMV Soil

VMMV seedlings usually germinate in spring and summer, with the greatest number of seedlings appearing during wet years or after large storms and prolonged moist soil. Seedlings and juveniles require moist soil to reach maturity.

To ensure an adequate moisture supply to VMMV seedlings and juveniles, they should be monitored at least monthly from February to August and preferably every two weeks during warm dry periods.

Controlled drip irrigation should be applied to seedlings and juveniles during the spring and summer months (in short pulses to minimize pooling/spreading, e.g., 5-minute pulses with 10-minute soak) repeated three times during each watering session whenever surface soils drop below 70% soil moisture. More frequent water application may be necessary during hot, dry, windy spells.

Drip tubing to new seedlings should be added every spring. Drip irrigation is not applied to mature plants and is removed from juveniles when they have matured or died; emitters are removed from dead plants several months after last signs of green leaves, because VMMV often die back during the winter months and re-sprout the following year.

3.5.1.5 Irrigation System Maintenance

Drip irrigation requires regular inspection and maintenance to detect and repair leaks and clogs. Clogs can be minimized by regularly cleaning filters and flushing any new lines prior to adding emitters. Leaks generally result from animal damage (including human footsteps). Leaks from animal chewing can be reduced by adding drains at the low points in each zone so no water is left standing in tubes. Hidden leaks are a possibility and may be detected by regularly checking the quantity of irrigation water used. At the VMMVP the belowground irrigation perforated pipe may become clogged by roots. Such clogs can be cleared by using a hydro-jetter with an extra-long hose to reach from outside the fenced area.

High dissolved solids: Municipally supplied irrigation water has moderately high dissolved solids content. Therefore, the soil in the VMMVP should be monitored visually for salt encrustations and soils should be sampled at least every three years for salt build-up. If significant salt crusts are observed or soil samples show marked increases in salinity, then a salinity management plan will be developed and implemented. Salinity management would include sampling to determine the magnitude and spatial extent and might include treatments such as winter leaching of soils in consultation with the VMMV TAC and CDFW.

3.5.2 Ongoing Weed Removal

All non-native plants will be removed on an ongoing basis to decrease competition with VMMV for available resources. Weed removal should be conducted only by the project biologists within 10 feet (3 m) of any VMMV individuals to safeguard emerging VMMV seedlings while removing weeds in the seedling stage to reduce weed competition. Wick or spray applications by a weed crew may be allowed outside the direct VMMV population areas and the 10-foot buffer under supervision of the project biologist when winds are less than 5 miles per hour (8.1 kilometers per hour [kph]). Annual weeding should be required in the VMMVP during March/April, in August/September, and in December/January after rains, and to maintain low to negligible populations of invasive weeds (less than or equal to 5% maximum cover) in VMMV areas. Weed removal effort, timing, and intensity is governed by the goal of preventing any non-native weed species from setting seed within the VMMVP.

3.5.3 Native Species Competition with VMMV

Cover by native species has increased over time, especially as a result of artificial irrigation and routine weed abatement. Notable increases in coyote bush (*Baccharis pilularis* subsp. *consanguinea*) and California sagebrush (*Artemisia californica*) have been observed. To address potential competition between VMMV and native species, targeted removal of native species, especially California sagebrush, may be conducted on an as-needed basis when such individual plants occur near VMMV and reducing vigor and/or appear to be affecting VMMV survival. Plots with no vegetation removal should be compared with targeted removal of dense native cover for comparison purposes to develop a long-term adaptive management strategy, if required

3.5.4 Herbivore Monitoring

Two herbivore types have been observed utilizing VMMV as a food source, snails, and brush rabbits.

Snails: Two species of non-native snails have been reported grazing on VMMV, the milk snail (*Otala lacteal*) and the brown garden snail (*Cantareus aspersus* [*Helix aspersa*]); see Meyer 2008. Although commercial snail bait has been used in the past, all snail removal is currently done by hand to prevent impacts to potential native snails in the area. All snails discovered in the vicinity of the VMMV are removed by hand, placed in a plastic bag, and disposed of offsite. Snails have been found underneath VMMV leaves, on adjacent mulefat, and hidden in the fabric of pin flags, so metal VMMV identification tags are used to reduce snail hiding places near VMMV.

Small mammals: The main small mammal herbivore observed within the VMMVP is the brush rabbit (*Sylvilagus bachmani*), a small species of "cottontail" rabbit found in dense vegetation in western North America. Although nibbled VMMV leaves have been observed, no plant deaths have been attributed to rabbits, and so no protection measures have been implemented at this time.

If more than 10 percent of the VMMV population exhibits signs of herbivore damage and/or more than 10 percent of the foliage is damaged on any given stem, then protective fencing should be installed around VMMV individuals or colonies. Herbivore monitoring should be conducted as needed.

3.5.5 Non-native Argentine Ant Colony Monitoring

Invasive Argentine ants (*Linepithema humile*) are present in the VMMVP, along with a small population of native California red harvester ants (*Pogonomyrmex californicus*). Although Argentine ants do not use VMMV as a food source, they are observed nesting in the woody bases of VMMV, visiting flowers probably to obtain nectar or farm aphids. They may be a potential factor in reducing seed set in VMMV. They also damage the ecosystem as a whole. Colonies of these ants should remain under observation.

3.5.6 Pathogen Monitoring

The primary pathogen observed by Arcadis on VMMV plants has been grey molds (*Botrytis* or *Cladosporium*), which forms on dying or stressed tissues and was also reported by Meyer (2008). Because these conditions are primarily associated with drought stress, adequate moisture availability is the primary treatment recommendation.

3.5.7 VMMV Operations - Infrastructure and Security Maintenance

The VMMVP is fenced and gated, with a combination lock. The chain link fence and combination lock should be inspected on a routine basis to ensure the security of the VMMVP from trespassers and repaired or replaced as necessary. Fence repair and/or replacement should be considered if sagging, rusting, and loss of attachment hardware are observed. Funds for fence and irrigation system repairs will be provided by the Owner.

No access should be allowed within the VMMVP without a CDFW or Lead Biologist as escort, including for any weed removal activities. If needed, VMMV within the VMMVP should be encircled with temporary caution tape and/or fencing prior to approved visitor entry.

3.6 Reporting

The lead project biologist should prepare a short annual monitoring report that summarizes the following data:

- Annual census of reproductive adults, vegetative adults, juveniles, and seedlings at the VMMVP
- Population size comparison table
- VMMV age structure by year
- VMMV status and health overview discussion
- Soil moisture monitoring results
- Biological diversity summary
- Maintenance summary
- Adaptive Management measures

This report will be submitted on an annual basis to CDFW, USFWS, City of Oxnard, and the TAC.

3.7 Responsibilities – Financial Assurance, Management, and Oversight

- The Owner will maintain a contract with the Lead Biologist for the purposes of funding the routine Management, Maintenance and Monitoring of the VMMVP.
- The Owner is financially responsible for:
    - Municipal Water Service and supply for the VMMVP
    - Fence repair/replacement costs
    - Irrigation system repair and/or replacement
    - Adaptive Management - Outplanting propagation event (contingency measure).
- The Lead Biologist will be responsible for all VMMVP routine maintenance, monitoring, and reporting within an annual capped budget, as disbursed by the Owner by means of the contract described above.
- Repair and/or replacement expenditures for fencing, irrigation or an adaptive management/contingency measure will be mutually agreed by the Lead Biologist and the Owner and, if necessary, CDFW or City of Oxnard may arbitrate.

4 CONCLUSION

The long-term management and preservation of VMMV within the VMMVP require continuing active measures to maintain healthy self-sustaining populations. Routine monitoring is necessary to facilitate an adaptive management program overseen by CDFW, qualified biologists, and the TAC. The adaptive

management measures implemented since 2009 and now prescribed herein have led to a significant increase in the VMMV population. Effective management will require regular monitoring and maintenance activities by specially qualified personnel to address VMMV health, soil moisture issues, weed competition, and other resource availability needs to maintain healthy self-sustaining populations of VMMV within the VMMVP.

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FIGURES

NOTES

- Aerial photo source: Google Earth Pro. dated 30 Sept. 2004.

0 500 1,000 2,000 Feet

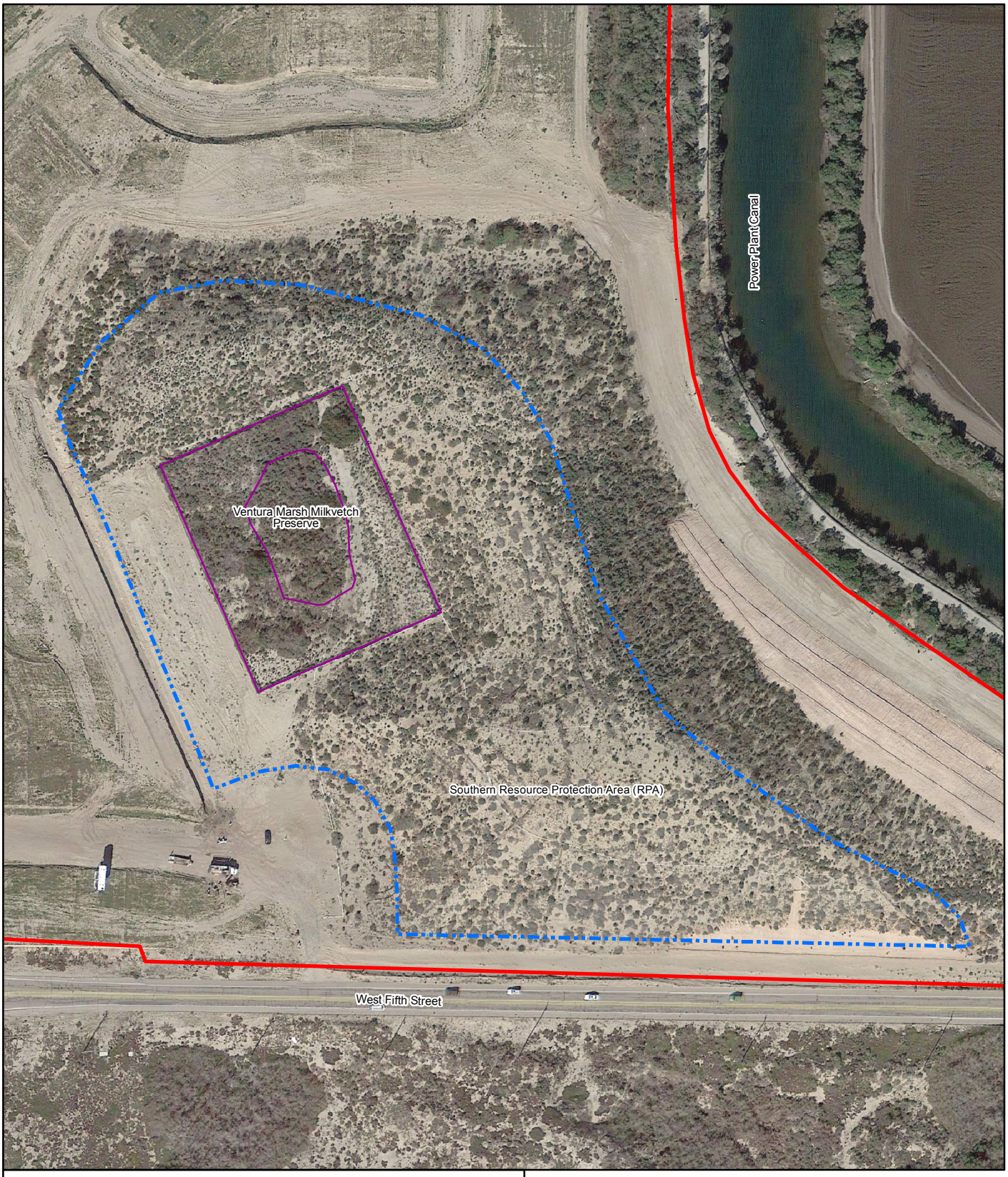
VMMV Long Term Preservation Plan
Site Vicinity Map

North Shore at Mandalay Bay Oxnard, California

ARCADIS

Figure 1

ENV: San Luis Obispo \\corpstorage\Data\ArcGisData\ \\corpstorage\Data\ArcGisData\GISProjects_ENV\EcoTeam\Mandalay Bay\North Shore\Projects\2017\Fig_1_site_vicinity_map.mxd 5/25/2017 Dtfische
Coordinate System: NAD 1983 HARN StatePlane California V FIPS 0405 Feet



Legend

- Ventura Marsh Milkvetch Preserve
- Ventura Marsh Milkvetch 10.1-ac Buffer Area
- Site Boundary

N

0 25 50 100 150 Feet

Aerial imagery from Google Earth Professional dated 8 Feb. 2016

VMMV Long Term Preservation Plan

VMMV Preserve and Buffer Area

North Shore at Mandalay Bay Oxnard, California

ARCADIS

Figure 2

ENV: San Luis Obispo \\corpstorage\Data\ArcGisData\ Z:\GISProjects_ENV\EcoTeam\Mandalay Bay\North Shore\Projects\VMMV\Management Plan\Fig 2 VMMVP Overview.mxd 9/16/2017 kgpeters
Coordinate System: NAD 1983 HARN StatePlane California V FIPS 0405 Feet

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APPENDIX C
EMERGENCY RESPONSE INSPECTION FORMS

EMERGENCY RESPONSE VAPOR BARRIER SYSTEM INSPECTION FORM

North Shore at Mandalay Bay **O&M INSPECTION**

Oxnard, California **Vapor Barrier System Inspection**

Inspector Information		**Project No.**
Inspector Name:		**Date/Time:**
Company:		**Lot ID:**
Address:		**Weather:**
Phone:		
E-mail:		

upon visual inspection is there noticable damage to the foundation? ❑ **Yes** ❑ **No**

Comments:

Is the sub-slab depressurization fan operational and in working condition? ❑ **Yes** ❑ **No**

Comments:

Is the sub-slab depressurization system in a state of alarm? ❑ **Yes** ❑ **No**

Comments:

Other evidence of system damage or failure? ❑ **Yes** ❑ **No**

Comments:

Inspector Signature:

EMERGENCY RESPONSE CAP SYSTEM INSPECTION FORM

North Shore at Mandalay Bay **O&M INSPECTION**
Oxnard, California **Soil Cap Inspection**

Inspector Information		**Project No.**
Inspector Name:		**Date/Time:**
Company:		**Weather:**
Address:		
Phone:		
E-mail:		

Are there large cracks in the soil cover? Comments:	❑ **Yes**	❑ **No**
Are there noticable depressions or ponding of surface water on the soil cover? Comments:	❑ **Yes**	❑ **No**
Are there signs of sliding or sloughing of the soil layer which might indicate slope failure? Comments:	❑ **Yes**	❑ **No**
Is there excessive debris, silt, or other deleterious material obstructing flow through the surface water control system? Comments:	❑ **Yes**	❑ **No**
Is the fence present and in good condition? Comments:	❑ **Yes**	❑ **No**
Is there evidence of vandalism? Comments:	❑ **Yes**	❑ **No**
Is there evidence of pedestrian traffic? Comments:	❑ **Yes**	❑ **No**
Other evidence of cap damage or failure? Comments:	❑ **Yes**	❑ **No**
Inspector Signature:		

APPENDIX D
FIELD INSPECTION FORMS

FIELD INSPECTION FORM

North Shore at Mandalay Bay — **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
184-1-A	Y N n/a			184-32-A	Y N n/a		
184-2-A	Y N n/a			184-33-A	Y N n/a		
184-3-A	Y N n/a			184-34-A	Y N n/a		
184-4-A	Y N n/a			184-35-A	Y N n/a		
184-5-A	Y N n/a			184-36-A	Y N n/a		
184-6-A	Y N n/a			184-37-A	Y N n/a		
184-7-A	Y N n/a			184-38-A	Y N n/a		
184-8-A	Y N n/a			184-39-A	Y N n/a		
184-9-A	Y N n/a			184-40-A	Y N n/a		
184-10-A	Y N n/a			184-41-A	Y N n/a		
184-11-A	Y N n/a			184-42-A	Y N n/a		
184-12-A	Y N n/a			184-43-A	Y N n/a		
184-13-A	Y N n/a			184-44-A	Y N n/a		
184-14-A	Y N n/a			184-45-A	Y N n/a		
184-15-A	Y N n/a			184-46-A	Y N n/a		
184-16-A	Y N n/a			184-47-A	Y N n/a		
184-17-A	Y N n/a			184-48-A	Y N n/a		
184-18-A	Y N n/a			184-49-A	Y N n/a		
184-19-A	Y N n/a			184-50-A	Y N n/a		
184-20-A	Y N n/a			184-51-A	Y N n/a		
184-21-A	Y N n/a			184-52-A	Y N n/a		
184-22-A	Y N n/a			184-53-A	Y N n/a		
184-23-A	Y N n/a			184-54-A	Y N n/a		
184-24-A	Y N n/a			184-55-A	Y N n/a		
184-25-A	Y N n/a			184-56-A	Y N n/a		
184-26-A	Y N n/a			184-57-A	Y N n/a		
184-27-A	Y N n/a			184-58-A	Y N n/a		
184-28-A	Y N n/a			184-59-A	Y N n/a		
184-29-A	Y N n/a			184-60-A	Y N n/a		
184-30-A	Y N n/a			184-61-A	Y N n/a		
184-31-A	Y N n/a			184-62-A	Y N n/a		
184-64-A	Y N n/a			184-63-A	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		**Weather:**
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
184-65-A	Y N n/a			186-9-A	Y N n/a		
184-66-A	Y N n/a			186-10-A	Y N n/a		
184-67-A	Y N n/a			186-11-A	Y N n/a		
184-68-A	Y N n/a			186-12-A	Y N n/a		
184-69-A	Y N n/a			186-13-A	Y N n/a		
184-70-A	Y N n/a			186-14-A	Y N n/a		
184-71-A	Y N n/a			186-15-A	Y N n/a		
184-72-A	Y N n/a			186-16-A	Y N n/a		
184-73-A	Y N n/a			186-17-A	Y N n/a		
184-74-A	Y N n/a			186-18-A	Y N n/a		
184-75-A	Y N n/a			Lot-1-C	Y N n/a		
184-76-A	Y N n/a			Lot-2-C	Y N n/a		
184-77-A	Y N n/a			Lot-3-C	Y N n/a		
185-1-A	Y N n/a			Lot-4-C	Y N n/a		
185-2-A	Y N n/a			Lot-5-C	Y N n/a		
185-3-A	Y N n/a			Lot-6-C	Y N n/a		
185-4-A	Y N n/a			Lot-7-C	Y N n/a		
185-5-A	Y N n/a			Lot-8-C	Y N n/a		
185-6-A	Y N n/a			Lot-9-C	Y N n/a		
185-7-A	Y N n/a			Lot-10-C	Y N n/a		
185-8-A	Y N n/a			Lot-11-C	Y N n/a		
185-9-A	Y N n/a			Lot-12-C	Y N n/a		
185-10-A	Y N n/a			Lot-13-C	Y N n/a		
186-1-A	Y N n/a			Lot-14-C	Y N n/a		
186-2-A	Y N n/a			Lot-15-C	Y N n/a		
186-3-A	Y N n/a			Lot-16-C	Y N n/a		
186-4-A	Y N n/a			Lot-17-C	Y N n/a		
186-5-A	Y N n/a			Lot-18-C	Y N n/a		
186-6-A	Y N n/a			Lot-19-B	Y N n/a		
186-7-A	Y N n/a			Lot-20-B	Y N n/a		
186-8-A	Y N n/a			Lot-21-B	Y N n/a		
Lot-23-B	Y N n/a			Lot-22-B	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
Lot-24-B	Y N n/a			Lot-54-C	Y N n/a		
Lot-25-B	Y N n/a			Lot-55-C	Y N n/a		
Lot-26-B	Y N n/a			Lot-56-C	Y N n/a		
Lot-27-B	Y N n/a			Lot-57-C	Y N n/a		
Lot-28-B	Y N n/a			Lot-58-C	Y N n/a		
Lot-29-B	Y N n/a			Lot-59-C	Y N n/a		
Lot-30-B	Y N n/a			Lot-60-C	Y N n/a		
Lot-31-B	Y N n/a			Lot-61-C	Y N n/a		
Lot-32-B	Y N n/a			Lot-62-C	Y N n/a		
Lot-33-B	Y N n/a			Lot-63-C	Y N n/a		
Lot-34-B	Y N n/a			Lot-64-C	Y N n/a		
Lot-35-B	Y N n/a			Lot-65-C	Y N n/a		
Lot-36-B	Y N n/a			Lot-66-C	Y N n/a		
Lot-37-B	Y N n/a			Lot-67-C	Y N n/a		
Lot-38-B	Y N n/a			Lot-68-C	Y N n/a		
Lot-39-B	Y N n/a			Lot-69-C	Y N n/a		
Lot-40-B	Y N n/a			Lot-70-C	Y N n/a		
Lot-41-B	Y N n/a			Lot-71-C	Y N n/a		
Lot-42-B	Y N n/a			Lot-72-C	Y N n/a		
Lot-43-B	Y N n/a			Lot-73-C	Y N n/a		
Lot-44-B	Y N n/a			Lot-74-C	Y N n/a		
Lot-45-B	Y N n/a			Lot-75-C	Y N n/a		
Lot-46-B	Y N n/a			Lot-76-C	Y N n/a		
Lot-47-B	Y N n/a			Lot-77-C	Y N n/a		
Lot-48-B	Y N n/a			Lot-78-C	Y N n/a		
Lot-49-B	Y N n/a			Lot-79-C	Y N n/a		
Lot-50-B	Y N n/a			Lot-80-C	Y N n/a		
Lot-51-C	Y N n/a			Lot-81-C	Y N n/a		
Lot-52-C	Y N n/a			Lot-82-C	Y N n/a		
Lot-53-C	Y N n/a			Lot-83-C	Y N n/a		
Lot-85-C	Y N n/a			Lot-84-C	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
Lot-86-C	Y N n/a			Lot-117-B	Y N n/a		
Lot-87-C	Y N n/a			Lot-118-B	Y N n/a		
Lot-88-C	Y N n/a			Lot-119-B	Y N n/a		
Lot-89-C	Y N n/a			Lot-120-B	Y N n/a		
Lot-90-C	Y N n/a			Lot-121-B	Y N n/a		
Lot-91-C	Y N n/a			Lot-122-B	Y N n/a		
Lot-92-C	Y N n/a			Lot-123-B	Y N n/a		
Lot-93-C	Y N n/a			Lot-124-B	Y N n/a		
Lot-94-C	Y N n/a			Lot-125-B	Y N n/a		
Lot-95-C	Y N n/a			Lot-126-B	Y N n/a		
Lot-96-C	Y N n/a			Lot-127-B	Y N n/a		
Lot-97-C	Y N n/a			Lot-128-B	Y N n/a		
Lot-98-C	Y N n/a			Lot-129-B	Y N n/a		
Lot-99-C	Y N n/a			Lot-130-B	Y N n/a		
Lot-100-C	Y N n/a			Lot-131-B	Y N n/a		
Lot-101-C	Y N n/a			Lot-132-B	Y N n/a		
Lot-102-C	Y N n/a			Lot-133-B	Y N n/a		
Lot-103-C	Y N n/a			Lot-134-B	Y N n/a		
Lot-104-C	Y N n/a			Lot-135-B	Y N n/a		
Lot-105-C	Y N n/a			Lot-136-B	Y N n/a		
Lot-106-B	Y N n/a			Lot-137-B	Y N n/a		
Lot-107-B	Y N n/a			Lot-138-B	Y N n/a		
Lot-108-B	Y N n/a			Lot-139-B	Y N n/a		
Lot-109-B	Y N n/a			Lot-140-B	Y N n/a		
Lot-110-B	Y N n/a			Lot-141-B	Y N n/a		
Lot-111-B	Y N n/a			Lot-142-B	Y N n/a		
Lot-112-B	Y N n/a			Lot-143-B	Y N n/a		
Lot-113-B	Y N n/a			Lot-144-B	Y N n/a		
Lot-114-B	Y N n/a			Lot-145-B	Y N n/a		
Lot-115-B	Y N n/a			Lot-146-B	Y N n/a		
Lot-116-B	Y N n/a			Lot-147-B	Y N n/a		
Lot-149-B	Y N n/a			Lot-148-B	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
Lot-150-B	Y N n/a			Lot-167-C	Y N n/a		
Lot-151-B	Y N n/a			Lot-168-C	Y N n/a		
Lot-152-B	Y N n/a			Lot-169-C	Y N n/a		
Lot-153-B	Y N n/a			Lot-170-C	Y N n/a		
Lot-154-B	Y N n/a			Lot-171-C	Y N n/a		
Lot-155-B	Y N n/a			Lot-172-C	Y N n/a		
Lot-156-B	Y N n/a			Lot-173-C	Y N n/a		
Lot-157-B	Y N n/a			Lot-174-C	Y N n/a		
Lot-158-B	Y N n/a			Lot-175-C	Y N n/a		
Lot-159-B	Y N n/a			Lot-176-C	Y N n/a		
Lot-160-B	Y N n/a			Lot-177-C	Y N n/a		
Lot-161-B	Y N n/a			Lot-178-C	Y N n/a		
Lot-162-C	Y N n/a			Lot-179-C	Y N n/a		
Lot-163-C	Y N n/a			Lot-180-C	Y N n/a		
Lot-164-C	Y N n/a			Lot-181-C	Y N n/a		
Lot-165-C	Y N n/a			Lot-182-C	Y N n/a		
Lot-166-C	Y N n/a			Lot-183-C	Y N n/a		

Recommendations

Inspector Signature:

Date:

O&M Field Data Sheet

North Shore at Mandalay Bay
City of Oxnard, CA - Tract 5592

Date: _____
Personnel: _____
Reason for Visit: O&M Site Visit

SYSTEM DESCRIPTION

SUCTION/SVE: Soil-vapor extraction system with a three (3) 15-Hp blowers each with VFDs, two (2) 55-gallon high vacuum air/water separators with high level switch, two (3) inline filters;
LIQUID TRANSFER: Two (2) Submersible transfer pumps (TP);
WATER TREATMENT: Two (2) granular-activated carbon (GAC) canisters for pre-treatment; and
VAPOR TREATMENT: Two (2) sets of two (2) 1,000 lb permanganate impregnrated granulated activated carbon vessels with effluent stack

Site Power: 150 amp, 460-Volt, 3-Phase

EQUIPMENT CONDITIONS

	EQUIPMENT STATUS					PRESSURE SIDE					
Operating System	Status Upon Arrival (on/off)	Status Upon Departure (on/off)	Hours (hours)	Days (Days)	SVE Dilution Valve (% Open)	Static (Total) Pressure 1 Blower (in. H_2O)	ΔP 1 Blower (in. H_2O)	Static (Total) Pressure 2 Blowers (in. H_2O)	ΔP 2 Blowers (in. H_2O)	Temp. (^{0}f)	Flow Rate (SCFM)
Blower 1											0.0
Blower 2						Comments:					
Blower 3											
Transfer Pump 1											
Transfer Pump 2											

SVE EXTRACTION WELLS

WELL ID	Operating (% OPEN)	Vacuum (in. Hg)	VOC (RRU)	LEL (%)	O_2 (%)	WELL ID	Operating (% OPEN)	Vacuum (in. Hg)	VOC (RRU)	LEL (%)	O_2 (%)
A-1						A-22					
A-2						A-23					
A-3						A-24					
A-4						B-1					
A-5						B-2					
A-6						B-3					
A-7						B-4					
A-8						B-5					
A-9						B-6					
A-10						B-7					
A-11						B-8					
A-12						B-9					
A-13						B-10					
A-14						B-11					
A-15						B-12					
A-16						B-13					
A-17						B-14					
A-18						B-15					
A-19						B-16					
A-20						B-17					
A-21											

SYSTEM EQUIPMENT MAINTENANCE						CONDENSATE DISCHARGE		BLOWER CONDITIONS			Room Temp. (*F)
Check Blower 1 Oil (yes/no)	Check Blower 2 Oil (yes/no)	Check Blower 3 Oil (yes/no)	Check Filter 1 (yes/no)	Check Filter 2 (yes/no)	Check Filter 3 (yes/no)	Flow Total (gallons)	Flow Rate (gpm)	Vacuum at Blower 1 (inHg)	Vacuum at Blower 2 (gpm)	Vacuum at Blower 3 (gpm)	

SAMPLE COLLECTION

Location	Frequency	Date	Time	Sample Name (Prefix + YYYYMMDD)	VOC (RRU)	LEL (%)	O_2 (%)	CO_2 (ppm)
Influent	Monthly			S121_INF_				
Effluent	Monthly			S121_EFF_				
GAC Influent	Monthly			S121_INF_				
Mid Carbon	Optional			S121_MID_				
GAC Effluent	Monthly			S121_EFF_				

NOTES:
System/Site Observation/Comments:

Materials/Equipment Needed for Next Visit:

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		**Weather:**
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Barrier Efficacy Test?	Test Result	Vapor Sampling Performed?	Result/Rationale	Other Observations
184-1-A	Y N n/a		Y N n/a		Y N n/a		
184-2-A	Y N n/a		Y N n/a		Y N n/a		
184-3-A	Y N n/a		Y N n/a		Y N n/a		
184-4-A	Y N n/a		Y N n/a		Y N n/a		
184-5-A	Y N n/a		Y N n/a		Y N n/a		
184-6-A	Y N n/a		Y N n/a		Y N n/a		
184-7-A	Y N n/a		Y N n/a		Y N n/a		
184-8-A	Y N n/a		Y N n/a		Y N n/a		
184-9-A	Y N n/a		Y N n/a		Y N n/a		
184-10-A	Y N n/a		Y N n/a		Y N n/a		
184-11-A	Y N n/a		Y N n/a		Y N n/a		
184-12-A	Y N n/a		Y N n/a		Y N n/a		
184-13-A	Y N n/a		Y N n/a		Y N n/a		
184-14-A	Y N n/a		Y N n/a		Y N n/a		
184-15-A	Y N n/a		Y N n/a		Y N n/a		
184-16-A	Y N n/a		Y N n/a		Y N n/a		
184-17-A	Y N n/a		Y N n/a		Y N n/a		
184-18-A	Y N n/a		Y N n/a		Y N n/a		
184-19-A	Y N n/a		Y N n/a		Y N n/a		
184-20-A	Y N n/a		Y N n/a		Y N n/a		
184-21-A	Y N n/a		Y N n/a		Y N n/a		
184-22-A	Y N n/a		Y N n/a		Y N n/a		
184-23-A	Y N n/a		Y N n/a		Y N n/a		
184-24-A	Y N n/a		Y N n/a		Y N n/a		
184-25-A	Y N n/a		Y N n/a		Y N n/a		
184-26-A	Y N n/a		Y N n/a		Y N n/a		
184-27-A	Y N n/a		Y N n/a		Y N n/a		
184-28-A	Y N n/a		Y N n/a		Y N n/a		
184-29-A	Y N n/a		Y N n/a		Y N n/a		
184-30-A	Y N n/a		Y N n/a		Y N n/a		
184-31-A	Y N n/a		Y N n/a		Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		**Project No.**
Date/Time:		
Inspector Name:		**Weather:**
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Barrier Efficacy Test?	Test Result	Vapor Sampling Performed?	Result/Rationale	Other Observations
184-32-A	Y N n/a		Y N n/a		Y N n/a		
184-33-A	Y N n/a		Y N n/a		Y N n/a		
184-34-A	Y N n/a		Y N n/a		Y N n/a		
184-35-A	Y N n/a		Y N n/a		Y N n/a		
184-36-A	Y N n/a		Y N n/a		Y N n/a		
184-37-A	Y N n/a		Y N n/a		Y N n/a		
184-38-A	Y N n/a		Y N n/a		Y N n/a		
184-39-A	Y N n/a		Y N n/a		Y N n/a		
184-40-A	Y N n/a		Y N n/a		Y N n/a		
184-41-A	Y N n/a		Y N n/a		Y N n/a		
184-42-A	Y N n/a		Y N n/a		Y N n/a		
184-43-A	Y N n/a		Y N n/a		Y N n/a		
184-44-A	Y N n/a		Y N n/a		Y N n/a		
184-45-A	Y N n/a		Y N n/a		Y N n/a		
184-46-A	Y N n/a		Y N n/a		Y N n/a		
184-47-A	Y N n/a		Y N n/a		Y N n/a		
184-48-A	Y N n/a		Y N n/a		Y N n/a		
184-49-A	Y N n/a		Y N n/a		Y N n/a		
184-50-A	Y N n/a		Y N n/a		Y N n/a		
184-51-A	Y N n/a		Y N n/a		Y N n/a		
184-52-A	Y N n/a		Y N n/a		Y N n/a		
184-53-A	Y N n/a		Y N n/a		Y N n/a		
184-54-A	Y N n/a		Y N n/a		Y N n/a		
184-55-A	Y N n/a		Y N n/a		Y N n/a		
184-56-A	Y N n/a		Y N n/a		Y N n/a		
184-57-A	Y N n/a		Y N n/a		Y N n/a		
184-58-A	Y N n/a		Y N n/a		Y N n/a		
184-59-A	Y N n/a		Y N n/a		Y N n/a		
184-60-A	Y N n/a		Y N n/a		Y N n/a		
184-61-A	Y N n/a		Y N n/a		Y N n/a		
184-62-A	Y N n/a		Y N n/a		Y N n/a		
184-63-A	Y N n/a		Y N n/a		Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		**Project No.**
Date/Time:		
Inspector Name:		**Weather:**
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Barrier Efficacy Test?	Test Result	Vapor Sampling Performed?	Result/Rationale	Other Observations
184-64-A	Y N n/a		Y N n/a		Y N n/a		
184-65-A	Y N n/a		Y N n/a		Y N n/a		
184-66-A	Y N n/a		Y N n/a		Y N n/a		
184-67-A	Y N n/a		Y N n/a		Y N n/a		
184-68-A	Y N n/a		Y N n/a		Y N n/a		
184-69-A	Y N n/a		Y N n/a		Y N n/a		
184-70-A	Y N n/a		Y N n/a		Y N n/a		
184-71-A	Y N n/a		Y N n/a		Y N n/a		
184-72-A	Y N n/a		Y N n/a		Y N n/a		
184-73-A	Y N n/a		Y N n/a		Y N n/a		
184-74-A	Y N n/a		Y N n/a		Y N n/a		
184-75-A	Y N n/a		Y N n/a		Y N n/a		
184-76-A	Y N n/a		Y N n/a		Y N n/a		
184-77-A	Y N n/a		Y N n/a		Y N n/a		
185-1-A	Y N n/a		Y N n/a		Y N n/a		
185-2-A	Y N n/a		Y N n/a		Y N n/a		
185-3-A	Y N n/a		Y N n/a		Y N n/a		
185-4-A	Y N n/a		Y N n/a		Y N n/a		
185-5-A	Y N n/a		Y N n/a		Y N n/a		
185-6-A	Y N n/a		Y N n/a		Y N n/a		
185-7-A	Y N n/a		Y N n/a		Y N n/a		
185-8-A	Y N n/a		Y N n/a		Y N n/a		
185-9-A	Y N n/a		Y N n/a		Y N n/a		
185-10-A	Y N n/a		Y N n/a		Y N n/a		
186-1-A	Y N n/a		Y N n/a		Y N n/a		
186-2-A	Y N n/a		Y N n/a		Y N n/a		
186-3-A	Y N n/a		Y N n/a		Y N n/a		
186-4-A	Y N n/a		Y N n/a		Y N n/a		
186-5-A	Y N n/a		Y N n/a		Y N n/a		
186-6-A	Y N n/a		Y N n/a		Y N n/a		
186-7-A	Y N n/a		Y N n/a		Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		**Project No.**
Date/Time:		
Inspector Name:		**Weather:**
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Barrier Efficacy Test?	Test Result	Vapor Sampling Performed?	Result/Rationale	Other Observations
186-8-A	Y N n/a		Y N n/a		Y N n/a		
186-9-A	Y N n/a		Y N n/a		Y N n/a		
186-10-A	Y N n/a		Y N n/a		Y N n/a		
186-11-A	Y N n/a		Y N n/a		Y N n/a		
186-12-A	Y N n/a		Y N n/a		Y N n/a		
186-13-A	Y N n/a		Y N n/a		Y N n/a		
186-14-A	Y N n/a		Y N n/a		Y N n/a		
186-15-A	Y N n/a		Y N n/a		Y N n/a		
186-16-A	Y N n/a		Y N n/a		Y N n/a		
186-17-A	Y N n/a		Y N n/a		Y N n/a		
186-18-A	Y N n/a		Y N n/a		Y N n/a		
Lot-1-C	Y N n/a		Y N n/a		Y N n/a		
Lot-2-C	Y N n/a		Y N n/a		Y N n/a		
Lot-3-C	Y N n/a		Y N n/a		Y N n/a		
Lot-4-C	Y N n/a		Y N n/a		Y N n/a		
Lot-5-C	Y N n/a		Y N n/a		Y N n/a		
Lot-6-C	Y N n/a		Y N n/a		Y N n/a		
Lot-7-C	Y N n/a		Y N n/a		Y N n/a		
Lot-8-C	Y N n/a		Y N n/a		Y N n/a		
Lot-9-C	Y N n/a		Y N n/a		Y N n/a		
Lot-10-C	Y N n/a		Y N n/a		Y N n/a		
Lot-11-C	Y N n/a		Y N n/a		Y N n/a		
Lot-12-C	Y N n/a		Y N n/a		Y N n/a		
Lot-13-C	Y N n/a		Y N n/a		Y N n/a		
Lot-14-C	Y N n/a		Y N n/a		Y N n/a		
Lot-15-C	Y N n/a		Y N n/a		Y N n/a		
Lot-16-C	Y N n/a		Y N n/a		Y N n/a		
Lot-17-C	Y N n/a		Y N n/a		Y N n/a		
Lot-18-C	Y N n/a		Y N n/a		Y N n/a		
Lot-19-B	Y N n/a		Y N n/a		Y N n/a		
Lot-20-B	Y N n/a		Y N n/a		Y N n/a		
Lot-21-B	Y N n/a		Y N n/a		Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		**Project No.**
Date/Time:		
Inspector Name:		**Weather:**
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Barrier Efficacy Test?	Test Result	Vapor Sampling Performed?	Result/Rationale	Other Observations
Lot-22-B	Y N n/a		Y N n/a		Y N n/a		
Lot-23-B	Y N n/a		Y N n/a		Y N n/a		
Lot-24-B	Y N n/a		Y N n/a		Y N n/a		
Lot-25-B	Y N n/a		Y N n/a		Y N n/a		
Lot-26-B	Y N n/a		Y N n/a		Y N n/a		
Lot-27-B	Y N n/a		Y N n/a		Y N n/a		
Lot-28-B	Y N n/a		Y N n/a		Y N n/a		
Lot-29-B	Y N n/a		Y N n/a		Y N n/a		
Lot-30-B	Y N n/a		Y N n/a		Y N n/a		
Lot-31-B	Y N n/a		Y N n/a		Y N n/a		
Lot-32-B	Y N n/a		Y N n/a		Y N n/a		
Lot-33-B	Y N n/a		Y N n/a		Y N n/a		
Lot-34-B	Y N n/a		Y N n/a		Y N n/a		
Lot-35-B	Y N n/a		Y N n/a		Y N n/a		
Lot-36-B	Y N n/a		Y N n/a		Y N n/a		
Lot-37-B	Y N n/a		Y N n/a		Y N n/a		
Lot-38-B	Y N n/a		Y N n/a		Y N n/a		
Lot-39-B	Y N n/a		Y N n/a		Y N n/a		
Lot-40-B	Y N n/a		Y N n/a		Y N n/a		
Lot-41-B	Y N n/a		Y N n/a		Y N n/a		
Lot-42-B	Y N n/a		Y N n/a		Y N n/a		
Lot-43-B	Y N n/a		Y N n/a		Y N n/a		
Lot-44-B	Y N n/a		Y N n/a		Y N n/a		
Lot-45-B	Y N n/a		Y N n/a		Y N n/a		
Lot-46-B	Y N n/a		Y N n/a		Y N n/a		
Lot-47-B	Y N n/a		Y N n/a		Y N n/a		
Lot-48-B	Y N n/a		Y N n/a		Y N n/a		
Lot-49-B	Y N n/a		Y N n/a		Y N n/a		
Lot-50-B	Y N n/a		Y N n/a		Y N n/a		
Lot-51-C	Y N n/a		Y N n/a		Y N n/a		
Lot-52-C	Y N n/a		Y N n/a		Y N n/a		
Lot-53-C	Y N n/a		Y N n/a		Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		**Project No.**
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Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Barrier Efficacy Test?	Test Result	Vapor Sampling Performed?	Result/Rationale	Other Observations
Lot-54-C	Y N n/a		Y N n/a		Y N n/a		
Lot-55-C	Y N n/a		Y N n/a		Y N n/a		
Lot-56-C	Y N n/a		Y N n/a		Y N n/a		
Lot-57-C	Y N n/a		Y N n/a		Y N n/a		
Lot-58-C	Y N n/a		Y N n/a		Y N n/a		
Lot-59-C	Y N n/a		Y N n/a		Y N n/a		
Lot-60-C	Y N n/a		Y N n/a		Y N n/a		
Lot-61-C	Y N n/a		Y N n/a		Y N n/a		
Lot-62-C	Y N n/a		Y N n/a		Y N n/a		
Lot-63-C	Y N n/a		Y N n/a		Y N n/a		
Lot-64-C	Y N n/a		Y N n/a		Y N n/a		
Lot-65-C	Y N n/a		Y N n/a		Y N n/a		
Lot-66-C	Y N n/a		Y N n/a		Y N n/a		
Lot-67-C	Y N n/a		Y N n/a		Y N n/a		
Lot-68-C	Y N n/a		Y N n/a		Y N n/a		
Lot-69-C	Y N n/a		Y N n/a		Y N n/a		
Lot-70-C	Y N n/a		Y N n/a		Y N n/a		
Lot-71-C	Y N n/a		Y N n/a		Y N n/a		
Lot-72-C	Y N n/a		Y N n/a		Y N n/a		
Lot-73-C	Y N n/a		Y N n/a		Y N n/a		
Lot-74-C	Y N n/a		Y N n/a		Y N n/a		
Lot-75-C	Y N n/a		Y N n/a		Y N n/a		
Lot-76-C	Y N n/a		Y N n/a		Y N n/a		
Lot-77-C	Y N n/a		Y N n/a		Y N n/a		
Lot-78-C	Y N n/a		Y N n/a		Y N n/a		
Lot-79-C	Y N n/a		Y N n/a		Y N n/a		
Lot-80-C	Y N n/a		Y N n/a		Y N n/a		
Lot-81-C	Y N n/a		Y N n/a		Y N n/a		
Lot-82-C	Y N n/a		Y N n/a		Y N n/a		
Lot-83-C	Y N n/a		Y N n/a		Y N n/a		
Lot-84-C	Y N n/a		Y N n/a		Y N n/a		
Lot-85-C	Y N n/a		Y N n/a		Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		**Project No.**
Date/Time:		
Inspector Name:		**Weather:**
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Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Barrier Efficacy Test?	Test Result	Vapor Sampling Performed?	Result/Rationale	Other Observations
Lot-86-C	Y N n/a		Y N n/a		Y N n/a		
Lot-87-C	Y N n/a		Y N n/a		Y N n/a		
Lot-88-C	Y N n/a		Y N n/a		Y N n/a		
Lot-89-C	Y N n/a		Y N n/a		Y N n/a		
Lot-90-C	Y N n/a		Y N n/a		Y N n/a		
Lot-91-C	Y N n/a		Y N n/a		Y N n/a		
Lot-92-C	Y N n/a		Y N n/a		Y N n/a		
Lot-93-C	Y N n/a		Y N n/a		Y N n/a		
Lot-94-C	Y N n/a		Y N n/a		Y N n/a		
Lot-95-C	Y N n/a		Y N n/a		Y N n/a		
Lot-96-C	Y N n/a		Y N n/a		Y N n/a		
Lot-97-C	Y N n/a		Y N n/a		Y N n/a		
Lot-98-C	Y N n/a		Y N n/a		Y N n/a		
Lot-99-C	Y N n/a		Y N n/a		Y N n/a		
Lot-100-C	Y N n/a		Y N n/a		Y N n/a		
Lot-101-C	Y N n/a		Y N n/a		Y N n/a		
Lot-102-C	Y N n/a		Y N n/a		Y N n/a		
Lot-103-C	Y N n/a		Y N n/a		Y N n/a		
Lot-104-C	Y N n/a		Y N n/a		Y N n/a		
Lot-105-C	Y N n/a		Y N n/a		Y N n/a		
Lot-106-B	Y N n/a		Y N n/a		Y N n/a		
Lot-107-B	Y N n/a		Y N n/a		Y N n/a		
Lot-108-B	Y N n/a		Y N n/a		Y N n/a		
Lot-109-B	Y N n/a		Y N n/a		Y N n/a		
Lot-110-B	Y N n/a		Y N n/a		Y N n/a		
Lot-111-B	Y N n/a		Y N n/a		Y N n/a		
Lot-112-B	Y N n/a		Y N n/a		Y N n/a		
Lot-113-B	Y N n/a		Y N n/a		Y N n/a		
Lot-114-B	Y N n/a		Y N n/a		Y N n/a		
Lot-115-B	Y N n/a		Y N n/a		Y N n/a		
Lot-116-B	Y N n/a		Y N n/a		Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		**Weather:**
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Barrier Efficacy Test?	Test Result	Vapor Sampling Performed?	Result/Rationale	Other Observations
Lot-117-B	Y N n/a		Y N n/a		Y N n/a		
Lot-118-B	Y N n/a		Y N n/a		Y N n/a		
Lot-119-B	Y N n/a		Y N n/a		Y N n/a		
Lot-120-B	Y N n/a		Y N n/a		Y N n/a		
Lot-121-B	Y N n/a		Y N n/a		Y N n/a		
Lot-122-B	Y N n/a		Y N n/a		Y N n/a		
Lot-123-B	Y N n/a		Y N n/a		Y N n/a		
Lot-124-B	Y N n/a		Y N n/a		Y N n/a		
Lot-125-B	Y N n/a		Y N n/a		Y N n/a		
Lot-126-B	Y N n/a		Y N n/a		Y N n/a		
Lot-127-B	Y N n/a		Y N n/a		Y N n/a		
Lot-128-B	Y N n/a		Y N n/a		Y N n/a		
Lot-129-B	Y N n/a		Y N n/a		Y N n/a		
Lot-130-B	Y N n/a		Y N n/a		Y N n/a		
Lot-131-B	Y N n/a		Y N n/a		Y N n/a		
Lot-132-B	Y N n/a		Y N n/a		Y N n/a		
Lot-133-B	Y N n/a		Y N n/a		Y N n/a		
Lot-134-B	Y N n/a		Y N n/a		Y N n/a		
Lot-135-B	Y N n/a		Y N n/a		Y N n/a		
Lot-136-B	Y N n/a		Y N n/a		Y N n/a		
Lot-137-B	Y N n/a		Y N n/a		Y N n/a		
Lot-138-B	Y N n/a		Y N n/a		Y N n/a		
Lot-139-B	Y N n/a		Y N n/a		Y N n/a		
Lot-140-B	Y N n/a		Y N n/a		Y N n/a		
Lot-141-B	Y N n/a		Y N n/a		Y N n/a		
Lot-142-B	Y N n/a		Y N n/a		Y N n/a		
Lot-143-B	Y N n/a		Y N n/a		Y N n/a		
Lot-144-B	Y N n/a		Y N n/a		Y N n/a		
Lot-145-B	Y N n/a		Y N n/a		Y N n/a		
Lot-146-B	Y N n/a		Y N n/a		Y N n/a		
Lot-147-B	Y N n/a		Y N n/a		Y N n/a		
Lot-148-B	Y N n/a		Y N n/a		Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		**Project No.**
Date/Time:		
Inspector Name:		**Weather:**
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Barrier Efficacy Test?	Test Result	Vapor Sampling Performed?	Result/Rationale	Other Observations
Lot-149-B	Y N n/a		Y N n/a		Y N n/a		
Lot-150-B	Y N n/a		Y N n/a		Y N n/a		
Lot-151-B	Y N n/a		Y N n/a		Y N n/a		
Lot-152-B	Y N n/a		Y N n/a		Y N n/a		
Lot-153-B	Y N n/a		Y N n/a		Y N n/a		
Lot-154-B	Y N n/a		Y N n/a		Y N n/a		
Lot-155-B	Y N n/a		Y N n/a		Y N n/a		
Lot-156-B	Y N n/a		Y N n/a		Y N n/a		
Lot-157-B	Y N n/a		Y N n/a		Y N n/a		
Lot-158-B	Y N n/a		Y N n/a		Y N n/a		
Lot-159-B	Y N n/a		Y N n/a		Y N n/a		
Lot-160-B	Y N n/a		Y N n/a		Y N n/a		
Lot-161-B	Y N n/a		Y N n/a		Y N n/a		
Lot-162-C	Y N n/a		Y N n/a		Y N n/a		
Lot-163-C	Y N n/a		Y N n/a		Y N n/a		
Lot-164-C	Y N n/a		Y N n/a		Y N n/a		
Lot-165-C	Y N n/a		Y N n/a		Y N n/a		
Lot-166-C	Y N n/a		Y N n/a		Y N n/a		
Lot-167-C	Y N n/a		Y N n/a		Y N n/a		
Lot-168-C	Y N n/a		Y N n/a		Y N n/a		
Lot-169-C	Y N n/a		Y N n/a		Y N n/a		
Lot-170-C	Y N n/a		Y N n/a		Y N n/a		
Lot-171-C	Y N n/a		Y N n/a		Y N n/a		
Lot-172-C	Y N n/a		Y N n/a		Y N n/a		
Lot-173-C	Y N n/a		Y N n/a		Y N n/a		
Lot-174-C	Y N n/a		Y N n/a		Y N n/a		
Lot-175-C	Y N n/a		Y N n/a		Y N n/a		
Lot-176-C	Y N n/a		Y N n/a		Y N n/a		
Lot-177-C	Y N n/a		Y N n/a		Y N n/a		
Lot-178-C	Y N n/a		Y N n/a		Y N n/a		
Lot-179-C	Y N n/a		Y N n/a		Y N n/a		
Lot-180-C	Y N n/a		Y N n/a		Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		**Weather:**
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Barrier Efficacy Test?	Test Result	Vapor Sampling Performed?	Result/Rationale	Other Observations
Lot-181-C	Y N n/a		Y N n/a		Y N n/a		
Lot-182-C	Y N n/a		Y N n/a		Y N n/a		
Lot-183-C	Y N n/a		Y N n/a		Y N n/a		

Recommendations

Inspector Signature: Date:

CAP SYSTEM INSPECTION FORM

North Shore at Mandalay Bay
Oxnard, California

O&M INSPECTION
Soil Cap Inspection

Inspector Information		**Project No.**
Inspector Name:		**Date/Time:**
Company:		**Weather:**
Address:		
Phone:		
E-mail:		

Is cap material present at a thickness of 3-6 feet? Comments:	❑ **Yes**	❑ **No**
Are there cracks or rills in the soil cap more than 2-inches wide? Do the cracks extend through the cap? Comments:	❑ **Yes**	❑ **No**
Are there noticable depressions, ponding of surface water, or evidence of ponding on cap? Comments:	❑ **Yes**	❑ **No**
Are there signs of sliding or sloughing of the soil layer which might indicate slope failure? Comments:	❑ **Yes**	❑ **No**
Are there open holes or animal burrows in the cap? Comments:	❑ **Yes**	❑ **No**
Is there excessive debris, silt, or other deleterious material obstructing flow through the surface water control system? Comments:	❑ **Yes**	❑ **No**
Is there evidence of erosion or damage associated with surface water control system? Comments:	❑ **Yes**	❑ **No**

CAP SYSTEM INSPECTION FORM (CONTINUED…)

Are there areas of stressed or missing vegetation on the cap? Comments:	❑ **Yes**	❑ **No**
Are there areas with continual poor growth despite reseeding efforts? Comments:	❑ **Yes**	❑ **No**
Is the fence in good condition? Comments:	❑ **Yes**	❑ **No**
Is there evidence of inappropriate pedestrian traffic? Comments:	❑ **Yes**	❑ **No**
Other evidence of cap system damage or failure? Comments:	❑ **Yes**	❑ **No**
Recommendations for Repair and/or Maintenance of Cap:		
Inspector Signature:		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

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Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
184-1-A	Y N n/a			184-32-A	Y N n/a		
184-2-A	Y N n/a			184-33-A	Y N n/a		
184-3-A	Y N n/a			184-34-A	Y N n/a		
184-4-A	Y N n/a			184-35-A	Y N n/a		
184-5-A	Y N n/a			184-36-A	Y N n/a		
184-6-A	Y N n/a			184-37-A	Y N n/a		
184-7-A	Y N n/a			184-38-A	Y N n/a		
184-8-A	Y N n/a			184-39-A	Y N n/a		
184-9-A	Y N n/a			184-40-A	Y N n/a		
184-10-A	Y N n/a			184-41-A	Y N n/a		
184-11-A	Y N n/a			184-42-A	Y N n/a		
184-12-A	Y N n/a			184-43-A	Y N n/a		
184-13-A	Y N n/a			184-44-A	Y N n/a		
184-14-A	Y N n/a			184-45-A	Y N n/a		
184-15-A	Y N n/a			184-46-A	Y N n/a		
184-16-A	Y N n/a			184-47-A	Y N n/a		
184-17-A	Y N n/a			184-48-A	Y N n/a		
184-18-A	Y N n/a			184-49-A	Y N n/a		
184-19-A	Y N n/a			184-50-A	Y N n/a		
184-20-A	Y N n/a			184-51-A	Y N n/a		
184-21-A	Y N n/a			184-52-A	Y N n/a		
184-22-A	Y N n/a			184-53-A	Y N n/a		
184-23-A	Y N n/a			184-54-A	Y N n/a		
184-24-A	Y N n/a			184-55-A	Y N n/a		
184-25-A	Y N n/a			184-56-A	Y N n/a		
184-26-A	Y N n/a			184-57-A	Y N n/a		
184-27-A	Y N n/a			184-58-A	Y N n/a		
184-28-A	Y N n/a			184-59-A	Y N n/a		
184-29-A	Y N n/a			184-60-A	Y N n/a		
184-30-A	Y N n/a			184-61-A	Y N n/a		
184-31-A	Y N n/a			184-62-A	Y N n/a		
184-64-A	Y N n/a			184-63-A	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
184-65-A	Y N n/a			186-9-A	Y N n/a		
184-66-A	Y N n/a			186-10-A	Y N n/a		
184-67-A	Y N n/a			186-11-A	Y N n/a		
184-68-A	Y N n/a			186-12-A	Y N n/a		
184-69-A	Y N n/a			186-13-A	Y N n/a		
184-70-A	Y N n/a			186-14-A	Y N n/a		
184-71-A	Y N n/a			186-15-A	Y N n/a		
184-72-A	Y N n/a			186-16-A	Y N n/a		
184-73-A	Y N n/a			186-17-A	Y N n/a		
184-74-A	Y N n/a			186-18-A	Y N n/a		
184-75-A	Y N n/a			Lot-1-C	Y N n/a		
184-76-A	Y N n/a			Lot-2-C	Y N n/a		
184-77-A	Y N n/a			Lot-3-C	Y N n/a		
185-1-A	Y N n/a			Lot-4-C	Y N n/a		
185-2-A	Y N n/a			Lot-5-C	Y N n/a		
185-3-A	Y N n/a			Lot-6-C	Y N n/a		
185-4-A	Y N n/a			Lot-7-C	Y N n/a		
185-5-A	Y N n/a			Lot-8-C	Y N n/a		
185-6-A	Y N n/a			Lot-9-C	Y N n/a		
185-7-A	Y N n/a			Lot-10-C	Y N n/a		
185-8-A	Y N n/a			Lot-11-C	Y N n/a		
185-9-A	Y N n/a			Lot-12-C	Y N n/a		
185-10-A	Y N n/a			Lot-13-C	Y N n/a		
186-1-A	Y N n/a			Lot-14-C	Y N n/a		
186-2-A	Y N n/a			Lot-15-C	Y N n/a		
186-3-A	Y N n/a			Lot-16-C	Y N n/a		
186-4-A	Y N n/a			Lot-17-C	Y N n/a		
186-5-A	Y N n/a			Lot-18-C	Y N n/a		
186-6-A	Y N n/a			Lot-19-B	Y N n/a		
186-7-A	Y N n/a			Lot-20-B	Y N n/a		
186-8-A	Y N n/a			Lot-21-B	Y N n/a		
Lot-23-B	Y N n/a			Lot-22-B	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
Lot-24-B	Y N n/a			Lot-54-C	Y N n/a		
Lot-25-B	Y N n/a			Lot-55-C	Y N n/a		
Lot-26-B	Y N n/a			Lot-56-C	Y N n/a		
Lot-27-B	Y N n/a			Lot-57-C	Y N n/a		
Lot-28-B	Y N n/a			Lot-58-C	Y N n/a		
Lot-29-B	Y N n/a			Lot-59-C	Y N n/a		
Lot-30-B	Y N n/a			Lot-60-C	Y N n/a		
Lot-31-B	Y N n/a			Lot-61-C	Y N n/a		
Lot-32-B	Y N n/a			Lot-62-C	Y N n/a		
Lot-33-B	Y N n/a			Lot-63-C	Y N n/a		
Lot-34-B	Y N n/a			Lot-64-C	Y N n/a		
Lot-35-B	Y N n/a			Lot-65-C	Y N n/a		
Lot-36-B	Y N n/a			Lot-66-C	Y N n/a		
Lot-37-B	Y N n/a			Lot-67-C	Y N n/a		
Lot-38-B	Y N n/a			Lot-68-C	Y N n/a		
Lot-39-B	Y N n/a			Lot-69-C	Y N n/a		
Lot-40-B	Y N n/a			Lot-70-C	Y N n/a		
Lot-41-B	Y N n/a			Lot-71-C	Y N n/a		
Lot-42-B	Y N n/a			Lot-72-C	Y N n/a		
Lot-43-B	Y N n/a			Lot-73-C	Y N n/a		
Lot-44-B	Y N n/a			Lot-74-C	Y N n/a		
Lot-45-B	Y N n/a			Lot-75-C	Y N n/a		
Lot-46-B	Y N n/a			Lot-76-C	Y N n/a		
Lot-47-B	Y N n/a			Lot-77-C	Y N n/a		
Lot-48-B	Y N n/a			Lot-78-C	Y N n/a		
Lot-49-B	Y N n/a			Lot-79-C	Y N n/a		
Lot-50-B	Y N n/a			Lot-80-C	Y N n/a		
Lot-51-C	Y N n/a			Lot-81-C	Y N n/a		
Lot-52-C	Y N n/a			Lot-82-C	Y N n/a		
Lot-53-C	Y N n/a			Lot-83-C	Y N n/a		
Lot-85-C	Y N n/a			Lot-84-C	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
Lot-86-C	Y N n/a			Lot-117-B	Y N n/a		
Lot-87-C	Y N n/a			Lot-118-B	Y N n/a		
Lot-88-C	Y N n/a			Lot-119-B	Y N n/a		
Lot-89-C	Y N n/a			Lot-120-B	Y N n/a		
Lot-90-C	Y N n/a			Lot-121-B	Y N n/a		
Lot-91-C	Y N n/a			Lot-122-B	Y N n/a		
Lot-92-C	Y N n/a			Lot-123-B	Y N n/a		
Lot-93-C	Y N n/a			Lot-124-B	Y N n/a		
Lot-94-C	Y N n/a			Lot-125-B	Y N n/a		
Lot-95-C	Y N n/a			Lot-126-B	Y N n/a		
Lot-96-C	Y N n/a			Lot-127-B	Y N n/a		
Lot-97-C	Y N n/a			Lot-128-B	Y N n/a		
Lot-98-C	Y N n/a			Lot-129-B	Y N n/a		
Lot-99-C	Y N n/a			Lot-130-B	Y N n/a		
Lot-100-C	Y N n/a			Lot-131-B	Y N n/a		
Lot-101-C	Y N n/a			Lot-132-B	Y N n/a		
Lot-102-C	Y N n/a			Lot-133-B	Y N n/a		
Lot-103-C	Y N n/a			Lot-134-B	Y N n/a		
Lot-104-C	Y N n/a			Lot-135-B	Y N n/a		
Lot-105-C	Y N n/a			Lot-136-B	Y N n/a		
Lot-106-B	Y N n/a			Lot-137-B	Y N n/a		
Lot-107-B	Y N n/a			Lot-138-B	Y N n/a		
Lot-108-B	Y N n/a			Lot-139-B	Y N n/a		
Lot-109-B	Y N n/a			Lot-140-B	Y N n/a		
Lot-110-B	Y N n/a			Lot-141-B	Y N n/a		
Lot-111-B	Y N n/a			Lot-142-B	Y N n/a		
Lot-112-B	Y N n/a			Lot-143-B	Y N n/a		
Lot-113-B	Y N n/a			Lot-144-B	Y N n/a		
Lot-114-B	Y N n/a			Lot-145-B	Y N n/a		
Lot-115-B	Y N n/a			Lot-146-B	Y N n/a		
Lot-116-B	Y N n/a			Lot-147-B	Y N n/a		
Lot-149-B	Y N n/a			Lot-148-B	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
Lot-150-B	Y N n/a			Lot-167-C	Y N n/a		
Lot-151-B	Y N n/a			Lot-168-C	Y N n/a		
Lot-152-B	Y N n/a			Lot-169-C	Y N n/a		
Lot-153-B	Y N n/a			Lot-170-C	Y N n/a		
Lot-154-B	Y N n/a			Lot-171-C	Y N n/a		
Lot-155-B	Y N n/a			Lot-172-C	Y N n/a		
Lot-156-B	Y N n/a			Lot-173-C	Y N n/a		
Lot-157-B	Y N n/a			Lot-174-C	Y N n/a		
Lot-158-B	Y N n/a			Lot-175-C	Y N n/a		
Lot-159-B	Y N n/a			Lot-176-C	Y N n/a		
Lot-160-B	Y N n/a			Lot-177-C	Y N n/a		
Lot-161-B	Y N n/a			Lot-178-C	Y N n/a		
Lot-162-C	Y N n/a			Lot-179-C	Y N n/a		
Lot-163-C	Y N n/a			Lot-180-C	Y N n/a		
Lot-164-C	Y N n/a			Lot-181-C	Y N n/a		
Lot-165-C	Y N n/a			Lot-182-C	Y N n/a		
Lot-166-C	Y N n/a			Lot-183-C	Y N n/a		

Recommendations

Inspector Signature: Date:

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
184-1-A	Y N n/a			184-32-A	Y N n/a		
184-2-A	Y N n/a			184-33-A	Y N n/a		
184-3-A	Y N n/a			184-34-A	Y N n/a		
184-4-A	Y N n/a			184-35-A	Y N n/a		
184-5-A	Y N n/a			184-36-A	Y N n/a		
184-6-A	Y N n/a			184-37-A	Y N n/a		
184-7-A	Y N n/a			184-38-A	Y N n/a		
184-8-A	Y N n/a			184-39-A	Y N n/a		
184-9-A	Y N n/a			184-40-A	Y N n/a		
184-10-A	Y N n/a			184-41-A	Y N n/a		
184-11-A	Y N n/a			184-42-A	Y N n/a		
184-12-A	Y N n/a			184-43-A	Y N n/a		
184-13-A	Y N n/a			184-44-A	Y N n/a		
184-14-A	Y N n/a			184-45-A	Y N n/a		
184-15-A	Y N n/a			184-46-A	Y N n/a		
184-16-A	Y N n/a			184-47-A	Y N n/a		
184-17-A	Y N n/a			184-48-A	Y N n/a		
184-18-A	Y N n/a			184-49-A	Y N n/a		
184-19-A	Y N n/a			184-50-A	Y N n/a		
184-20-A	Y N n/a			184-51-A	Y N n/a		
184-21-A	Y N n/a			184-52-A	Y N n/a		
184-22-A	Y N n/a			184-53-A	Y N n/a		
184-23-A	Y N n/a			184-54-A	Y N n/a		
184-24-A	Y N n/a			184-55-A	Y N n/a		
184-25-A	Y N n/a			184-56-A	Y N n/a		
184-26-A	Y N n/a			184-57-A	Y N n/a		
184-27-A	Y N n/a			184-58-A	Y N n/a		
184-28-A	Y N n/a			184-59-A	Y N n/a		
184-29-A	Y N n/a			184-60-A	Y N n/a		
184-30-A	Y N n/a			184-61-A	Y N n/a		
184-31-A	Y N n/a			184-62-A	Y N n/a		
184-64-A	Y N n/a			184-63-A	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
184-65-A	Y N n/a			186-9-A	Y N n/a		
184-66-A	Y N n/a			186-10-A	Y N n/a		
184-67-A	Y N n/a			186-11-A	Y N n/a		
184-68-A	Y N n/a			186-12-A	Y N n/a		
184-69-A	Y N n/a			186-13-A	Y N n/a		
184-70-A	Y N n/a			186-14-A	Y N n/a		
184-71-A	Y N n/a			186-15-A	Y N n/a		
184-72-A	Y N n/a			186-16-A	Y N n/a		
184-73-A	Y N n/a			186-17-A	Y N n/a		
184-74-A	Y N n/a			186-18-A	Y N n/a		
184-75-A	Y N n/a			Lot-1-C	Y N n/a		
184-76-A	Y N n/a			Lot-2-C	Y N n/a		
184-77-A	Y N n/a			Lot-3-C	Y N n/a		
185-1-A	Y N n/a			Lot-4-C	Y N n/a		
185-2-A	Y N n/a			Lot-5-C	Y N n/a		
185-3-A	Y N n/a			Lot-6-C	Y N n/a		
185-4-A	Y N n/a			Lot-7-C	Y N n/a		
185-5-A	Y N n/a			Lot-8-C	Y N n/a		
185-6-A	Y N n/a			Lot-9-C	Y N n/a		
185-7-A	Y N n/a			Lot-10-C	Y N n/a		
185-8-A	Y N n/a			Lot-11-C	Y N n/a		
185-9-A	Y N n/a			Lot-12-C	Y N n/a		
185-10-A	Y N n/a			Lot-13-C	Y N n/a		
186-1-A	Y N n/a			Lot-14-C	Y N n/a		
186-2-A	Y N n/a			Lot-15-C	Y N n/a		
186-3-A	Y N n/a			Lot-16-C	Y N n/a		
186-4-A	Y N n/a			Lot-17-C	Y N n/a		
186-5-A	Y N n/a			Lot-18-C	Y N n/a		
186-6-A	Y N n/a			Lot-19-B	Y N n/a		
186-7-A	Y N n/a			Lot-20-B	Y N n/a		
186-8-A	Y N n/a			Lot-21-B	Y N n/a		
Lot-23-B	Y N n/a			Lot-22-B	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
Lot-24-B	Y N n/a			Lot-54-C	Y N n/a		
Lot-25-B	Y N n/a			Lot-55-C	Y N n/a		
Lot-26-B	Y N n/a			Lot-56-C	Y N n/a		
Lot-27-B	Y N n/a			Lot-57-C	Y N n/a		
Lot-28-B	Y N n/a			Lot-58-C	Y N n/a		
Lot-29-B	Y N n/a			Lot-59-C	Y N n/a		
Lot-30-B	Y N n/a			Lot-60-C	Y N n/a		
Lot-31-B	Y N n/a			Lot-61-C	Y N n/a		
Lot-32-B	Y N n/a			Lot-62-C	Y N n/a		
Lot-33-B	Y N n/a			Lot-63-C	Y N n/a		
Lot-34-B	Y N n/a			Lot-64-C	Y N n/a		
Lot-35-B	Y N n/a			Lot-65-C	Y N n/a		
Lot-36-B	Y N n/a			Lot-66-C	Y N n/a		
Lot-37-B	Y N n/a			Lot-67-C	Y N n/a		
Lot-38-B	Y N n/a			Lot-68-C	Y N n/a		
Lot-39-B	Y N n/a			Lot-69-C	Y N n/a		
Lot-40-B	Y N n/a			Lot-70-C	Y N n/a		
Lot-41-B	Y N n/a			Lot-71-C	Y N n/a		
Lot-42-B	Y N n/a			Lot-72-C	Y N n/a		
Lot-43-B	Y N n/a			Lot-73-C	Y N n/a		
Lot-44-B	Y N n/a			Lot-74-C	Y N n/a		
Lot-45-B	Y N n/a			Lot-75-C	Y N n/a		
Lot-46-B	Y N n/a			Lot-76-C	Y N n/a		
Lot-47-B	Y N n/a			Lot-77-C	Y N n/a		
Lot-48-B	Y N n/a			Lot-78-C	Y N n/a		
Lot-49-B	Y N n/a			Lot-79-C	Y N n/a		
Lot-50-B	Y N n/a			Lot-80-C	Y N n/a		
Lot-51-C	Y N n/a			Lot-81-C	Y N n/a		
Lot-52-C	Y N n/a			Lot-82-C	Y N n/a		
Lot-53-C	Y N n/a			Lot-83-C	Y N n/a		
Lot-85-C	Y N n/a			Lot-84-C	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
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E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
Lot-86-C	Y N n/a			Lot-117-B	Y N n/a		
Lot-87-C	Y N n/a			Lot-118-B	Y N n/a		
Lot-88-C	Y N n/a			Lot-119-B	Y N n/a		
Lot-89-C	Y N n/a			Lot-120-B	Y N n/a		
Lot-90-C	Y N n/a			Lot-121-B	Y N n/a		
Lot-91-C	Y N n/a			Lot-122-B	Y N n/a		
Lot-92-C	Y N n/a			Lot-123-B	Y N n/a		
Lot-93-C	Y N n/a			Lot-124-B	Y N n/a		
Lot-94-C	Y N n/a			Lot-125-B	Y N n/a		
Lot-95-C	Y N n/a			Lot-126-B	Y N n/a		
Lot-96-C	Y N n/a			Lot-127-B	Y N n/a		
Lot-97-C	Y N n/a			Lot-128-B	Y N n/a		
Lot-98-C	Y N n/a			Lot-129-B	Y N n/a		
Lot-99-C	Y N n/a			Lot-130-B	Y N n/a		
Lot-100-C	Y N n/a			Lot-131-B	Y N n/a		
Lot-101-C	Y N n/a			Lot-132-B	Y N n/a		
Lot-102-C	Y N n/a			Lot-133-B	Y N n/a		
Lot-103-C	Y N n/a			Lot-134-B	Y N n/a		
Lot-104-C	Y N n/a			Lot-135-B	Y N n/a		
Lot-105-C	Y N n/a			Lot-136-B	Y N n/a		
Lot-106-B	Y N n/a			Lot-137-B	Y N n/a		
Lot-107-B	Y N n/a			Lot-138-B	Y N n/a		
Lot-108-B	Y N n/a			Lot-139-B	Y N n/a		
Lot-109-B	Y N n/a			Lot-140-B	Y N n/a		
Lot-110-B	Y N n/a			Lot-141-B	Y N n/a		
Lot-111-B	Y N n/a			Lot-142-B	Y N n/a		
Lot-112-B	Y N n/a			Lot-143-B	Y N n/a		
Lot-113-B	Y N n/a			Lot-144-B	Y N n/a		
Lot-114-B	Y N n/a			Lot-145-B	Y N n/a		
Lot-115-B	Y N n/a			Lot-146-B	Y N n/a		
Lot-116-B	Y N n/a			Lot-147-B	Y N n/a		
Lot-149-B	Y N n/a			Lot-148-B	Y N n/a		

FIELD INSPECTION FORM

North Shore at Mandalay Bay **Vapor Barrier System Inspection**

Oxnard, California

Inspector Information		Project No.
Date/Time:		
Inspector Name:		Weather:
Company:		
Address:		
Phone:		
Fax:		
E-mail:		

Description of Inspection Methods

Observations

Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations	Lot ID	Verify SSD Fan Operating?	Problems, if noted	Other Observations
Lot-150-B	Y N n/a			Lot-167-C	Y N n/a		
Lot-151-B	Y N n/a			Lot-168-C	Y N n/a		
Lot-152-B	Y N n/a			Lot-169-C	Y N n/a		
Lot-153-B	Y N n/a			Lot-170-C	Y N n/a		
Lot-154-B	Y N n/a			Lot-171-C	Y N n/a		
Lot-155-B	Y N n/a			Lot-172-C	Y N n/a		
Lot-156-B	Y N n/a			Lot-173-C	Y N n/a		
Lot-157-B	Y N n/a			Lot-174-C	Y N n/a		
Lot-158-B	Y N n/a			Lot-175-C	Y N n/a		
Lot-159-B	Y N n/a			Lot-176-C	Y N n/a		
Lot-160-B	Y N n/a			Lot-177-C	Y N n/a		
Lot-161-B	Y N n/a			Lot-178-C	Y N n/a		
Lot-162-C	Y N n/a			Lot-179-C	Y N n/a		
Lot-163-C	Y N n/a			Lot-180-C	Y N n/a		
Lot-164-C	Y N n/a			Lot-181-C	Y N n/a		
Lot-165-C	Y N n/a			Lot-182-C	Y N n/a		
Lot-166-C	Y N n/a			Lot-183-C	Y N n/a		

Recommendations

Inspector Signature: Date:

APPENDIX E
RECORDED TRACT MAP (5592-1) AND
GRANT OF CONSERVATION EASEMENT

TRACT No. 5592-1

IN THE CITY OF OXNARD
COUNTY OF VENTURA, STATE OF CALIFORNIA

BEING PARCEL "A" OF LOT LINE ADJUSTMENT LLA 02-310-7, RECORDED JANUARY 31, 2003 AS INSTRUMENT NO. 2003-0033447-0 AND CORRECTED BY CERTIFICATE OF APPROVAL FOR LOT LINE ADJUSTMENT RECORDED OCTOBER 22, 2009 AS INSTRUMENT NO. 2009-0173560-0 OF OFFICIAL RECORDS LYING WITHIN LOT 115, 116, 117, 118, 120, 121, 122, 143, 144, AND 145, OF THE PATTERSON RANCH, IN THE COUNTY OF VENTURA, STATE OF CALIFORNIA AS PER MAP RECORDED IN BOOK 8, PAGE 1 OF MISCELLANEOUS RECORDS (MAPS).

JUNE 2015
MARK A. CASTELLANOS, PLS 8369
CONTAINING:
8 LOTS
37.50 ACRES GROSS (GRID & GROUND)
32.15 ACRES NET (GRID AND GROUND)

OWNER'S STATEMENT:

THE UNDERSIGNED HEREBY STATE THAT THEY ARE THE OWNERS OF, OR ARE INTERESTED IN THE LAND INCLUDED WITHIN THIS SUBDIVISION ENTITLED "TRACT NO. 5592-1" SHOWN ON THIS MAP, THAT THEY ARE THE ONLY PERSONS WHOSE CONSENT IS NECESSARY TO PASS TITLE TO SAID LAND, THAT THEY CONSENT TO THE MAKING AND RECORDATION OF SAID MAP AND SUBDIVISION AS SHOWN WITHIN THE EXTERIOR BOUNDARY LINE, AND THAT THEY DO HEREBY OFFER TO DEDICATE TO THE CITY OF OXNARD THE FOLLOWING ITEMS AS SHOWN ON SAID MAP:

ALL WATER RIGHTS AND THE RIGHT TO DEVELOP ALL WATER FOUND UNDER SAID LAND WITHOUT, HOWEVER, THE RIGHT OF SURFACE ENTRY.

AN EASEMENT FOR SEWER PUMP STATION PURPOSES OVER ALL OF LOT G

AN EASEMENT FOR PUBLIC ACCESS PURPOSES OVER ALL OF LOT E AND A PORTION OF LOT B

MPL PROPERTY HOLDINGS LLC,
A DELAWARE LIMITED LIABILITY COMPANY

BY: Bruce Cook
PRINT NAME: Bruce Cook
PRINT TITLE: Authorized Signatory
DATE: July 8, 2015

ACKNOWLEDGEMENTS:

A NOTARY PUBLIC OR OTHER OFFICER COMPLETING THIS CERTIFICATE VERIFIES ONLY THE IDENTITY OF THE INDIVIDUAL WHO SIGNED THE DOCUMENT TO WHICH THIS CERTIFICATE IS ATTACHED, AND NOT THE TRUTHFULNESS, ACCURACY, OR VALIDITY OF THE DOCUMENT.

STATE OF CALIFORNIA
COUNTY OF ORANGE

ON July 8, 2015 BEFORE ME, Elizabeth Meniucci, Notary Public PERSONALLY APPEARED Bruce Cook WHO PROVED TO ME ON THE BASIS OF SATISFACTORY EVIDENCE TO BE THE PERSON(S) WHOSE NAME(S) IS/ARE SUBSCRIBED TO THE WITHIN INSTRUMENT, AND ACKNOWLEDGED TO ME THAT HE/SHE/THEY EXECUTED THE SAME IN HIS/HER/THEIR AUTHORIZED CAPACITY(IES), AND THAT BY HIS/HER/THEIR SIGNATURE(S) ON THE INSTRUMENT, THE PERSON(S) OR THE ENTITY UPON BEHALF OF WHICH THE PERSON(S) ACTED, EXECUTED THE INSTRUMENT.

I CERTIFY UNDER PENALTY OF PERJURY UNDER THE LAWS OF THE STATE OF CALIFORNIA THAT THE FOREGOING PARAGRAPH IS TRUE AND CORRECT.

WITNESS MY HAND

SIGNATURE: Elizabeth Meniucci
NAME PRINTED: Elizabeth Meniucci
COMMISSION EXPIRES: 8/4/16
COMMISSION No. 1968677
PRINCIPAL OFFICE LOCATED IN THE COUNTY OF ORANGE

ELIZABETH MENIUCCI
Commission # 1968677
Notary Public - California
Orange County
My Comm. Expires Feb 4, 2016

NOTICE:

THIS MAP IS SUBJECT TO CERTAIN CONDITIONS CONTAINED IN AGREEMENTS BETWEEN THE OWNER AND THE CITY OF OXNARD RECORDED ON OR ABOUT THE TIME AS THE FILING OF THIS MAP.

THE MILK-VETCH CONSERVATION EASEMENT SHOWN HEREON IS SUBJECT TO CERTAIN CONDITIONS AND PROVISIONS CONTAINED WITHIN THE AGREEMENT RECORDED AS INSTRUMENT NO. 20090521-00082946-0 OF OFFICIAL RECORDS.

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Phone: (805) 963-9532 Fax: (805) 966-9801

V:\2064\active\20640118\1\geomatics\cad\FM 5592\FM5592-1_SHT_1-3.dwg

CITY SURVEYOR'S STATEMENT:

I HEREBY STATE THAT I HAVE EXAMINED THE FINAL MAP ENTITLED TRACT NO. 5592-1 AND THAT I AM SATISFIED THE MAP IS TECHNICALLY CORRECT.

DATE: 7/23, 2015

MATTHEW J. VERNON P.L.S. 7553
CITY SURVEYOR
CITY OF OXNARD

PROFESSIONAL LAND SURVEYOR MATTHEW J. VERNON No. PLS 7553 STATE OF CALIFORNIA

SURVEYOR'S STATEMENT:

THIS MAP WAS PREPARED BY ME OR UNDER MY DIRECTION AND IS BASED UPON A FIELD SURVEY IN CONFORMANCE WITH THE REQUIREMENTS OF THE SUBDIVISION MAP ACT AND LOCAL ORDINANCE AT THE REQUEST OF MPL PROPERTY HOLDINGS, LLC, IN DECEMBER 2014. I HEREBY STATE THAT ALL THE MONUMENTS ARE OF THE CHARACTER AND OCCUPY THE POSITIONS INDICATED OR THAT THEY WILL BE SET IN THOSE POSITIONS WITHIN ONE YEAR AFTER RECORDATION OF THIS FINAL MAP AND THAT THE MONUMENTS ARE, OR WILL BE SUFFICIENT TO ENABLE THE SURVEY TO BE RETRACED, AND THAT THIS FINAL MAP SUBSTANTIALLY CONFORMS TO THE CONDITIONALLY APPROVED TENTATIVE MAP.

MARK A. CASTELLANOS, PLS 8369 DATE 7-8-2015

PROFESSIONAL LAND SURVEYOR MARK A. CASTELLANOS NO. 8369 STATE OF CALIFORNIA

CITY ENGINEER'S STATEMENT:

I HEREBY STATE THAT I HAVE EXAMINED THE FINAL MAP ENTITLED TRACT NO. 5592-1 AND THAT THE SUBDIVISION SHOWN HEREON IS SUBSTANTIALLY THE SAME AS IT APPEARS ON THE TENTATIVE MAP AND ANY APPROVED ALTERATIONS THEREOF, THAT ALL OF THE PROVISIONS OF THE SUBDIVISION MAP ACT AND CITY OF OXNARD SUBDIVISION ORDINANCES APPLICABLE AT THE TIME OF THE APPROVAL OF THE TENTATIVE MAP HAVE BEEN COMPLIED WITH.

DATE: 7.23., 2015

PAUL WENDT R.C.E. 46333
CITY ENGINEER

REGISTERED PROFESSIONAL ENGINEER PAUL JEFFREY WENDT No. C 046333 Exp. 12/31/16 CIVIL STATE OF CALIFORNIA

CITY COUNCIL'S CERTIFICATE:

THIS MAP, ENTITLED TRACT No. 5592-1, CONSISTING OF 5 SHEETS, IS PRESENTED TO THE CITY COUNCIL OF THE CITY OF OXNARD OF VENTURA COUNTY, CALIFORNIA, AT A REGULAR MEETING OF SAID COUNCIL HELD ON THE 28 DAY OF July, 2015, FOR APPROVAL. SAID COUNCIL HEREBY APPROVES SAID MAP AND DOES HEREBY ACCEPT THE DEDICATION OF WATER RIGHTS, THE EASEMENT FOR SEWER PUMP STATION PURPOSES, AND THE EASEMENT FOR PUBLIC ACCESS PURPOSES AS SHOWN AND AS OFFERED HEREON. IN WITNESS WHEREOF, SAID CITY COUNCIL HAS CAUSED THIS CERTIFICATE TO BE SIGNED BY THE MAYOR AND ATTESTED TO BY THE CITY CLERK OF SAID CITY AND THE CORPORATE SEAL OF SAID CITY OF OXNARD TO BE AFFIXED HERETO THIS 28 DAY OF July, 2015.

CITY OF OXNARD INCORPORATED JUNE 30, 1903 STATE OF CALIFORNIA

ATTEST:
DANIEL MARTINEZ
CITY CLERK OF THE
CITY OF OXNARD

Carmen Ramirez for TF
TIM FLYNN
MAYOR OF THE CITY
OF OXNARD

COUNTY RECORDER'S CERTIFICATE:

DOC. 20150825-00128963-0

FILED THIS 25th DAY OF AUGUST, 2015 AT 8 A.M. IN BOOK 163 OF MISCELLANEOUS RECORDS (MAPS) AT PAGES 30-34 AT THE REQUEST OF MPL PROPERTY HOLDINGS, LLC, A DELAWARE LIMITED LIABILITY COMPANY.

MARK A. LUNN
COUNTY RECORDER
COUNTY OF VENTURA

BY: DEPUTY COUNTY RECORDER

20150825-00128963-0 1/5
08/25/2015 08:00:00 AM
27200 $18.00

COUNTY TAX COLLECTOR'S CERTIFICATE:

I HEREBY CERTIFY THAT ALL CERTIFICATES AND SECURITY REQUIRED UNDER THE PROVISIONS OF SECTIONS 66492 AND 66493 OF THE SUBDIVISION MAP ACT HAVE BEEN FILED AND DEPOSITED WITH ME.

DATE: 8/5, 2015

STEVEN HINTZ
COUNTY TAX COLLECTOR
COUNTY OF VENTURA

BY: DEPUTY COUNTY TAX COLLECTOR

CITY TREASURER'S CERTIFICATE:

I, DANIELLE M. NAVAS, CITY TREASURER OF THE CITY OF OXNARD, COUNTY OF VENTURA, STATE OF CALIFORNIA DO HEREBY CERTIFY THAT ACCORDING TO THE RECORDS OF MY OFFICE, THERE ARE NO LIENS AGAINST TRACT NO. 5592-1, OR ANY PART THEREOF, FOR UNPAID MUNICIPAL TAXES OR SPECIAL ASSESSMENTS COLLECTED AS MUNICIPAL TAXES, EXCEPT TAXES OR SPECIAL ASSESSMENTS NOT YET PAYABLE. WITNESS MY HAND AND THE OFFICIAL SEAL OF THE CITY OF OXNARD THIS 29th DAY OF July, 2015.

Danielle M. Navas
DANIELLE M. NAVAS
CITY TREASURER OF THE CITY OF OXNARD

NOTE:

SEE SHEET 2 OF 5 FOR SIGNATURE OMISSIONS.
SEE SHEET 3 OF 5 FOR TRACT BOUNDARY ESTABLISHMENT.
SEE SHEET 4 OF 5 FOR LOT DIMENSIONS AND EASEMENT DEDICATIONS.
SEE SHEET 5 OF 5 FOR EXISTING EASEMENTS.

SIGNATURE OMISSIONS:

THE SIGNATURES OF THE HOLDERS OF THE FOLLOWING EASEMENTS HAVE BEEN OMITTED PURSUANT TO SECTION 66436 (a)(3)(A)(I-viii) OF THE SUBDIVISION MAP ACT, THEIR INTEREST BEING SUCH THAT IT CANNOT RIPEN INTO A FEE TITLE:

PATTERSON RANCH COMPANY, A CORPORATION, AS EASEMENT HOLDER FOR RIGHTS TO LAY OR MAINTAIN PIPE CONDUITS FOR DRAINAGE PURPOSES, AS RECORDED JANUARY 10, 1919, IN BOOK 164, PAGE 408 OF DEEDS.

COUNTY OF VENTURA, A BODY AND POLITIC IN THE STATE OF CALIFORNIA, EASEMENT HOLDER FOR PUBLIC ROAD AND HIGHWAY PURPOSES, RECORDED JULY 7, 1927 IN BOOK 180, PAGE 56 OF OFFICIAL RECORDS.

COUNTY OF VENTURA, A POLITICAL SUBDIVISION OF THE STATE OF CALIFORNIA, EASEMENT HOLDER FOR PUBLIC ROAD AND HIGHWAY PURPOSES, RECORDED DECEMBER 16, 1955, IN BOOK 1361, PAGE 478 OF OFFICIAL RECORDS.

ROBERT LAGUNA HILLS. MCGRATH, A WIDOWER, EASEMENT HOLDER FOR ROADWAY AND BRIDGE PURPOSES, RECORDED DECEMBER 22, 1958, IN BOOK 1685, PAGE 534 OF OFFICIAL RECORDS. SUBJECT TO THE INTEREST OF STANDARD OIL COMPANY OF CALIFORNIA, A CORPORATION, RIGHT OF WAY OVER AND ALONG SAID BRIDGE FOR PIPELINE PURPOSES RECORDED IN BOOK 2175, PAGE 600 AND THE INTEREST OF JOHN FRANCIS MCGRATH, ET.AL, RIGHT OF WAY PURPOSES, RECORDED IN BOOK 2179, PAGE 361, PARTIAL QUITCLAIM DEED RECORDED APRIL 28, 1999 AS INSTRUMENT NO. 99-082184 AND PARTIAL QUITCLAIM DEED RECORDED DECEMBER 20, 2005 AS INSTRUMENT NO. 20051220-0310782 ALL OF OFFICIAL RECORDS.

THE COUNTY OF VENTURA, EASEMENT HOLDER FOR PUBLIC ROAD AND HIGHWAY PURPOSES, RECORDED MAY 20, 1959, IN BOOK 1736, PAGE 147 OF OFFICIAL RECORDS.

THE COUNTY OF VENTURA, EASEMENT HOLDER FOR PUBLIC ROAD AND HIGHWAY, RECORDED APRIL 22, 1965, IN BOOK 2774, PAGE 378 OF OFFICIAL RECORDS.

THE COUNTY OF VENTURA, A BODY CORPORATE AND POLITIC, EASEMENT HOLDER FOR PUBLIC ROAD AND HIGHWAY PURPOSE. RECORDED NOVEMBER 10, 1965 IN BOOK 2895, PAGE 31 OF OFFICIAL RECORDS.

SHELL OIL COMPANY, A CORPORATION, EASEMENT HOLDER FOR EXCLUSIVE SUBSURFACE BORING WELLS FROM SURFACE OUTSIDE THE LAND DESCRIBED, RECORDED AUGUST 31, 1981, AS INSTRUMENT NO. 1981-082656 OF OFFICIAL RECORDS.

SHELL OIL COMPANY, A CORPORATION, EASEMENT HOLDER FOR THE PURPOSE OF DRILLING AND MAINTAINING WELL BORES, RECORDED DECEMBER 21, 1981 AS INSTRUMENT NO. 119358, 119357, 119358, 119359, AND 119360 OF OFFICIAL RECORDS.

SOUTHERN CALIFORNIA EDISON COMPANY, A CALIFORNIA CORPORATION, EASEMENT HOLDER FOR BIKE PATH PURPOSES, RECORDED APRIL 7, 1998 AS INSTRUMENT NO. 98-051881 OF OFFICAL RECORDS.

BERRY PETROLEUM COMPANY, A DELAWARE CORPORATION, EASEMENT HOLDER FOR PIPELINES PURPOSES, RECORDED APRIL 28, 1999 AS INSTRUMENT NO. 99-082184 OF OFFICIAL RECORDS.

COUNTY OF VENTURA, EASEMENT HOLDER FOR AVIGATION PURPOSES, RECORDED MAY 23, 2006 AS INSTRUMENT NO. 20060523-0110492 OF OFFICIAL RECORDS.

CITY OF OXNARD, EASEMENT HOLDER FOR PUBLIC STREETS AND PUBLIC UTILITY PURPOSES, RECORDED JANUARY 16, 2008 AS INSTRUMENT NO. 20080116-0006807 OF OFFICIAL RECORDS.

CITY OF OXNARD, EASEMENT HOLDER FOR CONSERVATION PURUPOSES, RECORDED MAY 21, 2009 AS INSTRUMENT NO. 20090521-00082946 OF OFFICIAL RECORDS.

CITY OF OXNARD, A MUNICIPAL CORPORATION, EASEMENT HOLDER, RECORDED MAY 21, 2009 AS INSTRUMENT NO. 20090521-0082947 OF OFFICIAL RECORDS.

STANDARD OIL COMPANY OF CALIFORNIA, A CORPORATION, OWNER OF AN OIL AND GAS LEASE RECORDED MARCH 8, 1955 AS INSTRUMENT No. 8215, IN BOOK 1271, PAGE 377 OF OFFICIAL RECORDS MODIFIED JULY 10, 1956 AS INSTRUMENT No. 29246 IN BOOK 1422, PAGE 393 AND AUGUST 1, 1956 AS INSTRUMENT No. 33082 IN BOOK 1429, PAGE 527, ALL RIGHTS TO SURFACE ENTRY AND SUBSURFACE ENTRY, RECORDED APRIL 28, 1999 AS INSTRUMENT No. 99-82184 OF OFFICIAL RECORDS.

THE SIGNATURES OF THE PARTIES NAMED HEREINAFTER AS OWNERS OF THE INTEREST SET FORTH, MAY BE OMITTED UNDER THE PROVISIONS OF SECTION 66436, SUBSECTION (a)(3)(C) OF THE SUBDIVISION MAP ACT, THEIR INTEREST IS SUCH THAT IT CANNOT RIPEN INTO A FEE TITLE AND SAID SIGNATURES ARE NOT REQUIRED BY THE LOCAL AGENCY.

GEORGE D. McGRATH, ANNA VIRGINIA BERRY, MARGARET CLARE BODLE, BERNADINE COUTLAS, ESTELLA MARIE MAULHARDT, LEO BENJAMIN McGRATH AND MARY ELLEN MEAD, OWNERS OF ALL OIL, GAS, PETROLIUM, HYDROCARBONS AND MINERAL SUBSTANCES LYING IN, ON OR UNDER THE LAND IN QUITCLAIM DEED RECORDED MAY 14, 1958, IN BOOK 1617, PAGE 310 OF OFFICIAL RECORDS.

R.H. McGRATH FARMS, A PARTNERSHIP, OWNERS OF ALL OIL, GAS, AND OTHER HYDROCARBONS SUBSTANCES AND MINERALS IN AND UNDER SAID PROPERTY, WITHOUT, HOWEVER, THE RIGHT TO ENTER ON THE SURFACE THEREOF OR WITHIN 500 FEET BENEATH THE SURFACE, RECORDED JANUARY 24, 1984 AS INSTRUMENT No. 8492 OF OFFICIAL RECORDS.

RITA S. McGRATH, et al., OWNERS OF ALL OIL, GAS, PETROLEUM, HYDROCARBONS AND MINERAL SUBSTANCES LYING IN AND UNDER SAID PROPERTY, ALL RIGHT AND TITLE THEY MAY HAVE TO ENTER UPON OR USE THE SURFACE AND SUBSURFACE TO A DEPTH OF FIVE HUNDRED (500) FEET FROM THE PRESENT SURFACE OF THE GROUND OF THE REAL PROPERTY HEREINABOVE DESCRIBED, INSOFAR AS THEIR INTEREST APPEAR OF RECORD, FOR THE PURPOSE OF PROSPECTING FOR, DEVELOPING AND/OR EXTRACTING ALL OIL, GAS, PETROLEUM, HYDROCARBONS AND MINERAL SUBSTANCES LYING IN AND UNDER SAID REAL PROPERTY.

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TRACT No. 5592-1

IN THE CITY OF OXNARD
COUNTY OF VENTURA, STATE OF CALIFORNIA

BEING PARCEL "A" OF LOT LINE ADJUSTMENT LLA 02-310-7, RECORDED JANUARY 31, 2003 AS INSTRUMENT NO. 2003-0033447-0 AND CORRECTED BY CERTIFICATE OF APPROVAL FOR LOT LINE ADJUSTMENT RECORDED OCTOBER 22, 2009 AS INSTRUMENT NO. 2009-0173560-0 OF OFFICIAL RECORDS LYING WITHIN LOT 115, 116, 117, 118, 120, 121, 122, 143, 144, AND 145, OF THE PATTERSON RANCH, IN THE COUNTY OF VENTURA, STATE OF CALIFORNIA AS PER MAP RECORDED IN BOOK 8, PAGE 1 OF MISCELLANEOUS RECORDS (MAPS).

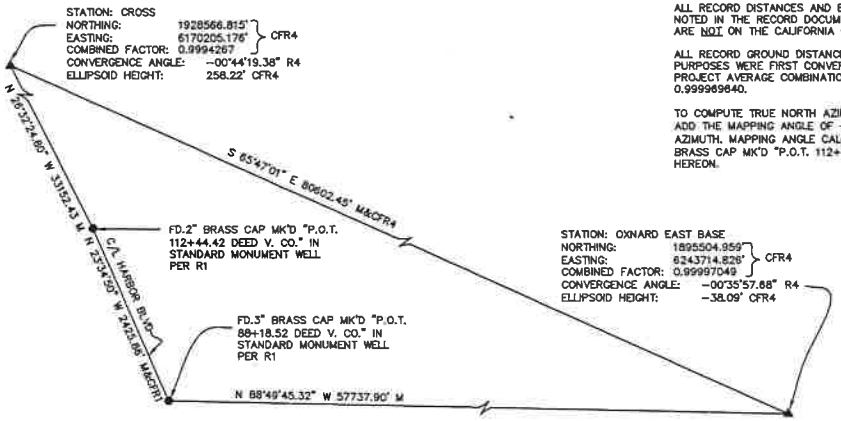
JUNE 2015
MARK A. CASTELLANOS, PLS 8369

LOT D IS FOR OPEN SPACE PURPOSES
LOT E IS FOR BUFFER PURPOSES
LOTS F, H & N ARE FOR OPEN SPACE PURPOSES
LOT G IS FOR SEWER PUMP STATION PURPOSES

MONUMENT NOTES

- ● FOUND MONUMENT AS NOTED.
- ⊕ 2" I.P. TAGGED "LS 8369" OR SPIKE & WASHER STAMPED "LS 8369" OR LEAD, TACK & TAG "LS 8369" TO BE SET AT ALL EXTERIOR TRACT BOUNDARY CORNERS WITHIN ONE YEAR AFTER RECORDATION OF THIS FINAL MAP, UNLESS OTHERWISE NOTED.
- ⊙ 1" I.P. TAGGED "LS 8369" OR SPIKE & WASHER STAMPED "LS 8369" OR LEAD, TACK & TAG "LS 8369" TO BE SET AT ALL INTERIOR LOT CORNERS WITHIN ONE YEAR AFTER RECORDATION OF THIS FINAL MAP, UNLESS OTHERWISE NOTED.

ALL DISTANCES SHOWN HEREON ARE IN FEET AND DECIMALS THEREOF.



CONTROL DIAGRAM SCALE: 1" = 1000'

LEGEND

BK.	BOOK
CFR	CALCULATED FROM RECORD
FD.	FOUND
INST.	INSTRUMENT
MK'D	MARKED
M	MEASURED
M.R.	MISCELLANEOUS RECORDS
O.R.	OFFICIAL RECORDS
PG.	PAGE
SQ FT	SQUARE FEET
(RAD)	RADIAL BEARING
RS	RECORDS OF SURVEY
SCE	SOUTHERN CALIFORNIA EDISON
SPC83	STATE PLANE COORDINATES, NORTH AMERICAN DATUM OF 1983
R1	RS BK. 50, PG. 84
R2	INST. NO. 2003-033447-00, O.R. CORRECTED BY INST. NO. 2009-0173560
R3	INST. NO. 20080116-006807-0, O.R.
R4	RS BK 50, PG. 25
(E)	PROPOSED EASEMENT NOTE
(1)	EXISTING EASEMENT NOTE

BASIS OF BEARINGS

BEARINGS SHOWN ON THIS MAP ARE BASED ON THE CALIFORNIA COORDINATE SYSTEM, ZONE 5, EPOCH 1991.35 NORTH AMERICAN DATUM OF 1983, DEFINED LOCALLY BY CONTROL SURVEY RECORDED IN BOOK 50, PAGES 25-27 INCLUSIVE OF RECORD OF SURVEYS. THIS SURVEY TIED TO STATION 0001 "CROSS" AND STATION 0006 "OXNARD EAST BASE" OF THE NETWORK. SEE CONTROL DIAGRAM ON THIS SHEET FOR TIES TO SAID NETWORK.

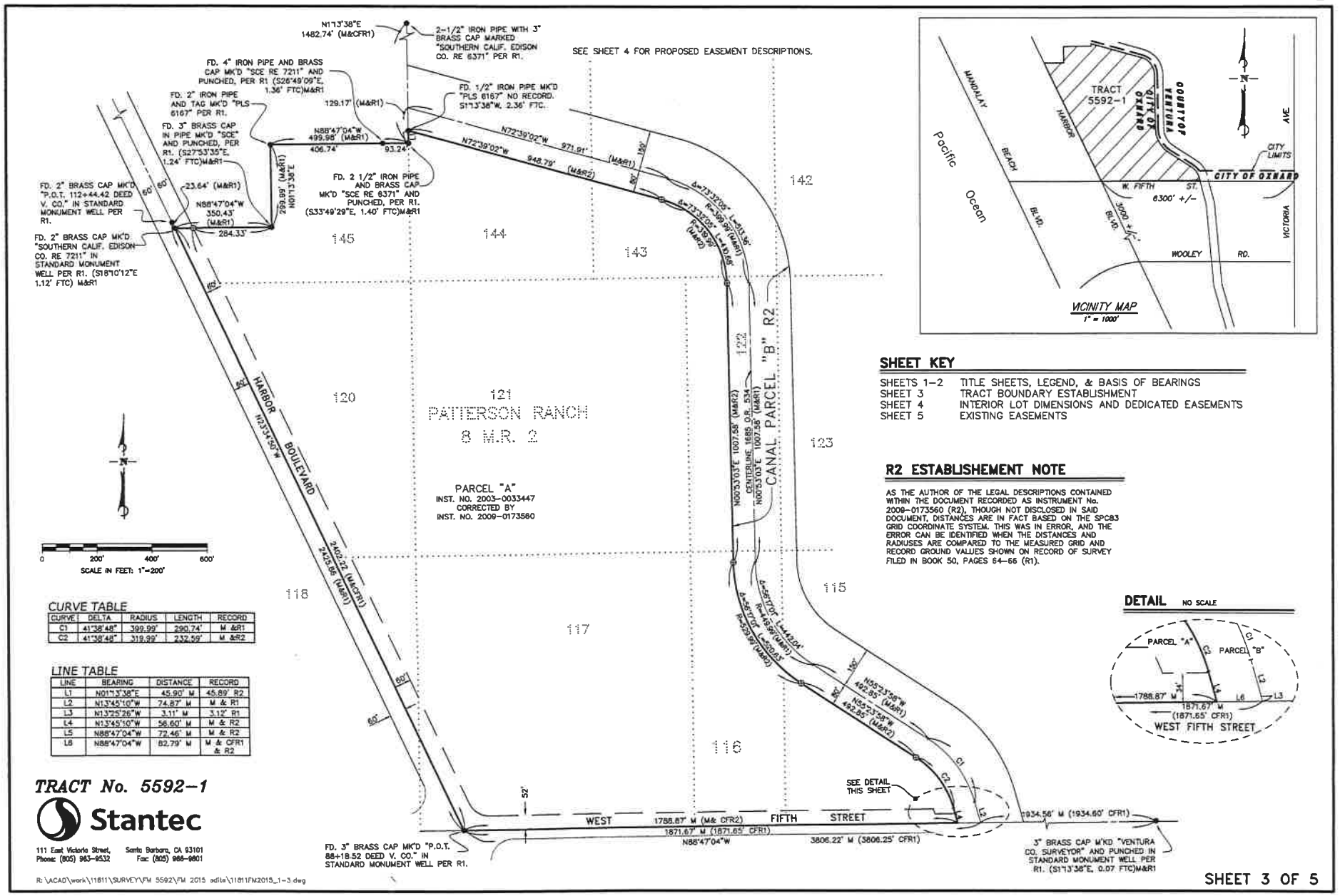
STATE PLANE COORDINATE NOTES

ALL DISTANCES AND BEARINGS SHOWN AS MEASURED OR PROPORTIONED ARE ON THE CALIFORNIA COORDINATE SYSTEM GRID, ZONE 5, NAD 83. TO OBTAIN "GROUND LEVEL" DISTANCES, MULTIPLY BY 1.000030361, WHICH IS THE INVERSE OF THE AVERAGE COMBINATION FACTOR PER R1 AND FOR THIS SURVEY.

ALL RECORD DISTANCES AND BEARINGS SHOWN ARE AS NOTED IN THE RECORD DOCUMENT BEING REFERENCED, AND ARE NOT ON THE CALIFORNIA COORDINATE SYSTEM GRID.

ALL RECORD GROUND DISTANCES USED FOR ESTABLISHMENT PURPOSES WERE FIRST CONVERTED TO GRID USING THE PROJECT AVERAGE COMBINATION FACTOR PER R1 OF 0.999969640.

TO COMPUTE TRUE NORTH AZIMUTHS (GEODETIC AZIMUTHS) ADD THE MAPPING ANGLE OF -0°42'36" TO THE GRID AZIMUTH. MAPPING ANGLE CALCULATED AT THE FOUND 2" BRASS CAP MK'D "P.O.T. 112+44.42 DEED V. CO" AS SHOWN HEREON.



SHEET KEY

SHEETS 1–2	TITLE SHEETS, LEGEND, & BASIS OF BEARINGS
SHEET 3	TRACT BOUNDARY ESTABLISHMENT
SHEET 4	INTERIOR LOT DIMENSIONS AND DEDICATED EASEMENTS
SHEET 5	EXISTING EASEMENTS

R2 ESTABLISHEMENT NOTE

AS THE AUTHOR OF THE LEGAL DESCRIPTIONS CONTAINED WITHIN THE DOCUMENT RECORDED AS INSTRUMENT No. 2009-0173560 (R2), THOUGH NOT DISCLOSED IN SAID DOCUMENT, DISTANCES ARE IN FACT BASED ON THE SPC83 GRID COORDINATE SYSTEM. THIS WAS IN ERROR, AND THE ERROR CAN BE IDENTIFIED WHEN THE DISTANCES AND RADIUSES ARE COMPARED TO THE MEASURED GRID AND RECORD GROUND VALUES SHOWN ON RECORD OF SURVEY FILED IN BOOK 50, PAGES 64–66 (R1).

CURVE TABLE

CURVE	DELTA	RADIUS	LENGTH	RECORD
C1	41°38'48"	399.99'	290.74'	M &R1
C2	41°38'48"	319.99'	232.59'	M &R2

LINE TABLE

LINE	BEARING	DISTANCE	RECORD
L1	N01°13'38"E	45.90' M	45.89' R2
L2	N13°45'10"W	74.87' M	M & R1
L3	N13°25'26"W	3.11' M	3.12' R1
L4	N13°45'10"W	56.60' M	M & R2
L5	N88°47'04"W	72.46' M	M & R2
L6	N88°47'04"W	82.79' M	M & CFR1 & R2

DETAIL NO SCALE

TRACT No. 5592-1

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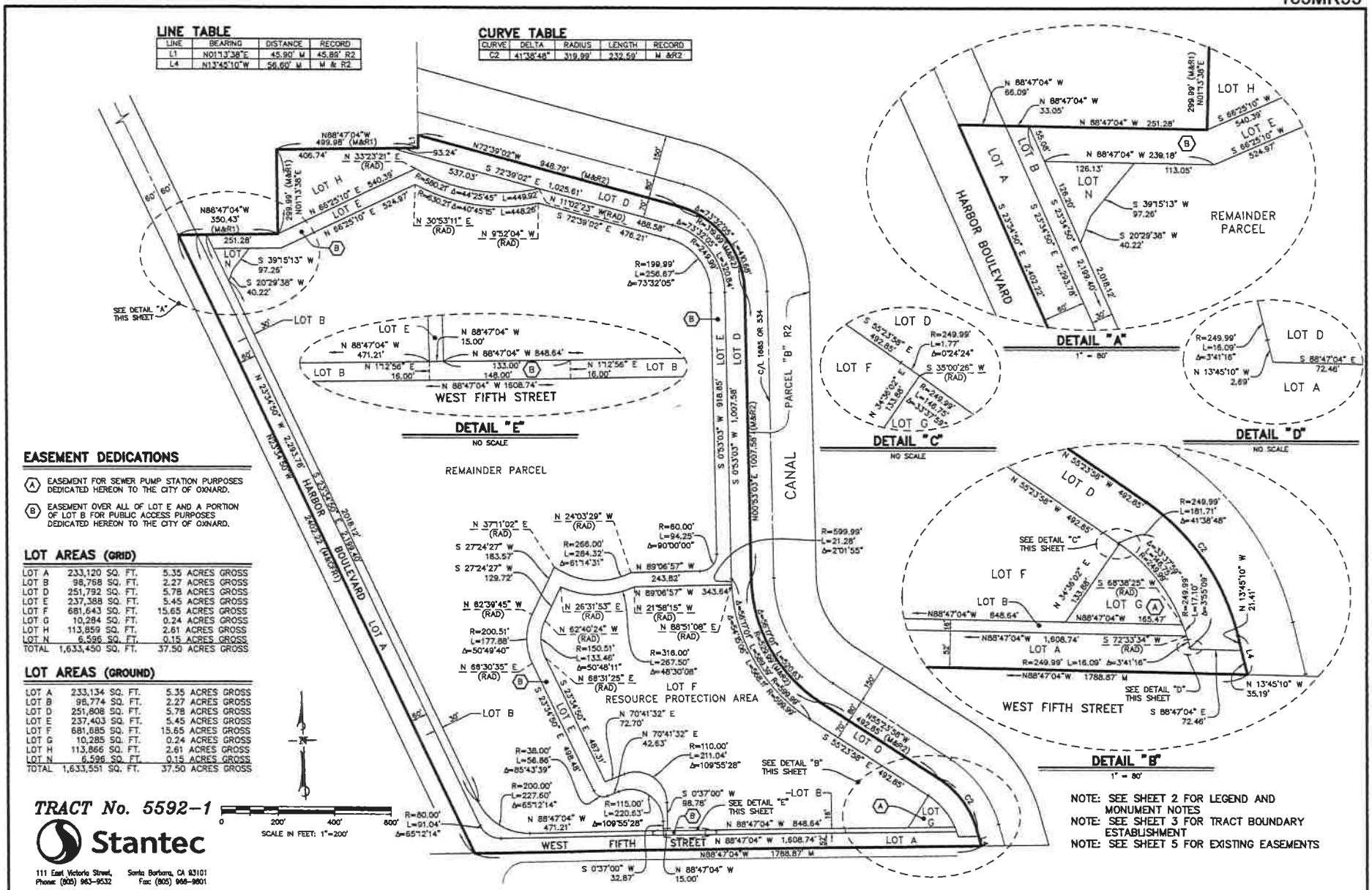
Phone: (805) 963-9532 Fax: (805) 966-9801

R: \ACAD\work\11811\SURVEY\FM 5592\FM 2015 adite\11811FM2015_1-3.dwg



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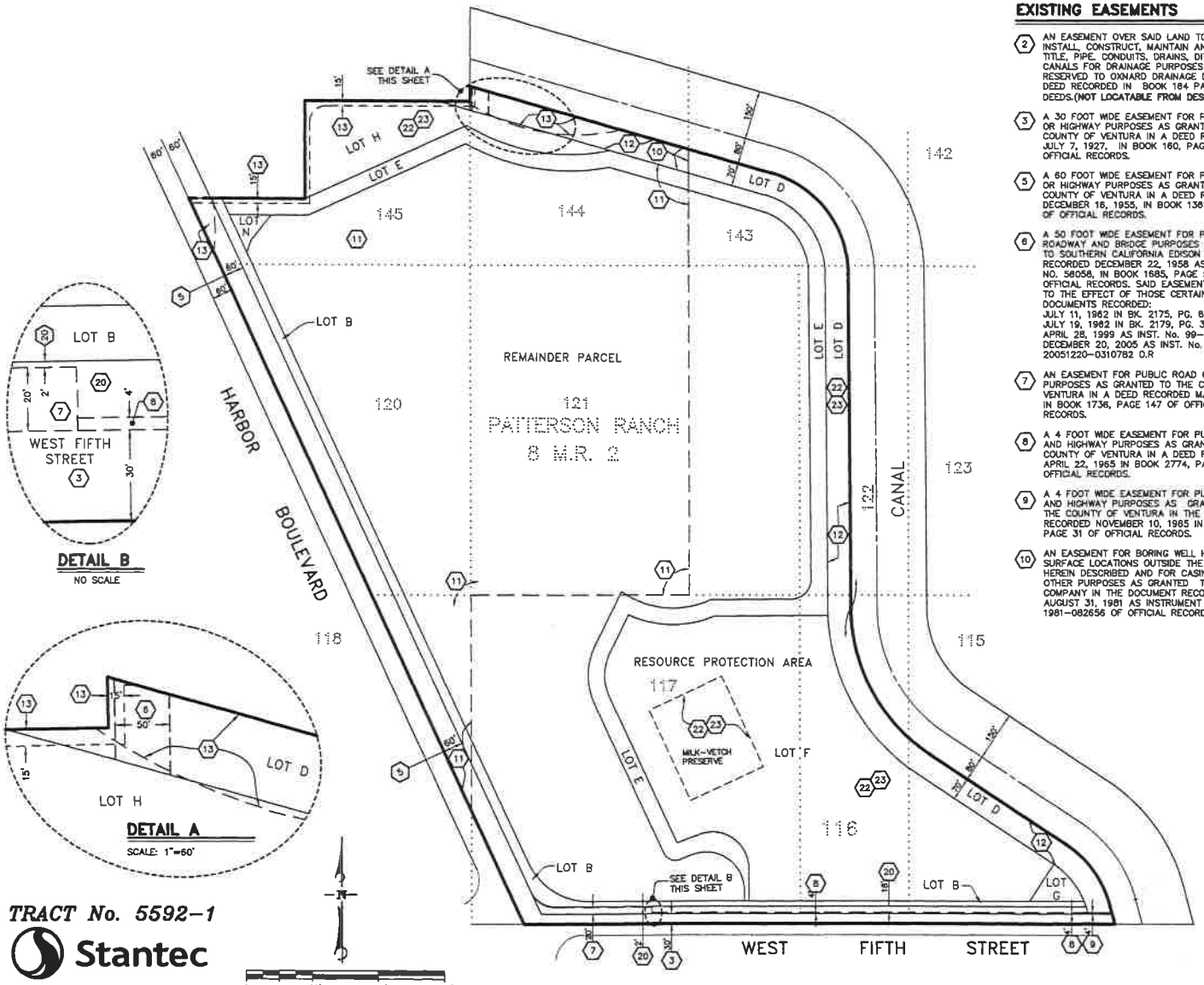

DETAIL B
NO SCALE

DETAIL A
SCALE: 1"=60'

EXISTING EASEMENTS

(2) AN EASEMENT OVER SAID LAND TO LAY, INSTALL, CONSTRUCT, MAINTAIN AND OPERATE TITLE, PIPE, CONDUITS, DRAINS, DITCHES AND CANALS FOR DRAINAGE PURPOSES ONLY, AS RESERVED TO OXNARD DRAINAGE DISTRICT BY DEED RECORDED IN BOOK 184 PAGE 408 OF DEEDS.(NOT LOCATABLE FROM DESCRIPTION)

(3) A 30 FOOT WIDE EASEMENT FOR PUBLIC ROAD OR HIGHWAY PURPOSES AS GRANTED TO THE COUNTY OF VENTURA IN A DEED RECORDED JULY 7, 1927, IN BOOK 160, PAGE 56 OF OFFICIAL RECORDS.

(5) A 60 FOOT WIDE EASEMENT FOR PUBLIC ROAD OR HIGHWAY PURPOSES AS GRANTED TO THE COUNTY OF VENTURA IN A DEED RECORDED DECEMBER 16, 1955, IN BOOK 1381, PAGE 478 OF OFFICIAL RECORDS.

(6) A 50 FOOT WIDE EASEMENT FOR PRIVATE ROADWAY AND BRIDGE PURPOSES AS GRANTED TO SOUTHERN CALIFORNIA EDISON IN A DEED RECORDED DECEMBER 22, 1958 AS DOCUMENT NO. 58058, IN BOOK 1685, PAGE 534 OF OFFICIAL RECORDS. SAID EASEMENT IS SUBJECT TO THE EFFECT OF THOSE CERTAIN DOCUMENTS RECORDED:
JULY 11, 1962 IN BK. 2175, PG. 800 O.R.
JULY 19, 1962 IN BK. 2179, PG. 361 O.R.
APRIL 28, 1999 AS INST. No. 99-082184 O.R.
DECEMBER 20, 2005 AS INST. No. 20051220-0310782 O.R

(7) AN EASEMENT FOR PUBLIC ROAD OR HIGHWAY PURPOSES AS GRANTED TO THE COUNTY OF VENTURA IN A DEED RECORDED MAY 20, 1959, IN BOOK 1736, PAGE 147 OF OFFICIAL RECORDS.

(8) A 4 FOOT WIDE EASEMENT FOR PUBLIC ROAD AND HIGHWAY PURPOSES AS GRANTED TO THE COUNTY OF VENTURA IN A DEED RECORDED APRIL 22, 1965 IN BOOK 2774, PAGE 378 OF OFFICIAL RECORDS.

(9) A 4 FOOT WIDE EASEMENT FOR PUBLIC ROAD AND HIGHWAY PURPOSES AS GRANTED TO THE COUNTY OF VENTURA IN THE DEED RECORDED NOVEMBER 10, 1965 IN BOOK 2895, PAGE 31 OF OFFICIAL RECORDS.

(10) AN EASEMENT FOR BORING WELL HOLES FROM SURFACE LOCATIONS OUTSIDE THE LANDS HEREIN DESCRIBED AND FOR CASING AND OTHER PURPOSES AS GRANTED TO SHELL OIL COMPANY IN THE DOCUMENT RECORDED AUGUST 31, 1981 AS INSTRUMENT NO. 1981-082656 OF OFFICIAL RECORDS.

(11) SUBSURFACE EASEMENT AT DEPTHS BELOW 500 FEET FOR THE PURPOSE OF DRILLING AND MAINTAINING WELL BORES TO BE USED TO EXPLORE FOR OIL, GAS AND OTHER HYDROCARBONS AS GRANTED TO THE SHELL OIL COMPANY, A CORPORATION IN DEEDS RECORDED DECEMBER 21, 1981, AS INSTRUMENT NUMBERS 119356, 119357, 119358, 119359 AND 119360, ALL OF OFFICIAL RECORDS. (BLANKET OVER PORTION SHOWN)

(12) A 70 FOOT WIDE EASEMENT FOR BIKE PATH PURPOSES RESERVED BY SOUTHERN CALIFORNIA EDISON COMPANY IN THE DOCUMENT RECORDED APRIL 7, 1998, AS INSTRUMENT NO. 98-051881 OF OFFICIAL RECORDS.

(13) QUITCLAIM, COVENANTS AND ENVIRONMENTAL USE RESTRICTIONS ALONG WITH GRANT OF EASEMENT GRANTED TO SAND HILLS RANCH IN THE DOCUMENT RECORDED APRIL 28, 1999 AS INSTRUMENT NO. 99-082184 OF OFFICIAL RECORDS, AND MODIFIED BY DOCUMENT RECORDED DECEMBER 20, 2005 AS INSTRUMENT NO. 20051220-0310782 OF OFFICIAL RECORDS.

(19) AN AVIGATION EASEMENT RESTRICTING AIRSPACE, RECORDED MAY 23, 2006 AS INSTRUMENT NO. 20060523-0110492 OF OFFICIAL RECORDS. (BLANKET EASEMENT OVER ALL OF TRACT 5592-1)

(20) AN EASEMENT FOR PUBLIC STREETS AND PUBLIC UTILITY PURPOSES IN THE DOCUMENT RECORDED JANUARY 18, 2008 AS INSTRUMENT NO. 20080116-00006607-0 OF OFFICIAL RECORDS.

(22) CONSERVATION EASEMENTS (FOUR) GRANTED TO THE CITY OF OXNARD PER DOCUMENT RECORDED MAY 21, 2009 AS INSTRUMENT NO. 20090521-0082948-0 OF OFFICIAL RECORDS.

(23) CONSERVATION EASEMENTS (FOUR) GRANTED TO THE CITY OF OXNARD, A MUNICIPAL CORPORATION, PER DOCUMENT RECORDED MAY 21, 2009 AS INSTRUMENT NO.20090521-0082947-0 OF OFFICIAL RECORDS. (ITEMS 22 & 23 CONSERVATION EASEMENTS ARE BLANKET EASEMENTS OVER LOTS D, F, AND H, AND A PORTION OF LOT F.)

NOTE: SEE SHEET 2 FOR LEGEND AND MONUMENT NOTES
NOTE: SEE SHEET 4 FOR LOTS AND DEDICATED EASEMENT DIMENSIONS.
NOTE: SEE SHEET 3 FOR TRACT BOUNDARY ESTABLISHMENT

TRACT No. 5592-1

Stantec
111 East Victoria Street, Santa Barbara, CA 93101
Phone: (805) 963-9532 Fax: (805) 966-9801

0 200' 400' 800'
SCALE IN FEET: 1"=200'

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MAIL TAX STATEMENTS TO:

N/A

RECORDING REQUESTED BY
AND AFTER RECORDING MAIL TO:

City of Oxnard
Planning and Environmental Services
214 South C Street
Oxnard, CA 93030
Attn: Linda Windsor, Associate Planner

20090521-00082946-0 1/13
Ventura County Clerk and Recorder
James B. Becker, Assistant
05/21/2009 08:12:15 AM
314395 $.00 BR

Document entitled to free recording pursuant to Govt. Code § 6103. Exempt from documentary transfer tax. Transfer to public entities. Rev. and Tax Code § 11922.

GRANT OF CONSERVATION EASEMENT

NORTH SHORE AT MANDALAY BAY

This Grant of Conservation Easement is made this 29 day of April, 2009 by Mandalay Bay Development LLC, a California limited liability company ("Mandalay Bay Development LLC") in favor of the City of Oxnard ("City");

WHEREAS, Mandalay Bay Development LLC is the owner of that certain property commonly referred to as the North Shore Parcel, consisting of approximately 90.26 acres depicted on Exhibits "A" and "B" attached hereto ("Property");

WHEREAS, the Property is located within the coastal zone as defined in § 30103 of Division 20 of the Public Resources Code, also known as the "California Coastal Act of 1976" ("Coastal Act");

Description: Ventura, CA Document-Year.DocID 2009.82946 Page: 1 of 13
Order: 1023800 Comment:

WHEREAS, the Property possesses wildlife, native habitat, aesthetic and other conservation values of great importance to the City and the People of the State of California;

WHEREAS, consistent with City of Oxnard Local Coastal Program Amendment No. OXN-MAJ-1-00 ("LCPA"), Mandalay Bay Development LLC applied to the City for a Coastal Development Permit (the "Permit") to authorize the North Shore at Mandalay Bay Project on the Property;

WHEREAS, in connection with the application, Mandalay Bay Development LLC caused to be prepared and submitted to the City the "North Shore Resource Area Protection/Milk-Vetch Preservation Plan" ("Resource Area Protection Plan" or "Plan") which sets forth measures to be implemented in connection with the restoration, maintenance and monitoring of the "Resource Protection Area" designated on the Property in the LCPA.

WHEREAS, on September 15, 2005, the City granted the Permit, subject to the uses and limitations set forth in the Permit, including Condition Nos. 106 and 108, requiring that a conservation easement be granted over the Property to permanently preserve, protect and maintain the wildlife, native habitat, aesthetic and other conservation values of the restored areas on the Parcel once it is restored consistent with the Resource Area Protection Plan;

Description: Ventura,CA Document-Year.DocID 2009.82946 Page: 2 of 13
Order: 1023800 Comment:

WHEREAS, the City found that but for the imposition of the condition requiring the conservation easement, the proposed development could not be found consistent with the City's certified Local Coastal Program;

WHEREAS, Mandalay Bay Development LLC has elected to comply with the condition and execute this Grant of Conservation Easement to convey to the City the right to preserve, protect and maintain the conservation values of the Property in perpetuity;

WHEREAS, this Grant of Conservation Easement is intended to be irrevocable, and it shall constitute enforceable restrictions within the meaning of Article XIII, section 8 of the California Constitution and, when accepted, it shall thereby qualify as an enforceable restriction under the provision of Revenue and Taxation Code section 402.1; and

WHEREAS, Grantee is a qualified public body under California Civil Code section 815 et seq. to accept the conservation easement.

NOW, THEREFORE, in consideration of the above recitals, the mutual covenants, terms, conditions, and restrictions contained herein, and the granting of the Permit by the City, Mandalay Bay Development LLC hereby grants to the City a conservation easement in perpetuity over the Property, as follows:

Description: Ventura,CA Document-Year.DocID 2009.82946 Page: 3 of 13
Order: 1023800 Comment:

1. Description. The Grant of Conservation Easement hereby affects that portion of the Property described as Parcels D, F and H, as described in Exhibits "A" and "B" attached hereto and incorporated herein by reference (the "Easement Area"), but does not affect that approximately 1.66-acre portion of the Property commonly referred to as the "Milk-Vetch Preserve," as described in Exhibits "A" and "B" attached hereto and incorporated herein by reference, which is separately preserved, protected, and maintained pursuant to that certain "Conservation Easement Deed (including Third Party Beneficiary)" dated April 29, 2009, and entered into by and between Mandalay Bay Development LLC and the City.

2. Purpose. The purpose of the Grant of Conservation Easement is to permanently preserve, protect and maintain the wildlife, native habitat, aesthetic and other conservation values of the Property once it is restored consistent with the Resource Protection Area Plan.

3. Restrictions on Use. The Easement Area shall be used by the City, its successors, assigns, and Mandalay Bay Development LLC solely for the uses authorized and subject to the limitations set forth in the Permit, including implementation, monitoring and maintenance of the Resource Protection Area Plan.

4. Run with the Land. The covenants, conditions, restrictions and limitations contained herein shall burden, be appurtenant to and run with the

Description: Ventura,CA Document-Year.DocID 2009.82946 Page: 4 of 13
Order: 1023800 Comment:

Property, shall burden the Mandalay Bay Development LLC and its successors and assigns, shall inure to the benefit of and be specifically enforceable by the City and its successors, assigns, and contractors, and shall be effective limitations on the use of the Property from the date of recordation of this document.

5. Successors and Assigns. The terms, covenants, conditions, obligations and reservations contained in this Grant of Conservation Easement shall be binding upon and inure to the benefit of the City and successors and assigns of each, whether voluntary or involuntary.

6. Applicable Law. This Grant of Conservation Easement shall be governed by and construed in accordance with the laws of the State of California.

IN WITNESS WHEREOF, the parties hereto have caused this Grant of Conservation Easement to be executed in accordance with the laws of the State of California.

MANDALAY BAY DEVELOPMENT LLC,
a California limited liability company

BY: California National Bank,
a national banking association, its sole member

BY: _____

NAME: Steven P. Timmons

TITLE: Regional Vice President

DATE: 4/29/09

Description: Ventura,CA Document-Year.DocID 2009.82946 Page: 5 of 13
Order: 1023800 Comment:

NOTARY

State of California

County of Ventura

On APRIL 29, 2009, before me KATHIE A. CLARK, NOTARY PUBLIC
Date — Insert here Name and Title of Officer

personally appeared, STEVEN P. TIMMONS
Name(s) of Signer(s)

Who proved to me on the basis of satisfactory evidence to be the person~~(s)~~ whose name~~(s)~~ is/~~are~~ subscribed to the within instrument and acknowledged to me that he/~~she~~/~~they~~ executed the same in his/~~her~~/~~their~~ authorized capacity~~(ies)~~, and that by his/~~her~~/~~their~~ signature~~(s)~~ on the instrument the person~~(s)~~, or the entity upon behalf of which the person~~(s)~~ acted, executed the instrument.

I certify under PENALTY of PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Kathie A. Clark
Signature of Notary Public

KATHIE A. CLARK
COMM. # 1826897
NOTARY PUBLIC - CALIFORNIA
LOS ANGELES COUNTY
COMM. EXPIRES DEC. 15, 2012

Description: Ventura,CA Document-Year.DocID 2009.82946 Page: 6 of 13
Order: 1023800 Comment:

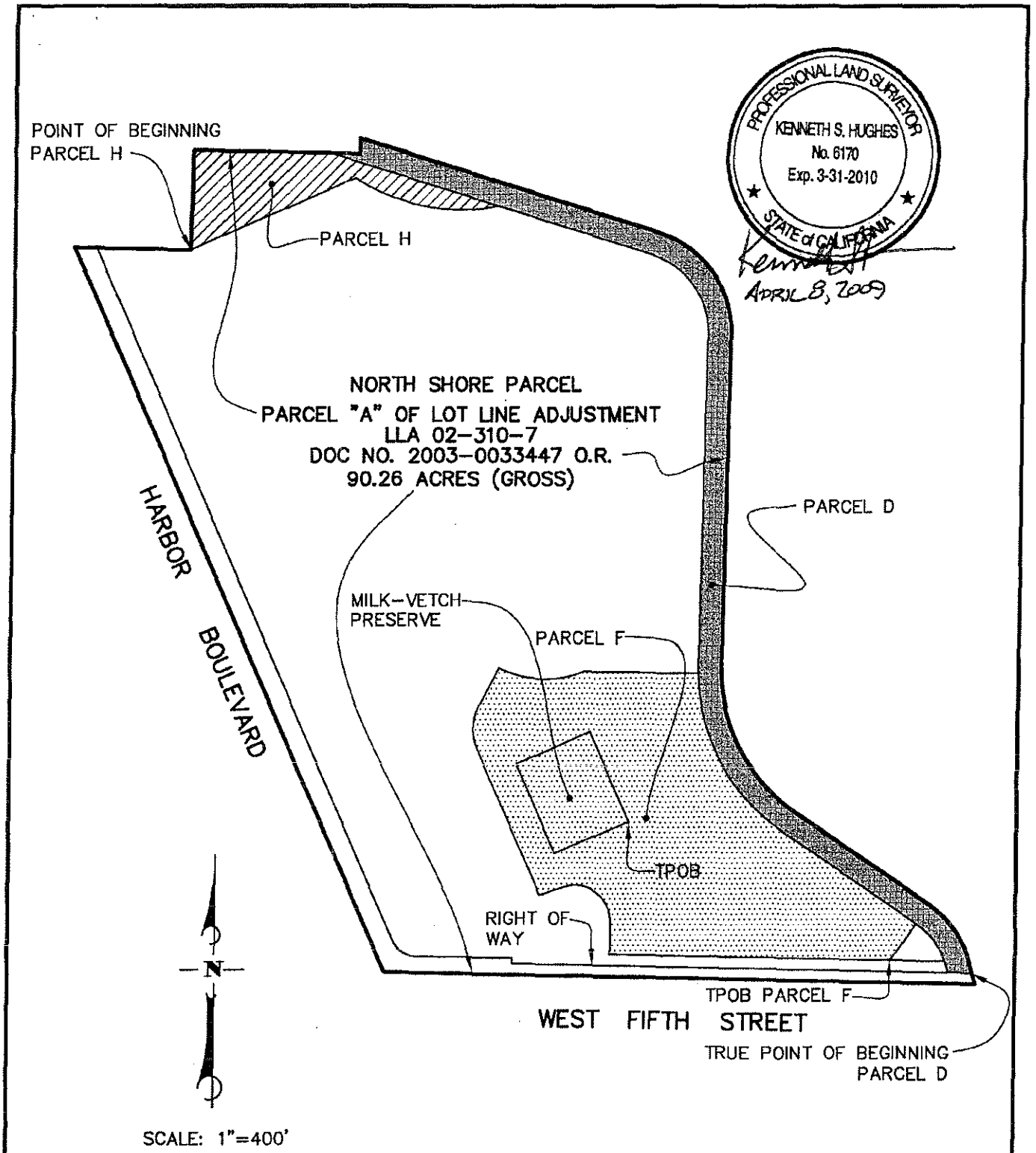

EXHIBIT "A"
CONSERVATION EASEMENTS
OVER NORTH SHORE PARCEL
COUNTY OF VENTURA, CALIFORNIA

Penfield & Smith
ENGINEERS • SURVEYORS • PLANNERS
SANTA BARBARA CAMARILLO SANTA MARIA LANCASTER
W.O. 11811.03 11811\11811.03\SURVEY\11811EX-B.DWG

APRIL 8, 2009

Description: Ventura,CA Document-Year.DocID 2009.82946 Page: 7 of 13
Order: 1023800 Comment:

Exhibit "B"
Easement Parcels D, F, H & MILK-VETCH PRESERVE

Legal Description

Those portions of the land, in the County of Ventura, State of California, as shown on the map filed in the office of the County Recorder of said County, in Book 50, Pages 64 through 66, inclusive, of Record of Surveys, described as follows:

Parcel D

Commencing at the southeasterly corner of Parcel "A", as described in the document recorded in the office of said County Recorder January 31, 2003, as Instrument No. 2003-0033447-00 of Official Records; thence, along the easterly line of said Parcel "A", North 13°45'10" West, 35.20 feet to the True Point of Beginning;

Thence, along said easterly line and northerly line of said Parcel "A", the following seven (7) courses:

1st, North 13°45'10" West, 22.60 feet to the beginning of a curve concave southwesterly having a radius of 319.99 feet;

2nd, northwesterly, along said curve, through a central angle of 41°38'48", an arc distance of 232.59 feet;

3rd, North 55°23'58" West, 492.85 feet to the beginning of a curve concave northeasterly having a radius of 529.98 feet;

4th, northwesterly, along said curve, through a central angle of 56°17'01", an arc distance of 520.62 feet;

5th, North 00°53'03" East, 1,007.58 feet to the beginning of a curve concave southwesterly having a radius of 319.99 feet;

6th, northwesterly, along said curve, through a central angle of 73°32'05", an arc distance of 410.68 feet;

7th, North 72°39'02" West, 948.79 feet to the most northerly corner of said Parcel "A";

Thence, 8th, continuing along the boundary of said Parcel "A", South 01°13'38" West, 47.05 feet to an angle point therein;

Thence, 9th, North 88°47'04" West, 89.26 feet to a line parallel with and distant southerly 70.00 feet, measured at right angles, from said northerly line;

Thence, 10th, along said parallel line, South 72°39'02" East, 1,021.47 feet to the beginning of a curve concave southwesterly having a radius of 249.99 feet;

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Penfield & Smith

Description: Ventura,CA Document-Year.DocID 2009.82946 Page: 8 of 13
Order: 1023800 Comment:

Thence, continuing concentric and parallel with said northerly and easterly lines of said Parcel "A", and distant southerly and westerly 70.00 feet therefrom, the following six (6) courses:

11th, southeasterly, along said curve, through a central angle of 73°32'05", an arc distance of 320.84 feet;

12th, South 00°53'03" West, 1,007.58 feet to the beginning of a curve concave northeasterly having a radius of 599.98 feet;

13th, southeasterly, along said curve, through a central angle of 56°17'01", an arc distance of 589.38 feet;

14th, South 55°23'58" East, 492.85 feet to the beginning of a curve concave southwesterly having a radius of 249.99 feet;

15th, southeasterly, along said curve, through a central angle of 41°38'48", an arc distance of 181.71 feet;

16th, South 13°45'10" East, 3.89 feet to a line parallel with and distant northerly 34.00 feet, measured at right angles, from the centerline of West Fifth Street;

Thence, 17th, along said parallel line, South 88°47'04" East, 72.46 feet to the True Point of Beginning.

Containing 5.78 acres, more or less.

Parcel F

Commencing at the southeasterly corner of Parcel "A", as described in the document recorded in the office of said County Recorder January 31, 2003, as Instrument No. 2003-0033447-00 of Official Records, said point being in the centerline of West Fifth Street; thence, along said centerline and the southerly line of said Parcel "A", North 88°47'04" West, 258.69 feet; thence, at right angles, North 01°12'56" East, 68.00 feet to the True Point of Beginning;

Thence, 1st, parallel with said centerline, North 88°47'04" West, 848.64 feet;

Thence, 2nd, North 00°37'00" East, 98.78 feet to the beginning of a curve concave southwesterly having a radius of 110.00 feet;

Thence, 3rd, northwesterly, along said curve, through a central angle of 109°55'28", an arc distance of 211.04 feet;

Thence, 4th, South 70°41'32" West, 72.70 feet;

Penfield & Smith

Description: Ventura,CA Document-Year.DocID 2009.82946 Page: 9 of 13
Order: 1023800 Comment:

Thence, 5th, North 23°34'50" West, 487.28 feet to the beginning of a non tangent curve concave easterly, having a radius of 150.44 feet and a radial center which bears North 66°29'59" East;

Thence, 6th, northerly, along said curve, through a central angle of 50°49'40", an arc distance of 133.46 feet;

Thence, 7th, North 27°24'27" East, 129.75 feet to the beginning of a non tangent curve concave northerly, having a radius of 316.00 feet and a radial center which bears North 26°31'52" East;

Thence, 8th, easterly, along said curve, through a central angle of 48°30'08", an arc distance of 267.50 feet;

Thence, 9th, South 89°06'57" East, 343.69 feet to the beginning of a non tangent curve concave northeasterly, having a radius of 599.98 feet and a radial center which bears North 88°44'33" East, said curve being concentric with and distant westerly 70.00 feet, measured radially, from the easterly line of the hereinabove referred Parcel "A";

Thence, 10th, southeasterly, along said curve, through a central angle of 54°08'31", an arc distance of 566.95 feet;

Thence, continuing concentric and parallel with said easterly line, distant westerly and southwesterly 70.00 feet therefrom, the following two courses:

11th, South 55°23'58" East, 492.85 feet to the beginning of a curve concave southwesterly having a radius of 249.99 feet;

12th, southeasterly, along said curve, through a central angle of 00°33'13", an arc distance of 2.42 feet;

Thence, 13th, South 34°36'02" West, 134.84 feet to the True Point of Beginning.

Containing 15.67 acres, more or less.

Penfield & Smith

Description: Ventura,CA Document-Year.DocID 2009.82946 Page: 10 of 13
Order: 1023800 Comment:

Parcel H

Beginning at the easterly terminus of the third course of Parcel "A", as described in the document recorded in the office of said County Recorder January 31, 2003, as Instrument No. 2003-0033447-00 of Official Records, said course being designated as "T1" in Exhibit "B" of said document;

Thence, 1st, along the northerly line of said Parcel "A", North 01°13'38" East, 299.99 feet to an angle point therein;

Thence, 2nd, continuing along said northerly line, South 88°47'04" East, 410.72 feet to a line parallel with and distant southerly 70.00 feet, measured at right angles, from said northerly line;

Thence, 3rd, along said parallel line, South 72°39'02" East, 535.25 feet to the beginning of a non tangent curve concave northerly, having a radius of 580.21 feet and a radial center which bears North 11°16'07" West;

Thence, 4th, westerly, along said curve, through a central angle of 44°39'28", an arc distance of 452.23 feet;

Thence, 5th, South 66°25'10" West, 540.39 feet to the point of beginning.
Containing 2.63 acres, more or less.

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R:\ACAD\WORK\11811\11811.03\SURVEY\11811EX-B.DWG

Penfield & Smith

Description: Ventura,CA Document-Year.DocID 2009.82946 Page: 11 of 13
Order: 1023800 Comment:

Milk-Vetch Preserve

Commencing at the southeasterly corner of Parcel "A", as described in the document recorded in the office of said County Recorder January 31, 2003, as Instrument No. 2003-0033447-00 of Official Records, said point being in the centerline of West Fifth Street; thence, along said centerline and the southerly line of said Parcel "A", North 88°47'04" West, 1063.58 feet; thence, at right angles, North 01°12'56" East, 472.18 feet to the True Point of Beginning;

Thence, 1st, South 66°33'37" West, 242.50 feet;

Thence, 2nd, North 23°26'23" West, 299.00 feet;

Thence, 3rd, North 66°33'37" East, 242.50 feet;

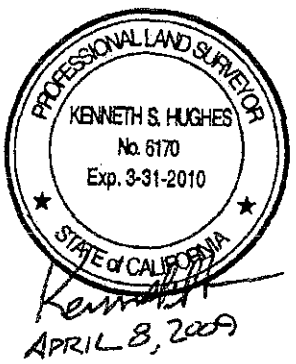
Thence, 4th, South 23°26'23" East, 299.00 feet to the True Point of Beginning.

Containing 1.66 acres, more or less.

The bearings and distances recited for the hereinabove described Parcels D, F, H, and the Milk-Vetch Preserve are based upon the California Coordinate System, Zone 5, NAD 83. To obtain ground level distances, multiply by a combined scale factor of 1.000030361.

Prepared by:

Kenneth S. Hughes
PLS 6170
License expiration date: 3/31/10



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R:\ACAD\WORK\11811\11811.03\SURVEY\11811EX-B.DWG

Penfield & Smith

Description: Ventura, CA Document-Year.DocID 2009.82946 Page: 12 of 13
Order: 1023800 Comment:

CERTIFICATE OF ACCEPTANCE

This is to certify that the interest in real property conveyed by the Grant of Conservation Easement dated April 29, 2009, from Mandalay Bay Development LLC to the City of Oxnard, a municipal corporation and governmental agency, is hereby accepted, and pursuant to City Council Resolution 1939, recorded in book 1591, Official Records of Ventura County at page 273, the City Council consents to recordation thereof by its duly authorized officer.

DATED: May 19, 2009

CITY OF OXNARD

By: _____
DR. THOMAS E. HOLDEN, MAYOR

APPROVED AS TO FORM:

_____
ALAN HOLMBERG
CITY ATTORNEY

Description: Ventura, CA Document-Year.DocID 2009.82946 Page: 13 of 13
Order: 1023800 Comment:

MAIL TAX STATEMENTS TO:
N/A

RECORDING REQUESTED BY AND)
WHEN RECORDED MAIL TO:)
)
State of California)
Wildlife Conservation Board)
1807 13th Street, Suite 103)
Sacramento, CA 95814)
)

20090521-00082947-0 1/19
Ventura County Clerk and Recorder
James B. Becker, Assistant
05/21/2009 08:12:15 AM
314395 $.00 BR

APN: N/A

Space Above Line for Recorder's Use Only

Document entitled to free recording pursuant to Govt. Code Section 6103. Exempt from documentary transfer tax. Transfer to public entities. Rev. and Tax Code Section 11922

CONSERVATION EASEMENT DEED
(Including Third-Party Beneficiary)

THIS CONSERVATION EASEMENT DEED is made this 29 day of April 2009, by Mandalay Bay Development LLC, a California limited liability company ("Grantor"), in favor of the City of Oxnard, a municipal corporation ("Grantee"), with reference to the following facts:

RECITALS

A. Grantor is the sole owner in fee simple of certain real property in the City of Oxnard, County of Ventura, State of California, commonly referred to as the "North Shore Parcel," consisting of approximately 90.26 acres depicted on Exhibit "A" and more particularly described in Exhibit "B" attached hereto and incorporated herein by this reference (the "Property");

B. The Property possesses wildlife and habitat values (collectively, "conservation values") of great importance to Grantee, the State of California, Department of Fish and Game ("CDFG"), and the people of the State of California;

C. The Property contains within a designated Resources Protection Area an approximately 1.66-acre Milk-Vetch Preserve, more particularly described as "Milk Vetch Preserve" in the aforesaid Exhibit "B", (the "Preserve"), which provides high quality habitat for the Ventura Marsh Milk-Vetch;

D. Grantee is authorized to hold conservation easements pursuant to Civil Code Section 815.3. Specifically, Grantee is *a governmental entity identified in Civil Code Section 815.3(b) and otherwise authorized to acquire and hold title to real property.*

Description: Ventura,CA Document-Year.DocID 2009.82947 Page: 1 of 19
Order: 1023800 Comment:

E. CDFG has jurisdiction, pursuant to Fish and Game Code Section 1802, over the conservation, protection, and management of fish, wildlife, native plants and the habitat necessary for biologically sustainable populations of those species, and the Department of Fish and Game is authorized to hold easements for these purposes pursuant to Civil Code Section 815.3, Fish and Game Code Section 1348, and other provisions of California law.

F. This Conservation Easement provides mitigation for certain impacts of the North Shore at Mandalay Bay project located in the City of Oxnard, County of Ventura, State of California, pursuant to Conditions No. 106 and 108 of the Coastal Development Permit approved by the City of Oxnard on September 15, 2005, and Paragraph 5.8 of that certain "Memorandum of Understanding Between North Shore at Mandalay Bay, L.L.C. and State of California Department of Fish and Game Regarding Additional Mitigation Measures for the North Shore Project Site," dated July 27, 1999.

G. Grantee agrees by accepting this grant to honor the intentions of Grantor stated herein to preserve and protect in perpetuity the conservation values of the Preserve in accordance with the terms of this Conservation Easement.

COVENANTS, TERMS, CONDITIONS AND RESTRICTIONS

For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, and pursuant to California law, including Civil Code Section 815, *et seq.*, Grantor hereby voluntarily grants and conveys to Grantee a conservation easement in perpetuity over the Preserve.

1. Purpose. The purpose of this Conservation Easement is to ensure the Preserve will be retained forever in a natural condition and to prevent any use of the Preserve that will impair or interfere with the conservation values of the Preserve. Grantor intends that this Conservation Easement will confine the use of the Preserve to such activities, including, without limitation, those involving the preservation and enhancement of native species and their habitat in a manner consistent with the habitat conservation purposes of this Conservation Easement.

2. Grantee's Rights. To accomplish the purposes of this Conservation Easement, Grantor hereby grants and conveys the following rights to Grantee and to CDFG as a third party beneficiary of this Conservation Easement:

(a) To preserve and protect the conservation values of the Preserve;

(b) To enter upon the Preserve at reasonable times in order to monitor Grantor's compliance with and to otherwise enforce the terms of this Conservation Easement, and for scientific research and interpretive purposes by Grantee or its designees and CDFG or its designees, provided that neither Grantee nor CDFG shall unreasonably interfere with Grantor's authorized use and quiet enjoyment of the Property outside of the Preserve;

(c) To prevent any activity on or use of the Preserve that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features of the Preserve that may be damaged by any act, failure to act, or any use that is inconsistent with the purposes of this Conservation Easement;

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(d) All mineral, air and water rights necessary to protect and to sustain the biological resources of the Preserve; and

(e) All present and future development rights within the Preserve.

3. Prohibited Uses. Any activity on or use of the Preserve inconsistent with the purposes of this Conservation Easement is prohibited, except as otherwise provided in the "North Shore Resource Protection Area/Milk-Vetch Preservation Plan," dated June 17, 2005, approved by Grantor and CDFG. Without limiting the generality of the foregoing, the following uses by Grantor, Grantor's agents, and third parties, are expressly prohibited:

(a) Unseasonal watering; use of fertilizers, pesticides, biocides, herbicides or other agricultural chemicals with the exception of use of herbicides for invasive plant species control subject to a CDFG-approved plan; weed abatement activities; incompatible fire protection activities; and any and all other activities and uses which may adversely affect the purposes of this Conservation Easement;

(b) Use of off-road vehicles and use of any other motorized vehicles except on existing roadways;

(c) Grazing or other agricultural activity of any kind;

(d) Recreational activities including, but not limited to, horseback riding, biking, hunting or fishing, except as may be specifically permitted under this Conservation Easement;

(e) Commercial or industrial uses;

(f) Any legal or de facto division, subdivision or partitioning of the Preserve;

(g) Construction, reconstruction or placement of any building, billboard or sign, or any other structure or improvement of any kind;

(h) Depositing or accumulation of soil, trash, ashes, refuse, waste, bio-solids or any other materials;

(i) Planting, introduction or dispersal of non-native or exotic plant or animal species;

(j) Filling, dumping, excavating, draining, dredging, mining, drilling, removing or exploring for or extraction of minerals, loam, soil, sands, gravel, rocks or other material on or below the surface of the Preserve;

(k) Altering the surface or general topography of the Preserve, including building of roads;

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(l) Removing, destroying, or cutting of trees, shrubs or other vegetation, except as required by law for (1) fire breaks, (2) maintenance of existing foot trails or roads, or (3) prevention or treatment of disease; and

(m) Manipulating, impounding or altering any natural water course, body of water or water circulation on the Preserve, and activities or uses detrimental to water quality, including but not limited to degradation or pollution of any surface or sub-surface waters.

4. Grantor's Duties. Grantor shall undertake all reasonable actions to prevent the unlawful entry and trespass by persons whose activities may degrade or harm the conservation values of the Preserve. In addition, Grantor shall undertake all necessary actions to perfect Grantee's rights under Section 2 of this Conservation Easement, including but not limited to, Grantee's water rights.

5. Reserved Rights. Grantor reserves to itself, and to its personal representatives, heirs, successors, and assigns, all rights accruing from its ownership of the Preserve, including the right to engage in or to permit or invite others to engage in all uses of the Preserve that are consistent with the purposes of this Conservation Easement. In addition, pursuant to that certain Settlement Agreement, dated August 17, 2000, by and between Grantor, North Shore at Mandalay Bay, LLC, and the California Native Plant Society ("CNPS"), the CNPS is guaranteed the right of access to the Preserve for conservation, monitoring, and research purposes.

6. Grantee's Remedies. CDFG, as a third party beneficiary of this Conservation Easement, shall have the same rights as Grantee under this section to enforce the terms of this Conservation Easement. If Grantee determines that Grantor is in violation of the terms of this Conservation Easement or that a violation is threatened, Grantee shall give written notice to Grantor of such violation and demand in writing the cure of such violation. At the time of giving any such notice, Grantee shall give a copy of the notice to CDFG. If Grantor fails to cure the violation within fifteen (15) days after receipt of written notice and demand from Grantee, or if the cure reasonably requires more than fifteen (15) days to complete and Grantor fails to begin the cure within the fifteen (15)-day period or fails to continue diligently to complete the cure, Grantee may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by Grantor with the terms of this Conservation Easement, to recover any damages to which Grantee may be entitled for violation by Grantor of the terms of this Conservation Easement or for any injury to the conservation values of the Preserve, to enjoin the violation, *ex parte* as necessary, by temporary or permanent injunction without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies, or for other equitable relief, including, but not limited to, the restoration of the Preserve to the condition in which it existed prior to any such violation or injury. Without limiting Grantor's liability therefore, Grantee may apply any damages recovered to the cost of undertaking any corrective action on the Preserve.

If Grantee, in its sole discretion, determines that circumstances require immediate action to prevent or mitigate damage to the conservation values of the Preserve, Grantee may pursue its remedies under this Section 6 without prior notice to Grantor or without waiting for the period provided for cure to expire. Grantee's rights under this section apply equally to actual or threatened violations of the terms of this Conservation Easement. Grantor agrees that Grantee's remedies at law for any violation of the terms of this Conservation Easement are inadequate and that Grantee shall be entitled to the injunctive

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relief described in this section, both prohibitive and mandatory, in addition to such other relief to which Grantee may be entitled, including specific performance of the terms of this Conservation Easement, without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies. Grantee's remedies described in this section shall be cumulative and shall be in addition to all remedies now or hereafter existing at law or in equity, including but not limited to, the remedies set forth in Civil Code Section 815, *et seq.*, inclusive. The failure of Grantee to discover a violation or to take immediate legal action shall not bar Grantee from taking such action at a later time.

If at any time in the future Grantor or any subsequent transferee uses or threatens to use the Preserve for purposes inconsistent with this Conservation Easement then, notwithstanding Civil Code Section 815.7, the California Attorney General or any entity or individual with a justifiable interest in the preservation of this Conservation Easement has standing as interested parties in any proceeding affecting this Conservation Easement.

6.1. Costs of Enforcement. Any costs incurred by Grantee or CDFG, where it is the prevailing party, in enforcing the terms of this Conservation Easement against Grantor, including, but not limited to, costs of suit and attorneys' and experts' fees, and any costs of restoration necessitated by Grantor's negligence or breach of this Conservation Easement shall be borne by Grantor.

6.2. Discretion of Grantee and CDFG. Enforcement of the terms of this Conservation Easement by Grantee or CDFG shall be at its discretion, and any forbearance by Grantee or CDFG to exercise its rights under this Conservation Easement in the event of any breach of any term of this Conservation Easement by Grantor shall not be deemed or construed to be a waiver by Grantee or CDFG of such term or of any subsequent breach of the same or any other term of this Conservation Easement or of any of Grantee's rights (or any rights of CDFG as a third party beneficiary) under this Conservation Easement. No delay or omission by Grantee or CDFG in the exercise of any right or remedy upon any breach by Grantor shall impair such right or remedy or be construed as a waiver.

6.3. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee or CDFG to bring any action against Grantor for any injury to or change in the Preserve resulting from (i) any natural cause beyond Grantor's control, including, without limitation, fire not caused by Grantor, flood, storm, and earth movement, or any prudent action taken by Grantor under emergency conditions to prevent, abate, or mitigate significant injury to the Preserve resulting from such causes; or (ii) acts by Grantee or its employees or CDFG or its employees.

6.4. Department of Fish and Game Right of Enforcement. All rights and remedies conveyed to Grantee under this Conservation Easement Deed shall extend to and are enforceable by CDFG. These rights are in addition to, and do not limit, the rights of enforcement under Conditions Nos. 106 and 108 of the Coastal Development Permit approved by the City of Oxnard.

7. Fence Installation and Maintenance. Grantor shall install and maintain a fence reasonably satisfactory to Grantee and CDFG around the Conservation Easement area to protect the conservation values of the Preserve, including but not limited to wildlife corridors.

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8. Access. Except as expressly provided above, this Conservation Easement does not convey a general right of access to the public.

9. Costs and Liabilities. Grantor retains all responsibilities and shall bear all costs and liabilities of any kind related to the ownership, operation, upkeep, and maintenance of the Preserve. Grantor agrees that neither Grantee nor CDFG shall have any duty or responsibility for the operation or maintenance of the Preserve, the monitoring of hazardous conditions thereon, or the protection of Grantor, the public or any third parties from risks relating to conditions on the Preserve. Grantor remains solely responsible for obtaining any applicable governmental permits and approvals for any activity or use permitted by this Conservation Easement Deed, and any activity or use shall be undertaken in accordance with all applicable federal, state, local and administrative agency statutes, ordinances, rules, regulations, orders and requirements.

9.1. Taxes; No Liens. Grantor shall pay before delinquency all taxes, assessments, fees, and charges of whatever description levied on or assessed against the Preserve by competent authority (collectively "taxes"), including any taxes imposed upon, or incurred as a result of, this Conservation Easement, and shall furnish Grantee and CDFG with satisfactory evidence of payment upon request. Grantor shall keep Grantee's interest in the Preserve free from any liens, including those arising out of any obligations incurred by Grantor or any labor or materials furnished or alleged to have been furnished to or for Grantor at or for use on the Preserve.

9.2. Hold Harmless. Grantor shall hold harmless, protect and indemnify Grantee and its directors, officers, employees, agents, contractors, and representatives and the heirs, personal representatives, successors and assigns of each of them (each a "Grantee Indemnified Party" and, collectively, "Grantee's Indemnified Parties") and CDFG and its directors, officers, employees, agents, contractors, and representatives and the heirs, personal representatives, successors and assigns of each of them (each a "CDFG Indemnified Party" and, collectively, "CDFG's Indemnified Parties") from and against any and all liabilities, penalties, costs, losses, damages, expenses (including, without limitation, reasonable attorneys' fees and experts' fees), causes of action, claims, demands, orders, liens or judgments (each a "Claim" and, collectively, "Claims"), arising from or in any way connected with: (1) injury to or the death of any person, or physical damage to any property, resulting from any act, omission, condition, or other matter related to or occurring on or about the Preserve, regardless of cause, except that (a) this indemnification shall be inapplicable to Grantee's Indemnified Parties with respect to any Claim due solely to the negligence of Grantee or any of its employees and (b) this indemnification shall be inapplicable to CDFG's Indemnified Parties with respect to any Claim due solely to the negligence of CDFG or any of its employees; (2) the obligations specified in Sections 4, 9, and 9.1; and (3) the existence or administration of this Conservation Easement. If any action or proceeding is brought against any of the CDFG Indemnified Parties by reason of any such Claim, Grantor shall, at the election of and upon written notice from CDFG, defend such action or proceeding by counsel reasonably acceptable to the CDFG Indemnified Party or reimburse CDFG for all charges incurred for services of the Attorney General in defending the action or proceeding.

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9.3. Condemnation. The purposes of the Conservation Easement are presumed to be the best and most necessary public use as defined at Code of Civil Procedure Section 1240.680 notwithstanding Code of Civil Procedure Sections 1240.690 and 1240.700.

10. Assignment. This Conservation Easement is transferable by Grantee, but Grantee may assign its rights and obligations under this Conservation Easement only to an entity or organization authorized to acquire and hold conservation easements pursuant to Civil Code Section 815.3. Grantee shall require the assignee to record the assignment in the county where the Property is located.

11. Subsequent Transfers. Grantor agrees to incorporate the terms of this Conservation Easement in any deed or other legal instrument by which Grantor divests itself of any interest in all or any portion of the Preserve, including, without limitation, a leasehold interest. Grantor further agrees to give written notice to Grantee and CDFG of the intent to transfer any interest at least thirty (30) days prior to the date of such transfer. Grantee or CDFG shall have the right to prevent subsequent transfers in which prospective subsequent claimants or transferees are not given notice of the covenants, terms, conditions and restrictions of this Conservation Easement. The failure of Grantor, Grantee or CDFG to perform any act provided in this section shall not impair the validity of this Conservation Easement or limit its enforceability in any way.

12. Notices. Any notice, demand, request, consent, approval, or communication that any party desires or is required to give to the other parties shall be in writing and be served personally or sent by recognized overnight courier that guarantees next-day delivery or by first class mail, postage fully prepaid, addressed as follows:

To Grantor: Mandalay Bay Development LLC
555 East Ocean Blvd. Suite 100
Long Beach, CA 90802
Attention: Steven P. Timmons

With a copy to: Richards, Watson & Gershon
355 S. Grand Avenue, 40th Floor
Los Angeles, CA 90071-3101
Attn: Steven H. Kaufmann

To Grantee:	**City of Oxnard** **Planning and Environmental Services** **305 West Third Street** **Oxnard, CA 93030** **Attn: Planning & Environmental Services Manager**
With a copy to:	**City of Oxnard** **300 West Third Street** **Oxnard, CA 93030** **Attn: Gary Gillig, City Attorney**
To CDFG:	**Department of Fish and Game** **Region 5** **4949 Viewridge Avenue** **San Diego, CA 92123** **Attn: Regional Manager**
With a copy to:	**Department of Fish and Game** **Office of the General Counsel** **1416 Ninth Street, 12th Floor** **Sacramento, California 95814-2090** **Attn: General Counsel**

or to such other address as Grantor, Grantee or CDFG may designate by written notice to the other parties. Notice shall be deemed effective upon delivery in the case of personal delivery or delivery by overnight courier or, in the case of delivery by first class mail, five (5) days after deposit into the United States mail.

13. Amendment. This Conservation Easement may be amended by Grantor and Grantee only by mutual written agreement and subject to the written approval of CDFG. Any such amendment shall be consistent with the purposes of this Conservation Easement and shall not affect its perpetual duration. Any such amendment shall be recorded in the official records of Ventura County, State of California.

14. General Provisions.

(a) Controlling Law. The interpretation and performance of this Conservation Easement shall be governed by the laws of the State of California, disregarding the conflicts of law principles of such state.

(b) Liberal Construction. Any general rule of construction to the contrary notwithstanding, this Conservation Easement shall be liberally construed to effect the purposes of this Conservation Easement and the policy and purpose of Civil Code

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Section 815, *et seq*. If any provision in this instrument is found to be ambiguous, an interpretation consistent with the purposes of this Conservation Easement that would render the provision valid shall be favored over any interpretation that would render it invalid.

(c) Severability. If a court of competent jurisdiction voids or invalidates on its face any provision of this Conservation Easement Deed, such action shall not affect the remainder of this Conservation Easement Deed. If a court of competent jurisdiction voids or invalidates the application of any provision of this Conservation Easement Deed to a person or circumstance, such action shall not affect the application of the provision to other persons or circumstances.

(d) Entire Agreement. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings, or agreements relating to the Conservation Easement. No alteration or variation of this instrument shall be valid or binding unless contained in an amendment in accordance with Section 13.

(e) No Forfeiture. Nothing contained herein will result in a forfeiture or reversion of Grantor's title in any respect.

(f) Successors. The covenants, terms, conditions, and restrictions of this Conservation Easement Deed shall be binding upon, and inure to the benefit of, the parties hereto and their respective personal representatives, heirs, successors, and assigns and shall constitute a servitude running in perpetuity with the Preserve.

(g) Termination of Rights and Obligations. A party's rights and obligations under this Conservation Easement terminate upon transfer of the party's interest in the Conservation Easement or Preserve, except that liability for acts or omissions occurring prior to transfer shall survive transfer.

(h) Captions. The captions in this instrument have been inserted solely for convenience of reference and are not a part of this instrument and shall have no effect upon its construction or interpretation.

(j) Warranty. Grantor represents and warrants that there are no outstanding mortgages, liens, encumbrances or other interests in the Preserve which have not been expressly subordinated to this Conservation Easement Deed, and that the Preserve is not subject to any other conservation easement.

(k) Additional Easements. Grantor shall not grant any additional easements, rights of way or other interests in the Preserve (other than a security interest

that is subordinate to this Conservation Easement Deed), or grant or otherwise abandon or relinquish any water agreement relating to the Preserve, without first obtaining the written consent of Grantee and CDFG. Grantee or CDFG may withhold such consent if it determines that the proposed interest or transfer is inconsistent with the purposes of this Conservation Easement or will impair or interfere with the conservation values of the Preserve. This Section 14(k) shall not prohibit transfer of a fee or leasehold interest in the Preserve that is subject to this Conservation Easement Deed and complies with Section 11.

(l) Counterparts. The parties may execute this instrument in any number of counterparts, which shall, in the aggregate, be signed by all of the parties; each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling.

IN WITNESS WHEREOF Grantor and Grantee have executed this Conservation Easement Deed as of the day and year first above written.

GRANTOR: MANDALAY BAY DEVELOPMENT LLC,
a California limited liability company

BY: California National Bank,
a national banking association, its sole member

BY: _____

NAME: Steven P. Timmons

TITLE: Regional Vice President

DATE: 4/29/09

GRANTEE: CITY OF OXNARD

BY: _____

NAME: Thomas E. Holden

TITLE: Mayor of the City of Oxnard

DATE: May 19, 2009

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CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

State of California
County of LOS ANGELES }

On APRIL 29, 2009 (Date) before me, KATHIE A. CLARK, NOTARY PUBLIC (Here Insert Name and Title of the Officer),

personally appeared STEVEN P. TIMMONS (Name(s) of Signer(s)),

who proved to me on the basis of satisfactory evidence to be the person~~(s)~~ whose name~~(s)~~ is/~~are~~ subscribed to the within instrument and acknowledged to me that he/~~she~~/they executed the same in his/~~her~~/their authorized capacity~~(ies)~~, and that by his/~~her~~/their signature~~(s)~~ on the instrument the person~~(s)~~, or the entity upon behalf of which the person~~(s)~~ acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature Kathie A. Clark (Signature of Notary Public)

KATHIE A. CLARK
COMM. # 1826897
NOTARY PUBLIC - CALIFORNIA
LOS ANGELES COUNTY
COMM. EXPIRES DEC. 15, 2012

Place Notary Seal Above

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

Description of Attached Document

Title or Type of Document: _____

Document Date: _____ Number of Pages: _____

Signer(s) Other Than Named Above: _____

Capacity(ies) Claimed by Signer(s)

Signer's Name: _____
☐ Individual
☐ Corporate Officer — Title(s): _____
☐ Partner — ☐ Limited ☐ General
☐ Attorney in Fact
☐ Trustee
☐ Guardian or Conservator
☐ Other: _____
Signer Is Representing: _____

RIGHT THUMBPRINT OF SIGNER
Top of thumb here

Signer's Name: _____
☐ Individual
☐ Corporate Officer — Title(s): _____
☐ Partner — ☐ Limited ☐ General
☐ Attorney in Fact
☐ Trustee
☐ Guardian or Conservator
☐ Other: _____
Signer Is Representing: _____

RIGHT THUMBPRINT OF SIGNER
Top of thumb here

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CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

State of California
County of Ventura }

On May 19, 2009 (Date) before me, Lourdes A. López, Notary Public (Here Insert Name and Title of the Officer),

personally appeared Thomas E. Holden (Name(s) of Signer(s)),

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/~~are~~ subscribed to the within instrument and acknowledged to me that he/~~she/they~~ executed the same in his/her/their authorized capacity(ies), and that by his/~~her/their~~ signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

LOURDES A. LOPEZ
Commission # 1793649
Notary Public - California
Ventura County
My Comm. Expires Apr 12, 2012

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature Lourdes A. López (Signature of Notary Public)

Place Notary Seal Above

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

Description of Attached Document

Title or Type of Document: Conservation

Document Date: April 29, 2009 Number of Pages: —

Signer(s) Other Than Named Above: —

Capacity(ies) Claimed by Signer(s)

Signer's Name: Thomas E. Holden

- ☐ Individual
- ☐ Corporate Officer — Title(s):
- ☐ Partner — ☐ Limited ☐ General
- ☐ Attorney in Fact
- ☐ Trustee
- ☐ Guardian or Conservator
- ☒ Other: Mayor

Signer Is Representing: City of Oxnard

RIGHT THUMBPRINT OF SIGNER — Top of thumb here

Signer's Name:

- ☐ Individual
- ☐ Corporate Officer — Title(s):
- ☐ Partner — ☐ Limited ☐ General
- ☐ Attorney in Fact
- ☐ Trustee
- ☐ Guardian or Conservator
- ☐ Other:

Signer Is Representing:

RIGHT THUMBPRINT OF SIGNER — Top of thumb here

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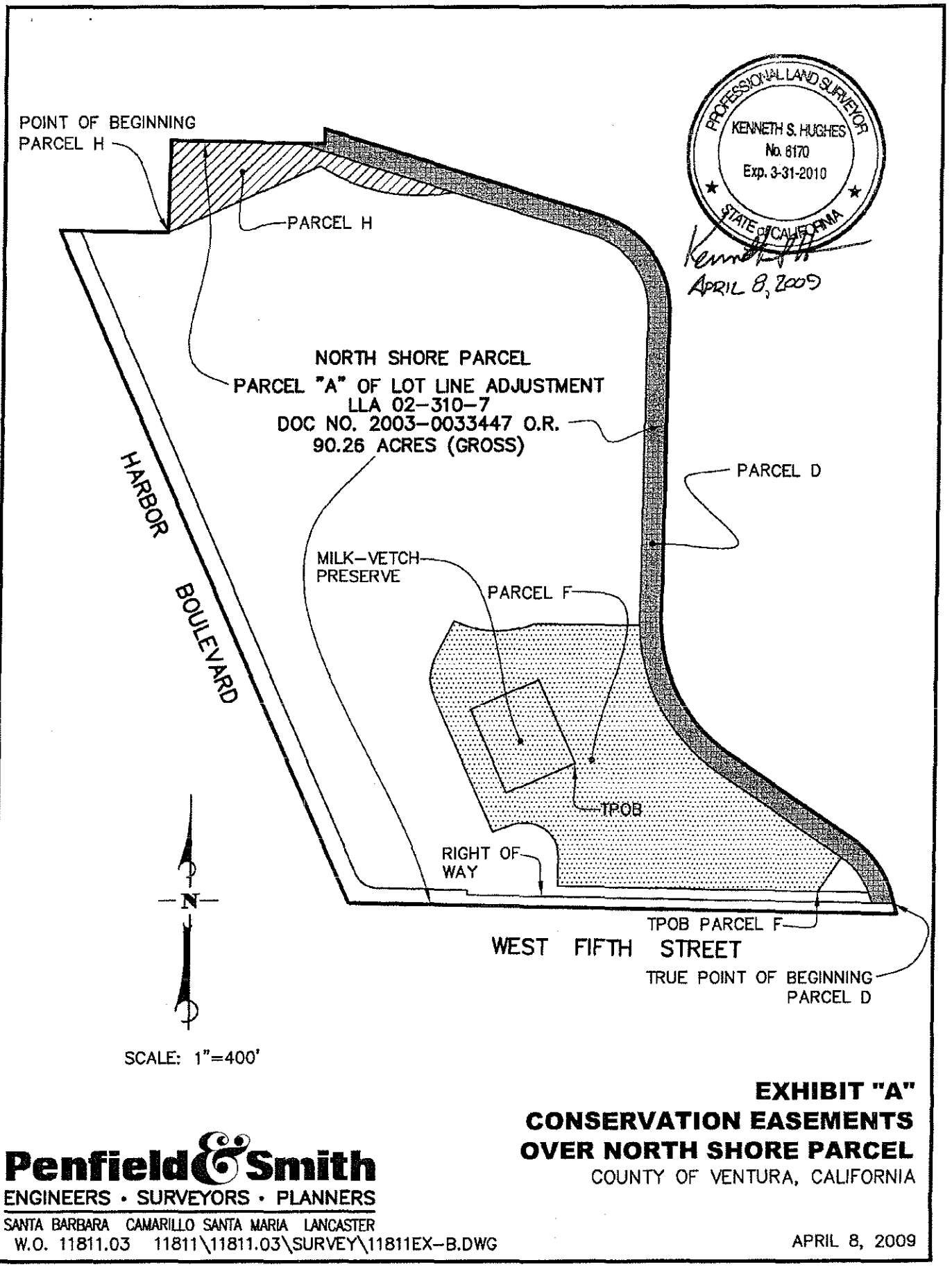

EXHIBIT "A"
CONSERVATION EASEMENTS
OVER NORTH SHORE PARCEL
COUNTY OF VENTURA, CALIFORNIA

Penfield & Smith
ENGINEERS • SURVEYORS • PLANNERS
SANTA BARBARA CAMARILLO SANTA MARIA LANCASTER
W.O. 11811.03 11811\11811.03\SURVEY\11811EX-B.DWG

APRIL 8, 2009

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Exhibit "B"
Easement Parcels D, F, H & MILK-VETCH PRESERVE

Legal Description

Those portions of the land, in the County of Ventura, State of California, as shown on the map filed in the office of the County Recorder of said County, in Book 50, Pages 64 through 66, inclusive, of Record of Surveys, described as follows:

Parcel D

Commencing at the southeasterly corner of Parcel "A", as described in the document recorded in the office of said County Recorder January 31, 2003, as Instrument No. 2003-0033447-00 of Official Records; thence, along the easterly line of said Parcel "A", North 13°45'10" West, 35.20 feet to the True Point of Beginning;

Thence, along said easterly line and northerly line of said Parcel "A", the following seven (7) courses:

1st, North 13°45'10" West, 22.60 feet to the beginning of a curve concave southwesterly having a radius of 319.99 feet;

2nd, northwesterly, along said curve, through a central angle of 41°38'48", an arc distance of 232.59 feet;

3rd, North 55°23'58" West, 492.85 feet to the beginning of a curve concave northeasterly having a radius of 529.98 feet;

4th, northwesterly, along said curve, through a central angle of 56°17'01", an arc distance of 520.62 feet;

5th, North 00°53'03" East, 1,007.58 feet to the beginning of a curve concave southwesterly having a radius of 319.99 feet;

6th, northwesterly, along said curve, through a central angle of 73°32'05", an arc distance of 410.68 feet;

7th, North 72°39'02" West, 948.79 feet to the most northerly corner of said Parcel "A";

Thence, 8th, continuing along the boundary of said Parcel "A", South 01°13'38" West, 47.05 feet to an angle point therein;

Thence, 9th, North 88°47'04" West, 89.26 feet to a line parallel with and distant southerly 70.00 feet, measured at right angles, from said northerly line;

Thence, 10th, along said parallel line, South 72°39'02" East, 1,021.47 feet to the beginning of a curve concave southwesterly having a radius of 249.99 feet;

W:\WORK\11811\11811.03\SURVEY\LEGAL\KSH-PCLS-DFH-LEGAL.DOC
R:\ACAD\WORK\11811\11811.03\SURVEY\11811EX-B.DWG

Penfield & Smith

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Thence, continuing concentric and parallel with said northerly and easterly lines of said Parcel "A", and distant southerly and westerly 70.00 feet therefrom, the following six (6) courses:

11th, southeasterly, along said curve, through a central angle of 73°32'05", an arc distance of 320.84 feet;

12th, South 00°53'03" West, 1,007.58 feet to the beginning of a curve concave northeasterly having a radius of 599.98 feet;

13th, southeasterly, along said curve, through a central angle of 56°17'01", an arc distance of 589.38 feet;

14th, South 55°23'58" East, 492.85 feet to the beginning of a curve concave southwesterly having a radius of 249.99 feet;

15th, southeasterly, along said curve, through a central angle of 41°38'48", an arc distance of 181.71 feet;

16th, South 13°45'10" East, 3.89 feet to a line parallel with and distant northerly 34.00 feet, measured at right angles, from the centerline of West Fifth Street;

Thence, 17th, along said parallel line, South 88°47'04" East, 72.46 feet to the True Point of Beginning.

Containing 5.78 acres, more or less.

Parcel F

Commencing at the southeasterly corner of Parcel "A", as described in the document recorded in the office of said County Recorder January 31, 2003, as Instrument No. 2003-0033447-00 of Official Records, said point being in the centerline of West Fifth Street; thence, along said centerline and the southerly line of said Parcel "A", North 88°47'04" West, 258.69 feet; thence, at right angles, North 01°12'56" East, 68.00 feet to the True Point of Beginning;

Thence, 1st, parallel with said centerline, North 88°47'04" West, 848.64 feet;

Thence, 2nd, North 00°37'00" East, 98.78 feet to the beginning of a curve concave southwesterly having a radius of 110.00 feet;

Thence, 3rd, northwesterly, along said curve, through a central angle of 109°55'28", an arc distance of 211.04 feet;

Thence, 4th, South 70°41'32" West, 72.70 feet;

Penfield&Smith

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Thence, 5th, North 23°34'50" West, 487.28 feet to the beginning of a non tangent curve concave easterly, having a radius of 150.44 feet and a radial center which bears North 66°29'59" East;

Thence, 6th, northerly, along said curve, through a central angle of 50°49'40", an arc distance of 133.46 feet;

Thence, 7th, North 27°24'27" East, 129.75 feet to the beginning of a non tangent curve concave northerly, having a radius of 316.00 feet and a radial center which bears North 26°31'52" East;

Thence, 8th, easterly, along said curve, through a central angle of 48°30'08", an arc distance of 267.50 feet;

Thence, 9th, South 89°06'57" East, 343.69 feet to the beginning of a non tangent curve concave northeasterly, having a radius of 599.98 feet and a radial center which bears North 88°44'33" East, said curve being concentric with and distant westerly 70.00 feet, measured radially, from the easterly line of the hereinabove referred Parcel "A";

Thence, 10th, southeasterly, along said curve, through a central angle of 54°08'31", an arc distance of 566.95 feet;

Thence, continuing concentric and parallel with said easterly line, distant westerly and southwesterly 70.00 feet therefrom, the following two courses:

11th, South 55°23'58" East, 492.85 feet to the beginning of a curve concave southwesterly having a radius of 249.99 feet;

12th, southeasterly, along said curve, through a central angle of 00°33'13", an arc distance of 2.42 feet;

Thence, 13th, South 34°36'02" West, 134.84 feet to the True Point of Beginning.

Containing 15.67 acres, more or less.

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Parcel H

Beginning at the easterly terminus of the third course of Parcel "A", as described in the document recorded in the office of said County Recorder January 31, 2003, as Instrument No. 2003-0033447-00 of Official Records, said course being designated as "T1" in Exhibit "B" of said document;

Thence, 1st, along the northerly line of said Parcel "A", North 01°13'38" East, 299.99 feet to an angle point therein;

Thence, 2nd, continuing along said northerly line, South 88°47'04" East, 410.72 feet to a line parallel with and distant southerly 70.00 feet, measured at right angles, from said northerly line;

Thence, 3rd, along said parallel line, South 72°39'02" East, 535.25 feet to the beginning of a non tangent curve concave northerly, having a radius of 580.21 feet and a radial center which bears North 11°16'07" West;

Thence, 4th, westerly, along said curve, through a central angle of 44°39'28", an arc distance of 452.23 feet;

Thence, 5th, South 66°25'10" West, 540.39 feet to the point of beginning.
Containing 2.63 acres, more or less.

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Penfield&Smith

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Milk-Vetch Preserve

Commencing at the southeasterly corner of Parcel "A", as described in the document recorded in the office of said County Recorder January 31, 2003, as Instrument No. 2003-0033447-00 of Official Records, said point being in the centerline of West Fifth Street; thence, along said centerline and the southerly line of said Parcel "A", North 88°47'04" West, 1063.58 feet; thence, at right angles, North 01°12'56" East, 472.18 feet to the True Point of Beginning;

Thence, 1st, South 66°33'37" West, 242.50 feet;

Thence, 2nd, North 23°26'23" West, 299.00 feet;

Thence, 3rd, North 66°33'37" East, 242.50 feet;

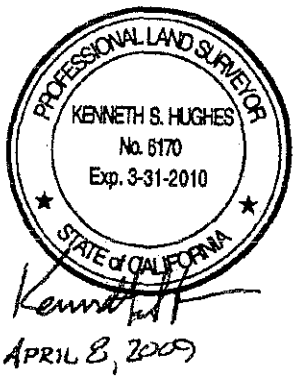
Thence, 4th, South 23°26'23" East, 299.00 feet to the True Point of Beginning.

Containing 1.66 acres, more or less.

The bearings and distances recited for the hereinabove described Parcels D, F, H, and the Milk-Vetch Preserve are based upon the California Coordinate System, Zone 5, NAD 83. To obtain ground level distances, multiply by a combined scale factor of 1.000030361.

Prepared by:

Kenneth S. Hughes
PLS 6170
License expiration
date: 3/31/10



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Penfield & Smith

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CERTIFICATE OF ACCEPTANCE

This is to certify that the interest in real property conveyed by the Conservation Easement Deed dated April 29, 2009, from Mandalay Bay Development LLC to the City of Oxnard, a municipal corporation and governmental agency, is hereby accepted, and pursuant to City Council Resolution 1939, recorded in book 1591, Official Records of Ventura County at page 273, the City Council consents to recordation thereof by its duly authorized officer.

DATED: May 19, 2009

CITY OF OXNARD

By: _____
DR. THOMAS E. HOLDEN, MAYOR

APPROVED AS TO FORM:

_____
ALAN HOLMBERG
CITY ATTORNEY

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APPENDIX F
SAMPLING PROCEDURES

SAMPLING PROCEDURES
NORTH SHORE AT MANDALAY BAY
198 SOUTH HARBOR BOULEVARD
OXNARD, CALIFORNIA

Prepared for

MPL Property Holdings, LLC
2392 Morse Avenue
Irvine, California 92614

Prepared by

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18401 Von Karman Ave, Suite 410
Irvine, California 92612

October 12, 2018

Project Number S041.001.001

terraphase engineering

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CONTENTS

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1.0 FIELD METHODS

1.1 Groundwater Sampling Procedures

1.1.1 Water Level Measurements

All accessible wells scheduled for monitoring will be measured for depth to water from top of casing and total well depth prior to purging. All wells should be measured at the beginning of the monitoring event, before sampling, to obtain time-synchronous water level data. An electronic water level meter, accurate to the nearest +/- 0.01 foot, will be used to measure depth to water in each well. The meter's weighted probe is lowered down the casing to the top of the water column. The graduated markings on the meter's wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. Typically, the measuring device emits a constant tone when the probe is submerged in standing water and most electronic water level meters have a visual indicator consisting of a small light bulb or diode that turns on when the probe encounters water. Total well depth will be measured to the nearest 0.01 foot from the surveyed top of casing by lowering the weighted probe to the bottom of the well. Care should be taken to minimize disturbance in the water column and dislodging any particulate matter attached to the sides or settled at the bottom of the well.

Water level data will be recorded on preprinted water level data sheets. Water level measuring equipment will be decontaminated before and after use in each well as described in Section 1.5, below. Water levels will be measured in wells that have the least amount of known contamination first, and wells with known or suspected contamination will be measured last.

1.1.2 Groundwater Sampling

Groundwater monitoring wells at the site will be purged and sampled using a peristaltic pump and tubing dedicated to each well. The purge and sample tubing is left in each well after sampling for reuse. If no tubing is present in a well at the time of sampling, new tubing will be installed for purging and sampling.

Start sampling at the well with the lowest historical total volatile organic compound (VOC) groundwater concentrations and proceed systematically to the well with the highest historical groundwater concentrations. Check the well box or monument, the well, the lock, and the locking cap for damage or evidence of tampering. Record observations on the appropriate form.

Lay out clean polyethylene sheeting on the ground next to each well for placement of monitoring and sampling equipment. After opening the well box or monument, measure VOCs in the airspace at the rim of the unopened well with a photoionization detector or flame ionization detector and record the reading in the field logbook or field notes.

If the well casing does not have a reference point marked already (usually a V-cut or indelible mark on the well casing), make one. The reference point is normally marked on the north side of the well casing. The reference point should have been previously surveyed for correction of groundwater elevations to the Site's geodetic datum.

Place the bottom of the tubing at the approximate mid-point of the saturated screened portion of the well or to the depth specified for that well by the Project Professional. Use care in placing the tubing so as to not stir up sediment in the well. The bottom of the tubing (sample intake) should be kept at least 2 feet above the bottom of the well to prevent disturbance and resuspension of any sediment present in the bottom of the well. Record the depth to which the tubing is lowered. Before starting the pump, measure the water level again, using a decontaminated water level meter, with the tubing in the well. Leave the water level meter in the well during purging.

Start pumping the well at 200 to 500 milliliters per minute (mL/min). The water level should be monitored approximately every 3 to 5 minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level with less than 0.3 feet of drawdown. Consult previous sampling data for target purge rates for each well. If drawdown is exceeding 0.3 feet during purging, pumping rates should be reduced so drawdown does not exceed 0.3 feet. If drawdown slightly exceeds 0.3 feet and stabilizes, continue purging. Care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record each adjustment made to the pumping rate and the water level measured on the appropriate form immediately after each adjustment.

During purging of the well, monitor and record field indicator parameters of turbidity, temperature, specific conductance, pH, oxidation-reduction potential, and dissolved oxygen approximately every 3 to 5 minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows:

- Temperature: +/- 3 percent (minimum of +/- 0.2 degrees Celsius)
- pH: +/- 0.1
- Specific conductance (conductivity): +/- 3 percent
- Oxidation-reduction potential: +/- 10 millivolts
- Dissolved oxygen: +/- 10 percent for dissolved oxygen for values greater than 0.5 milligrams per liter (mg/L). If three consecutive values are less than 0.5 mg/L the readings are considered stable.
- Turbidity: +/- 10 percent for turbidity values greater than 5 Nephelometric Turbidity Units (NTU). If three consecutive values are less than 5 NTU the readings are considered stable.

Dissolved oxygen and turbidity usually require the longest time to achieve stabilization. The pump must not be removed from the well between purging and sampling.

Collect samples at the flow rate that was used for purging the well. VOC samples must be collected first and directly into laboratory-supplied sample containers. All sample containers should be filled with minimal turbulence by allowing the groundwater to flow from the tubing

gently down the inside of the container. Containers with preservatives should not be overfilled during sample collection due to loss of preservative.

After sample collection, the tubing should be placed back in the well casing and hung for future use. If the tubing requires replacement, then remove and discard the tubing, making a note that new tubing will be required for subsequent monitoring events. Close and lock the well to prevent tampering.

1.2 Soil Sampling Procedures

1.2.1 Surface Soil Sampling

Surface soil samples are considered to be samples collected from the upper 1-foot of soil. Soil sampling locations will be determined in the field based on the specific needs and purpose of the soil sampling. Factors that can affect sample locations include accessibility and visible signs of potential contamination (e.g., stained soils). Soil sample locations and depths will be recorded in the field logbook or field notes as sampling is completed. A sketch of the sample location will be entered into the logbook and any physical reference points will be labeled. If possible, distances to the reference points will be given. Soil sample locations should be exposed using a decontaminated stainless steel hand trowel or similar equipment.

Samples to be analyzed for VOCs will be collected first, as grab samples (independent, discrete samples), using a multi-functional sampling device (MFSD) such as an EnCore™ sampler or Core N' One™ sampler which acts as both a coring tools and airtight storage containers. The analytical laboratory should be consulted prior to sampling to determine the number of MFSD containers required for analysis. The MFSD will be pushed into undisturbed soil for sample collection and sealing in accordance with the manufacturer's instructions. The MSFD sample containers should then be placed into zipper-sealed bags, and labeled with the sample identification, date, and time before being placed in a chilled cooler for transport to the analytical laboratory.

Surface soil samples to be analyzed for other than VOCs will be collected as grab samples (independent, discrete samples) using a stainless steel hand trowel or similar equipment. These soil samples will be placed directly into laboratory-supplied sample containers, usually wide-mouth jars with Teflon®-lined lids, using a stainless steel hand trowel. Sample containers will be filled to the top, taking care to prevent soil from remaining on the top edge of the jar or in the lid threads prior to being closed to prevent potential contaminant migration to or from the sample. See Section 3.0 for preservation and shipping procedures.

1.2.2 Subsurface Soil Sampling

Subsurface soil samples are considered to be samples collected from 12 inches or more below the surface. Soil sampling locations will be determined in the field based on the specific needs and purpose of the soil sampling. Factors that can affect sample locations include accessibility, and visible signs of potential contamination (e.g., stained soils). Soil sample locations and depths will be recorded in the field logbook or field notes as sampling is completed. A sketch of the sample location will be entered into the logbook and any physical reference points will be labeled. If possible, distances to the reference points will be given.

Subsurface soil sampling may be accomplished by several means, including hand auger sampling with grab samples collected directly from the hand auger bucket or from driven core samples, direct-push sampling equipment with driven acetate soil cores, hollow-stem auger drilling with driven core samples, or from excavations where the soil is already exposed and safely accessible for sample collection. All equipment used in sample collection should be decontaminated prior to sampling.

Samples to be analyzed for VOCs will be collected first, as grab samples (independent, discrete samples), using an MFSD, such as an EnCore™ sampler or Core N' One™ sampler which acts as both a coring tools and airtight storage containers. The analytical laboratory should be consulted prior to sampling to determine the number of MFSD containers required for analysis. The MFSD will be pushed into the undisturbed soil core or in situ soil location for sample collection and sealing in accordance with the manufacturer's instructions. The MSFD sample containers should then be placed into zipper-sealed bags and labeled with the sample identification, date, and time before being placed in a chilled cooler for transport to the analytical laboratory.

Subsurface soil samples to be analyzed for other than VOCs will be collected as grab samples (independent, discrete samples) using the soil core, hand auger, or other tool. Soil samples will be transferred from the cores or collected directly using a decontaminated stainless steel hand trowel into laboratory-supplied sample containers, usually wide-mouth jars with Teflon®-lined lids, or capped and sealed in the sample core liner without removal. Sample containers will be filled to the top, taking care to prevent soil from remaining on the top edge of the jar or in the lid threads prior to being closed to ensure the container is sealed without any leaks. The ends of the soil cores will be covered with Teflon®, capped, and sealed with paraffin wax tape or other inert material. Individual soil sample containers should be sealed in zipper-sealed bags. See Section 3.0 for preservation and shipping procedures.

1.3 Soil Gas Sampling Procedures

Soil gas samples will be collected from the soil vapor monitoring probes in accordance with the California Department of Toxic Substances Control (DTSC) and Los Angeles Regional Water Quality Control Board Advisory—Active Soil Gas Investigations (California EPA 2015; the Soil Gas Advisory). Soil gas samples will be collected from the soil vapor monitoring probes using gas-tight glass syringes with Teflon® seals or passivated stainless steel canisters.

1.3.1 Shut-In Test

Prior to purging or sampling, a shut-in test should be conducted to check for leaks in the aboveground sampling system. To conduct a shut-in test, assemble the aboveground valves, lines, and fittings downstream from the top of the probe. Evacuate the system to a minimum measured vacuum of about 100 inches of water using a purge pump or syringe. The test is conducted while the sampling syringe or canister is attached with its valve in the closed position. Observe the vacuum gauge or manometer connected to the system with a "T"-fitting for at least 1 minute or longer. If there is any observable loss of vacuum, the fittings are adjusted until the

vacuum in the sample train does not noticeably dissipate. After a successful shut-in test, the sampling train should not be altered. The vacuum gauge or manometer should be calibrated and sensitive enough to indicate a water pressure change of 0.5 inches.

1.3.2 Leak Test

A leak test will be performed to evaluate whether ambient air is introduced into the soil gas sample during the collection process. A leak test will be conducted at every soil gas well each time a soil gas sample is collected to evaluate the integrity of the sample. Introducing ambient air may result in an underestimation of actual concentrations or, alternatively, may introduce external contaminants into samples from ambient air.

The leak test will be performed using a tracer that is not associated with the compounds detected at the Site (e.g., 2-propanol, isobutene, or similar) as a leak check compound. A rag dampened with the tracer will be placed around all connections in the sampling train and at the surface of the probe while purging to detect possible leaks in the probe construction or the sampling system. If the concentration of the leak check compound is greater than or equal to 10 times the reporting limit for the target analyte(s), then the cause of the leak will be investigated and corrected, if possible. A second leak test will then be performed to demonstrate the integrity of the sampling system.

1.3.3 Purging and Sampling

The purpose of purging is to remove stagnant air from the sampling system so that representative samples can be collected from the subsurface. A default of three purge volumes will be used. One purge volume includes the internal volume of the tubing and probe tip and the void space of the sand pack around the probe tip.

Purging will be conducted immediately after the shut-in test. Each probe will be purged at flow rates between 100 to 200 mL/min and vacuums less than 100 inches of water will be maintained during purging and sampling. A flow rate greater than 200 mL/min may be used when purging times are excessive; however, a vacuum of 100 inches of water or less must be maintained. The vacuum gauge or manometer used to measure vacuum should be calibrated and in good working order. When purging at rates of greater 200 mL/min, reduce the flow rate to 200 mL/min for sampling.

Immediately following purging, soil vapor samples will be collected in gas-tight glass syringes with Teflon® seals or passivated stainless steel canisters. Syringes should be checked for leaks before each use by closing the exit valve and attempting to force ambient air through the needle. The samples will then be taken directly to the mobile laboratory for analysis and handled in a manner that will prevent photodegradation of the target analytes.

Following soil gas sample collection, the probe tubing will remain in place for subsequent sampling events, as needed. The sample tubing will be plugged with a gas-tight fitting and pushed downhole inside the well box and secured to prevent tampering for use during subsequent sampling events, as required.

1.4 Soil Vapor Extraction System sampling

Samples of the soil vapor extracted at the site will be collected from several locations, including at individual soil vapor extraction wells, and the combined vapor stream prior to, and after treatment by the carbon adsorption vessels. Samples will be collected in passivated stainless steel canisters or Tedlar bags using a lung sampler for transport to the analytical laboratory. If the samples are being analyzed by an on-site mobile laboratory, then the samples may be collected in gas-tight glass syringes with Teflon® seals. Care will be taken to ensure sufficient sample volume is collected for the intended laboratory analysis.

1.5 Decontamination

Prior to the start of work, all reusable, non-dedicated equipment will be decontaminated. All equipment that comes into contact with soil and/or groundwater during the collection of environmental samples for analysis will be unused, clean, and disposable or thoroughly decontaminated prior to its use at each drilling or sampling location Disposable equipment intended for one-time use, such as disposable bailers, sampling spigots, and nylon string, will not be decontaminated, but will be packaged for appropriate disposal after use at a single sampling location.

All reusable equipment that comes into contact with soil and/or groundwater will be thoroughly cleaned (decontaminated). Sampling equipment will be cleaned prior to use at each sampling location/interval. Equipment will be steam-cleaned or washed and scrubbed in a solution of laboratory-grade, non-phosphate detergent and potable water to remove all visible dirt; rinsed with clean potable water; and allowed to air dry. If possible, the final rinse water should also be organic-free (if sampling is being conducted for VOCs) or metal-free (if sampling for metals). Larger sampling equipment, such as pumps for purging wells, will be thoroughly cleaned by rinsing, inside and out, with a steam-cleaner, then a potable water rinse, followed by a final distilled/deionized organic-free spray rinse.

Decontamination water will be replaced at a minimum daily, or during the work day when notable amounts of dirt or other contaminants are present in the detergent wash or rinse water. Water generated during decontamination procedures will be containerized and stored on Site in properly labeled 55-gallon drums. Decontaminated equipment should be placed on clean polyethylene sheeting and allowed to air dry after decontamination and prior to its next use.

2.0 QUALITY CONTROL

2.1 Equipment Blanks

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring laboratory supplied organic-free water over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for the same analytes as the primary sample collected before the equipment was decontaminated.

The equipment rinsate blanks will be preserved, packaged, and sealed in the same manner as the primary samples. A separate sample number and station number will be assigned to each equipment blank sample, and it will be submitted blind to the laboratory.

2.2 Field Blanks

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to ambient conditions or from sample containers. Field blank samples will be obtained by pouring laboratory supplied organic-free water into a sampling container at the sampling point. The field blanks that are collected will be analyzed for the same analytes as the primary samples.

The field blanks will be preserved, packaged, and sealed in the same manner as the primary samples. A separate sample number and station number will be assigned to each field blank sample, and it will be submitted blind to the laboratory.

2.3 Trip Blanks

Trip blanks will be prepared to evaluate if the shipping and handling procedures are introducing contaminants into the samples and if cross contamination in the form of VOC migration has occurred between the collected samples. A minimum of one trip blank will be submitted to the laboratory for analysis with every shipment of samples for VOC analysis. Trip blanks are 40-milliliter (mL) vials that have been filled with laboratory-grade water that has been purged so it is VOC free and shipped with the empty sampling containers to the site or sampling area prior to sampling. The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same cooler with the samples collected for volatile analyses. The trip blanks will be preserved, packaged, and sealed in the manner described for the primary samples. A separate sample number and station number will be assigned to each trip sample, and it will be submitted blind to the laboratory.

2.4 Temperature Blanks

For each cooler that is shipped or transported to an analytical laboratory a container of water will be included that is marked “temperature blank.” This blank will be used by the sample custodian to check the temperature of samples upon receipt.

2.5 Field Duplicate or Replicate Samples

Duplicate soils samples will be collected at a frequency of approximately 10 percent (1 in 10 samples) of the primary samples. Soil samples to be analyzed for all analytes, with the exception of volatiles, will be homogenized with a trowel in a sample-dedicated disposable pail. Homogenized material from the bucket will then be transferred to the appropriate wide-mouth glass jars for both the regular and duplicate samples. All jars designated for a particular analysis will be filled sequentially before jars designated for another analysis are filled. Soil samples for VOC analyses will not be homogenized. Equivalent samples from a co-located location will be collected identically to the original samples, assigned unique sample numbers and sent blind to the laboratory.

Duplicate water samples will be collected at a frequency of approximately 10 percent (1 in 10 samples) of the primary samples. When collecting duplicate water samples, samples for VOCs will be collected first (the primary sample and then the duplicate). All containers designated for a particular analysis will be filled sequentially (primary sample and then the duplicate sample) before containers designated for another analysis are filled.

Replicate soil vapor samples will be collected at a frequency of approximately 10 percent (1 in 10 samples) of the primary samples. When collecting replicate soil vapor samples, the primary and replicate sample will be collected sequentially, without delay between collection times.

Duplicate samples will be preserved, packaged, and sealed in the same manner as other samples of the same matrix. A separate sample number and station number will be assigned to each duplicate, and it will be submitted blind to the laboratory.

2.6 Split Samples

Split samples may be collected at the request of the DTSC. Split samples will be collected using the same procedures, preservation, and other protocols as the primary samples and relinquished to the DTSC.

3.0 SAMPLE CONTAINERS, PRESERVATION, PACKAGING, AND SHIPPING

This section describes the types of containers to be used and the procedures for preserving, packaging, and shipping samples. Information concerning the number/type of sample containers, volumes, and preservatives should be obtained from the analytical laboratory prior to sampling. The containers are pre-cleaned and will not be rinsed prior to sample collection. Preservatives, if required, will be added by the analytical laboratory to the containers prior to delivery of the sampling materials.

3.1 Soil Samples

3.1.1 Volatile Organic Compounds

Soil samples to be analyzed for VOCs will be stored in their sealed MFSD samplers for no more than 2 days prior to analysis. Samples will be chilled to 4 degrees Celsius immediately upon collection.

3.1.2 Metals and Other Organic Compounds

Soil samples for non-VOC organic analyses will be placed into 8-ounce, wide-mouth glass jars using a trowel. Alternatively, samples will be retained in the sleeve in which collected until sample preparation begins. The samples will be chilled to 4 degrees Celsius immediately upon collection.

3.2 Water Samples

3.2.1 Volatile Organic Compounds

Water samples to be analyzed for volatile organic compounds will be collected in 40-mL glass vials preserved with hydrochloric acid by the laboratory prior to sample container delivery. The sample vials will be filled so that there is no headspace. The vials will be inverted and checked for air bubbles to ensure zero headspace. If a bubble appears, the vial will be discarded and a new sample will be collected. The samples will be chilled to 4 degrees Celsius immediately upon collection.

3.2.2 Other Analyses

Water samples collected for other analyses such as metals, general chemistry, and semivolatile organic compounds analyses will be collected in appropriately preserved bottles (if required) provided by the laboratory prior to sample container delivery. The samples will be chilled to 4 degrees Celsius immediately upon collection.

3.3 Air Samples

Air samples that are collected for on-site analysis by a mobile laboratory will be collected in gas-tight glass syringes with Teflon® seals and taken immediately to the mobile laboratory for analysis. Air samples that will require transport to an offsite analytical laboratory will be

collected in passivated stainless steel canisters or Tedlar bags. Air samples will be handled and transported in a manner that will prevent photodegradation of the target analytes. Air samples are not required to be chilled during transport to the laboratory.

3.4 Packaging and Shipping

All sample containers will be placed in a strong-outside cooler capable of withstanding shipment to a laboratory, if required. The following outlines the packaging procedures that should be followed:

1. When ice is used, pack it in double zipper-sealed bags. Seal the drain plug of the cooler with fiberglass tape to prevent melting ice from leaking out of the cooler.
2. Line the bottom of the cooler with bubble wrap to prevent breakage during shipment.
3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of the sample bottles with indelible ink.
4. Secure bottle/container tops with clear tape and custody seal all container tops.
5. Affix sample labels onto the containers with clear tape.
6. Wrap all glass sample containers in bubble wrap to prevent breakage.
7. Seal all sample containers in heavy duty plastic zipper-sealed bags. Write the sample numbers on the outside of the plastic bags with indelible ink.
8. Place samples in a sturdy cooler(s) lined with a large plastic trash bag. Enclose the appropriate chain-of-custody forms in a zipper-sealed bag affixed to the underside of the cooler lid.
9. Fill empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment. Place vermiculite in the cooler to absorb spills if they occur.
10. Double seal the ice used to cool samples in two zipper-sealed bags and place on top and around the samples to chill them to the correct temperature.
11. Securely tape each ice chest shut with fiberglass strapping tape, and affix custody seals to the front, right, and back of each cooler.

4.0 FIELD DOCUMENTATION

This section discusses record keeping in the field. This may be accomplished through a combination of logbooks, preprinted forms, photographs, or other documentation.

4.1 Field Logbooks

Use field logbooks to document where, when, how, and from whom any vital project information was obtained. Logbook entries should be complete and accurate enough to permit reconstruction of field activities. Maintain a separate logbook for each sampling event or project, using consecutively numbered pages. All entries should be legible, written in black ink, and signed by the individual making the entries. Use factual, objective language.

At a minimum, the following information will be recorded during the collection of each sample:

- Sample location and description
- Site or sampling area sketch showing sample location and measured distances
- Sampler's name(s)
- Date and time of sample collection
- Type of sample (soil, sediment or water)
- Type of sampling equipment used
- Field instrument readings and calibration
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.)
- Preliminary sample descriptions (e.g., for soils: clay loam, very wet; for water: clear water with strong ammonia-like odor)
- Sample preservation
- Lot numbers of the sample containers, sample identification numbers and any explanatory codes, and chain-of-custody form numbers
- Shipping/courier arrangements (overnight air bill number/courier company)
- Name(s) of recipient laboratory(ies)

In addition to the sampling information, the following specific information will also be recorded in the field logbook for each day of sampling:

- Team members and their responsibilities

- Time of arrival/entry on site and time of site departure
- Other personnel on site
- Summary of any meetings or discussions with tribal, contractor, or federal agency personnel
- Deviations from sampling plans, site safety plans, and Quality Assurance Project Plan procedures
- Changes in personnel and responsibilities with reasons for the changes
- Levels of safety protection

Calibration readings for any equipment used and equipment model and serial number

4.2 Field Notes and Forms

Field notes and forms are used to augment, or sometimes replace, field logbooks for documenting field activities. Like logbook entries, field notes and forms should be legible, complete, and accurate enough to permit reconstruction of field activities. If a field logbook is not used, the items listed in Section 4.1 should be recorded on the field notes and forms for proper documentation.

4.3 Photographs

Photographs, if taken, will be taken at the sampling locations and at other areas of interest on the site or sampling area. They will serve to verify information entered in the field logbook. For each photograph taken, the following information will be written in the logbook or recorded in a separate field photography log:

- Time, date, location, and weather conditions
- Description of the subject photographed
- Name of person taking the photograph

4.4 Labeling

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. At a minimum, the sample labels will contain the following information: sample name, date and time of collection, analytical parameter(s), and method of preservation. Every sample, including samples collected from a single location but going to separate laboratories, will be assigned a unique sample number.

4.5 Sample Chain-of-Custody Forms and Custody Seals

All sample shipments for analyses will be accompanied by a chain-of-custody record. Form(s) will be completed and sent with the samples for each laboratory and each shipment (i.e., each day). If multiple coolers are sent to a single laboratory on a single day, form(s) will be completed and sent with the samples for each cooler.

The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone’s custody if it is either in someone’s physical possession, in someone's view, locked up, or kept in a

secured area that is restricted to authorized personnel. The sampling team leader or designee will sign the chain-of-custody form in the “relinquished by” box and note date, time, and air bill number.

A self-adhesive custody seal will be placed across the lid of each sample. For VOC samples, the seal will be wrapped around the cap. The shipping containers in which samples are stored (usually a sturdy picnic cooler or ice chest) will be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated.

5.0 HEALTH AND SAFETY

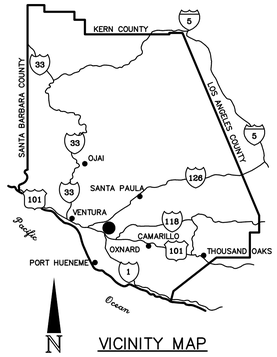
Prior to performing work on site, operating personnel must review and be familiar with the most current version of the Site-specific Health and Safety Plan. The general Health and Safety Plan prepared for use during this project addresses anticipated safety issues for work at the site and provides contacts for site emergencies and a route to the nearest hospital.

APPENDIX G
SVE SYSTEM AS-BUILTS

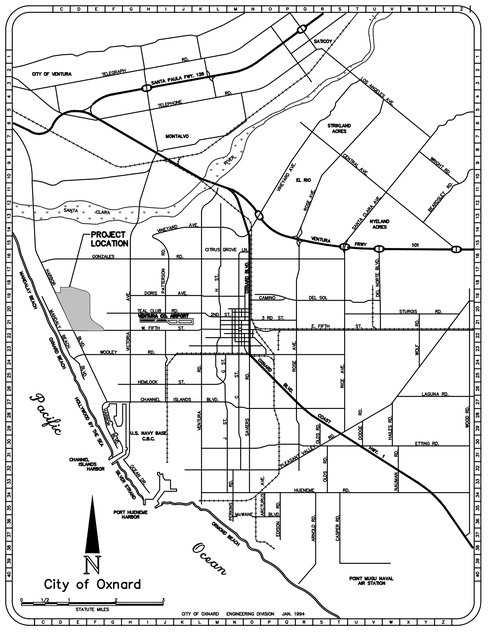
CITY OF OXNARD, CALIFORNIA

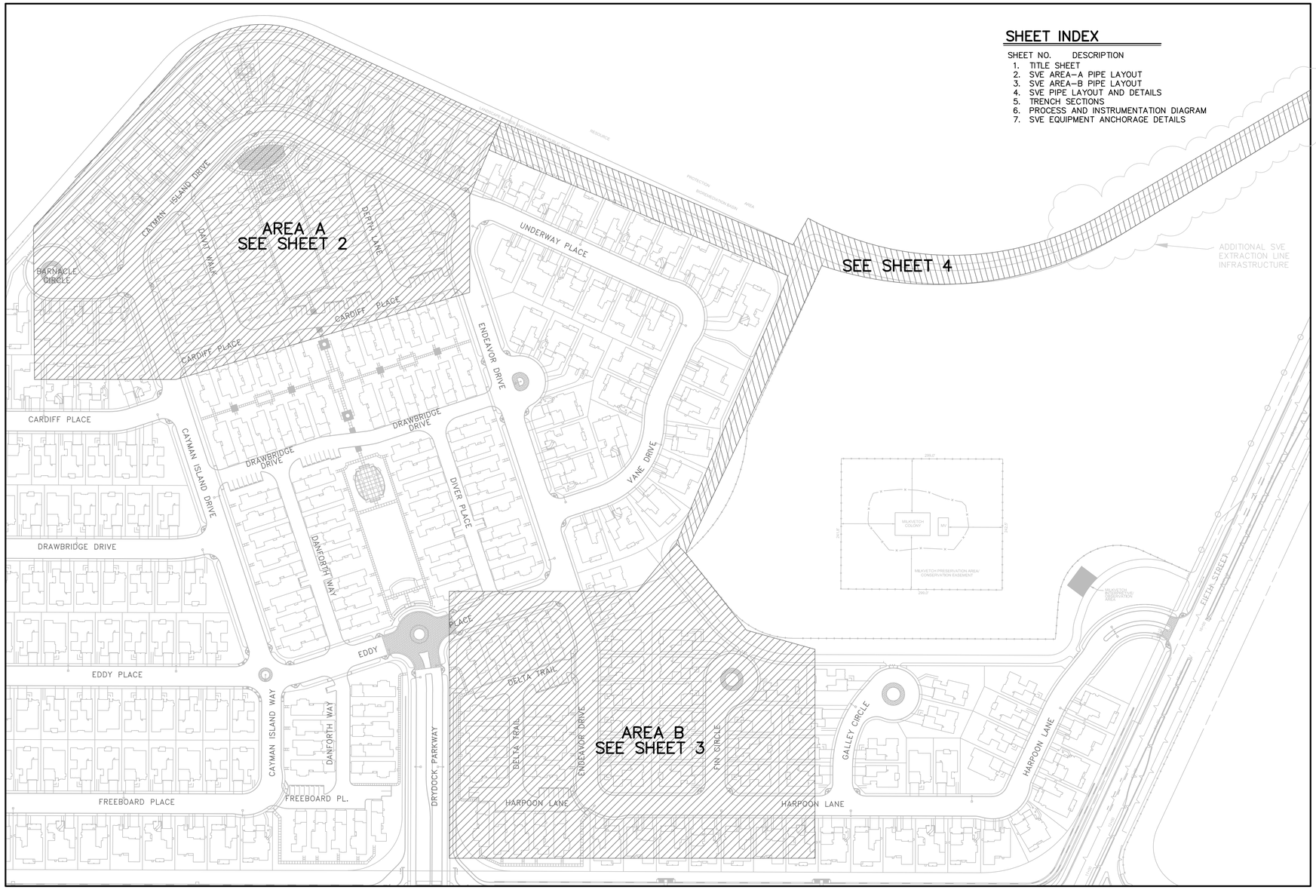
TRACT 5592

SVE PIPING LAYOUT PLAN



VICINITY MAP





SHEET INDEX

ABBREVIATIONS:

A.B.	AGGREGATE BASE
A.C.	ASPHALTIC CONCRETE
A.R.H.M.	ASPHALT RUBBER HOT MIX
B.V.	BUTTERFLY VALVE
B.C.	BEGINNING OF CURVE
B.C.R.	BEGINNING OF CURB RETURN
C.F.	CURB FACE
C&G	CURB AND GUTTER
C.L. OR ℄	CENTER LINE
C.M.P.	CORRUGATED METAL PIPE
CONC.	CONCRETE
CATV	CABLE TELEVISION
D/W	DRIVEWAY
E	EDISON LINE
E.C.	END CURVE
E.C.R.	END OF CURB RETURN
EL.	ELEVATION
E.T.B.	EMULSION TREATED BASE
E.J.	EXPANSION JOINT
F.G.	FINISHED GRADE
F.H.	FIRE HYDRANT
F.L. OR ℄	FLOW LINE
G	GAS LINE
GA.	GAUGE
G.V.	GATE VALVE
I.L.	IRRIGATION LINE
M.H.	MANHOLE
P.C.C.	PORTLAND CEMENT CONCRETE
P.L. OR ℄	PROPERTY LINE
P.N.M.	PROCESSED NATURAL MATERIAL
P.P.	POWER POLE
P.R.C.	POINT OF REVERSE CURVE
PVMT.	PAVEMENT
R	RADIUS
R.C.P.	REINFORCED CONCRETE PIPE
RECONST.	RECONSTRUCT
R/W	RIGHT OF WAY
S	SLOPE
S.D.	STORM DRAIN
S.L.	SURVEY LINE
SS	SANITARY SEWER
STA.	STATION
S/W	SIDEWALK
T	TELEPHONE LINE
T.C.	TOP OF CURB
V.B.	VALVE BOX
VERT.	VERTICAL
W	WATER LINE

APPROVAL

PROJECT ADDRESS
MPL PROPERT□ HOLDINGS LLC
NORTH SHORE - MANDALA□ BA□
1□□ S HARBOR BOULEVARD
O NARD CALIFORNIA

PROJECT OWNER INFORMATION
MPL PARTNERS
23 2 MORSE AVENUE
IRVINE CALIFORNIA

SCALE: 1"=100'
0 100 200 300

SCALE
DRAWN BY: ZJG
CHECKED BY: CER
PROJECT NAME: NORTH SHORE AT MANDALAY BAY
PROJECT NO.: S121-001

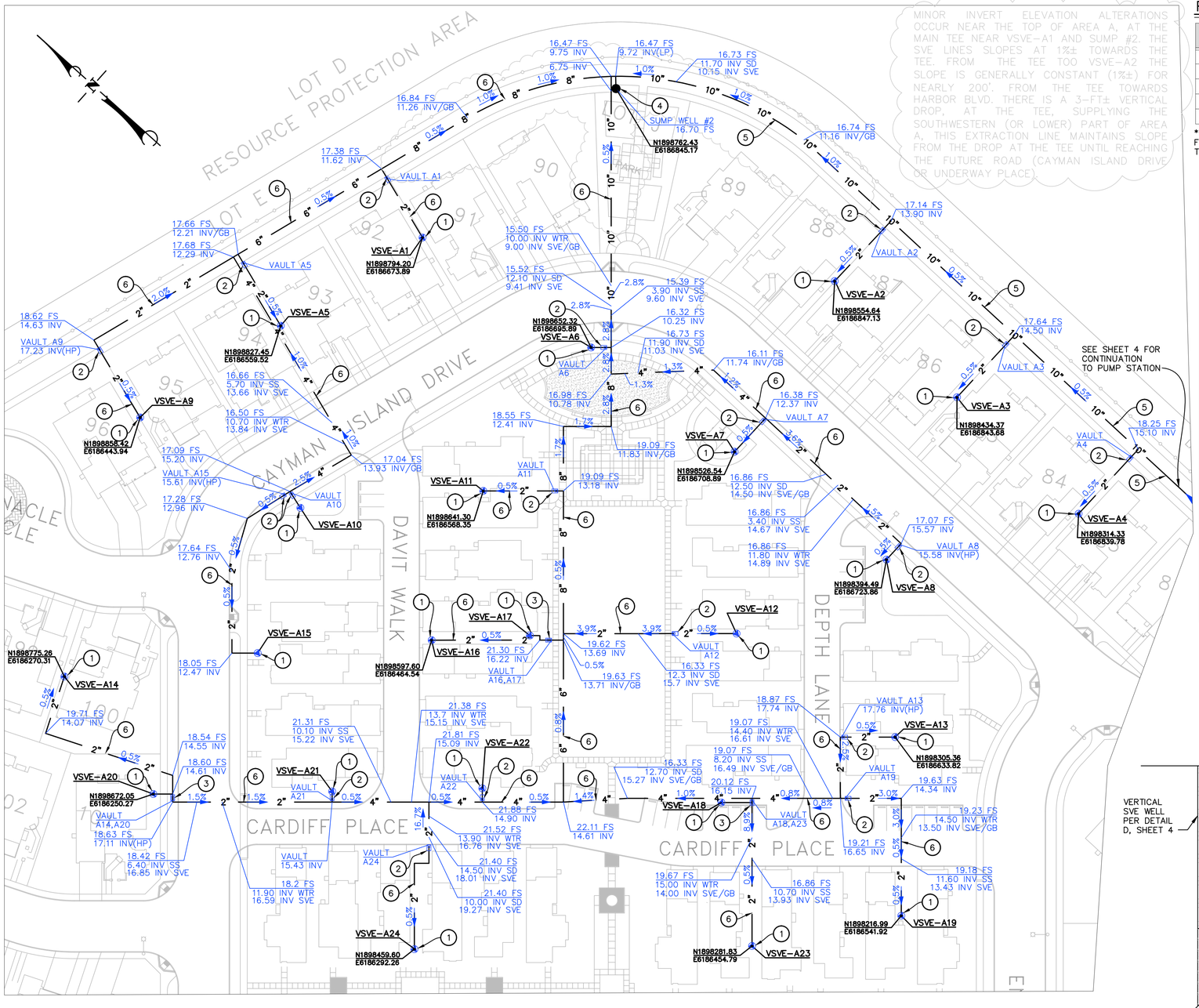
SHEET TITLE
TITLE SHEET
TRACT 55□2, OXNARD, CALIFORNIA

SoundEarth Strategies
WWW.SOUNDEARTHINC.COM

SOUNDEARTH STRATEGIES INC
CALIFORNIA OFFICE:
2□ MAUCHLY, SUITE 213
IRVINE, CALIFORNIA □2□1□

	DATE	REVISION
B	12-0□-1□	AS-BUILTS
A	0□-15-1□	SOIL VAPOR EXTRACTION SYSTEM PLANS

SHEET NO.
1



PIPE LENGTHS:

Pipe Size (dia-inch)	Length (ft)
2	1901
4	684
6	238
8	422
10	1716

*10" PIPE LENGTH IS MEASURED FROM PUMP STATION NOT SHOWN ON THIS SHEET.

SUMP SCHEDULE:

Sump Well #	FS @ Sump Well	Lateral Invert @ Main (ft)	Lateral Invert @ Sump (ft)	Lateral Length (ft)	Bottom of Sump Elveation (ft)	Approx. Sump Well Depth (ft)
1	18.05	5.20	5.08	6.0	1.20	16.85
2	16.70	8.18	8.06	6.0	4.18	12.52
3	20.93	15.49	15.43	3.0	11.49	9.44

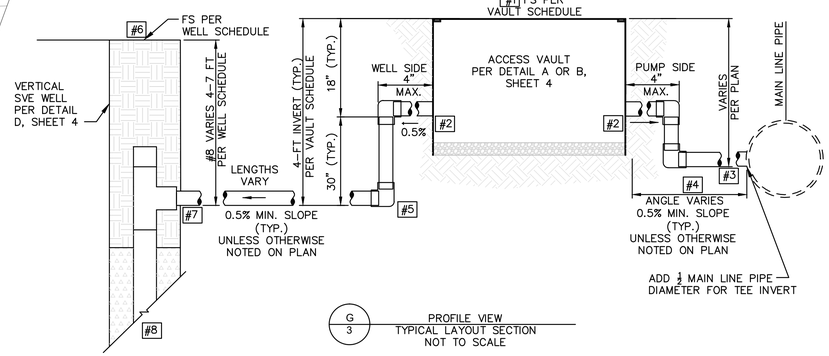
VAULT SCHEDULE:

VAULT #	VAULT: FS (ft) #1	LATERAL INVERT @ VAULT (ft) #2	LATERAL INVERT @MAIN/TRUNK LINE (ft) #3	APPROX. LAT. LENGTH MAIN TO VAULT (ft) #4	LATERAL INVERT TO WELL (ft) #5
A1	17.93	16.43	11.62	6.50	13.93
A2	17.48	15.98	13.90	7.36	13.48
A3	17.98	16.48	14.50	7.28	13.98
A4	18.36	16.86	15.10	6.61	14.36
A5	18.05	16.55	12.21	6.49	14.05
A6	16.35	14.85	10.25	3.14	12.35
A7	16.42	14.92	12.37	1.00	12.42
A8	17.1	15.60	15.57	0.87	13.10
A9	18.73	17.23	14.63	6.48	14.73
A10	17.13	15.63	15.20	1.01	13.13
A11	19.25	17.75	13.18	1.14	15.25
A12	18.18	16.68	13.69	76.67	14.18
A13	19.26	17.76	17.74	0.80	15.26
A14*	18.62	17.12	17.11	0.68	14.62
A15	17.11	15.61	15.20	3.88	13.11
A16*	20.24	18.74	13.71	8.51	16.24
A17*	20.24	18.74	13.71	8.51	16.24
A18*	20.12	18.62	16.15	1.00	16.12
A19	19.48	17.98	16.65	3.41	15.48
A20*	18.62	17.12	17.11	0.68	14.62
A21	21.38	19.88	15.43	1.00	17.38
A22	21.88	20.38	14.90	1.00	17.88
A23*	20.12	18.62	16.15	1.00	16.12
A24	21.69	20.19	15.09	30.48	17.69
*INDICATES A SHARED VAULT					

WELL SCHEDULE:

WELL # (VSVE)	WELL: FS (ft) #6	LATERAL INVERT @ WELL (ft) #7	LATERAL INVERT DEPTH @ WELL (ft) #8
A1	18.17	13.69	4.48
A2	18.02	13.23	4.79
A3	18.68	13.72	4.96
A4	19.40	14.09	5.31
A5	18.64	13.80	4.84
A6	16.36	12.30	4.06
A7	16.74	12.27	4.47
A8	17.38	13.04	4.34
A9	19.18	14.45	4.73
A10	17.96	13.08	4.88
A11	20.40	14.99	5.41
A12	18.90	13.96	4.94
A13	19.70	15.08	4.62
A14	19.56	13.86	5.70
A15	20.12	12.38	7.74
A16	21.30	15.83	5.47
A17	21.00	16.16	4.84
A18	20.19	16.02	4.17
A19	20.40	13.22	7.18
A20	20.30	14.54	5.76
A21	21.90	17.36	4.54
A22	21.90	17.85	4.05
A23	20.90	13.61	7.29
A24	22.10	17.28	4.82

NOTE:
REFER TO SECTION G, BELOW, FOR SYSTEM ASSEMBLY.
NUMBERS ON DETAIL BELOW (#1) REFER TO COLUMNS IN SCHEDULE TABLES ABOVE. MAINTAIN NEGATIVE SLOPE FROM VAULT TO MAIN/TRUNK LINE.



CONSTRUCTION NOTES

1. VERTICAL SOIL VAPOR EXTRACTION (SVE) WELL PER DETAIL D, SHEET 4.
2. SINGLE ACCESS VAULT PER DETAIL A, SHEET 4.
3. DOUBLE ACCESS VAULT PER DETAIL B, SHEET 4.
4. MOISTURE COLLECTION SUMP AND ACCESS VAULT PER DETAIL C, SHEET 4.
5. CONSTRUCT 10" SCHEDULE 40 PVC PIPE FOR VSVE, 1" SCHEDULE 40 PIPE FOR CONDENSATION WATER CONVEYANCE AND 1.5" SCHEDULE 40 PVC ELECTRICAL CONDUIT FOR SUMP WELL #2.
6. CONSTRUCT SCHEDULE 40 PVC PIPE, SIZE AS INDICATED ON PLAN, PER TYPICAL TRENCH SECTION DETAILS ON SHEET 5.

NOTE:
1. ALL PIPING MATERIAL IS TO BE SCHEDULE 40 PVC UNLESS OTHERWISE STATED ON PLAN.
2. ALL PIPING FROM VAULT TO WELL IS TO BE 2" DIAMETER WITH A 0.5% MINIMUM SLOPE UNLESS OTHERWISE STATED ON PLAN.
3. PVC JOINTS SHALL BE GLUED.

LEGEND

2"	PVC PIPE – SIZE AS NOTED WITH DIRECTION OF SLOPE
▲	VERTICAL SVE WELL
●	MOISTURE COLLECTION SUMP WELL
▯	VSVE VAULT
21.6 FS / 17.2 INV SD / 15.0 INV SVE	UTILITY CROSSING, FINISH SURFACE AND INVERT ELEVATIONS
21.6 FS / 17.2 INV	VSVE PIPING INVERT ELEVATION
VSVE-A1 / 14.4 INV	VSVE WELL NUMBER WITH CONNECTING PIPE INVERT
HP	HIGH POINT
LP	LOW POINT

APPROVAL

PROJECT ADDRESS
MPL PROPERTY HOLDINGS LLC
NORTH SHORE - MANDALAY BAY
1 S HARBOR BOULEVARD
OXNARD CALIFORNIA

PROJECT OWNER INFORMATION
MPL PARTNERS
23 2 MORSE AVENUE
IRVINE, CALIFORNIA

SCALE: 1"=40'
0 40 80 120

DRAWN BY	ZJG
CHECKED BY	CER
PROJECT NAME	NORTH SHORE AT MANDALAY BAY
PROJECT NO.	S121-001

SVE AREA-A PIPE LAYOUT
TRACT 55 2, OXNARD, CALIFORNIA

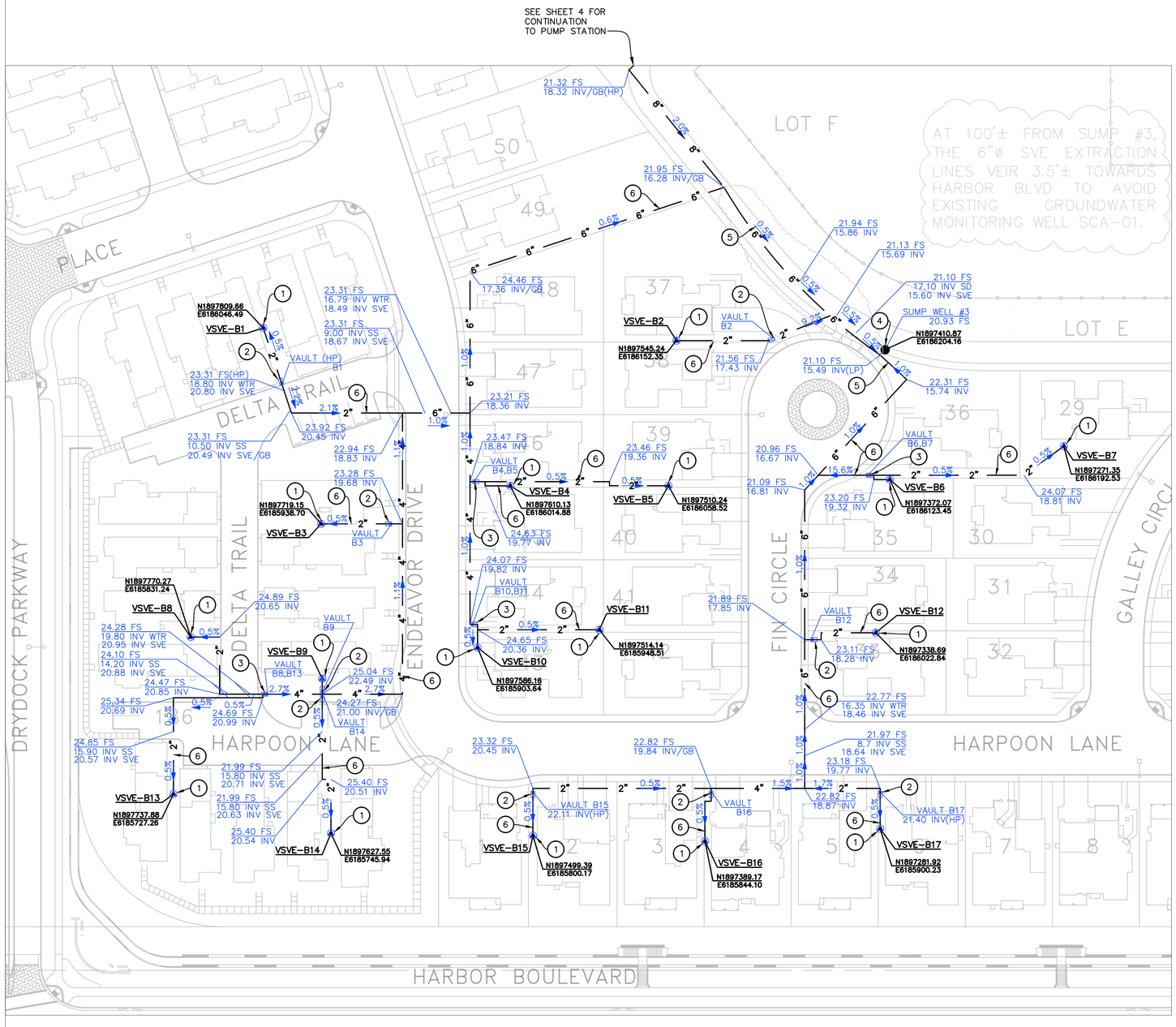
SHEET TITLE

SoundEarth Strategies
WWW.SOUNDEARTHINC.COM

SOUNDEARTH STRATEGIES INC
CALIFORNIA OFFICE:
2 MAUCHLY, SUITE 213
IRVINE, CALIFORNIA 2

DATE	REVISION
12-01-1	AS-BUILTS
0-15-1	SOIL VAPOR EXTRACTION SYSTEM PLANS

SHEET NO.
2



VAULT SCHEDULE:

VAULT #	VAULT: FS (ft) #1	LATERAL INVERT @ VAULT (ft) #2	LATERAL INVERT @MAIN/TRUNK LINE (ft) #3	APPROX. LAT. LENGTH MAIN TO VAULT (ft) #4	LATERAL INVERT TO WELL (ft) #5
B1	23.95	22.45	18.83	97.31	19.95
B2	21.44	19.94	15.69	46.20	17.44
B3	24.51	23.01	19.68	7.46	20.51
B4*	23.82	22.32	18.84	2.00	19.82
B5*	23.82	22.32	18.84	2.00	19.82
B6*	23.34	21.84	16.67	33.51	19.34
B7*	23.34	21.84	16.67	33.51	19.34
B8*	25.00	23.50	22.49	37.50	21.00
B9	25.28	23.78	22.49	1.50	21.28
B10*	24.39	22.89	19.82	1.00	20.39
B11*	24.39	22.89	19.82	1.00	20.39
B12	22.30	20.80	17.85	4.36	18.30
B13*	25.00	23.50	22.49	37.50	21.00
B14	24.82	23.32	22.49	1.00	20.82
B15	23.61	22.11	20.45	2.00	19.61
B16	23.12	21.62	18.84	3.12	19.12
B17	23.49	21.99	20.49	1.35	19.49
* INDICATES A SHARED VAULT					

NOTE:
REFER TO SECTION G, BELOW, FOR SYSTEM ASSEMBLY.
NUMBERS ON DETAIL BELOW (#1) REFER TO COLUMNS IN SCHEDULE TABLES ABOVE.
MAINTAIN NEGATIVE SLOPE FROM VAULT TO MAIN/TRUNK LINE.

WELL SCHEDULE:

WELL # (VSVE)	WELL: FS (ft) #6	LATERAL INVERT @ WELL (ft) #7	LATERAL INVERT DEPTH @ WELL (ft) #8
B1	24.1	19.76	4.34
B2	22.80	17.11	5.69
B3	25.20	20.28	4.92
B4	24.8	19.69	5.11
B5	22.91	19.14	3.77
B6	23.19	19.26	3.93
B7	23.90	18.64	5.26
B8	25.60	20.55	5.05
B9	25.60	21.24	4.36
B10	24.46	20.30	4.16
B11	24.72	19.94	4.78
B12	23.90	18.06	5.84
B13	26.20	20.36	5.84
B14	25.40	20.33	5.07
B15	24.50	19.47	5.03
B16	23.96	18.94	5.02
B17	24.30	19.37	4.93

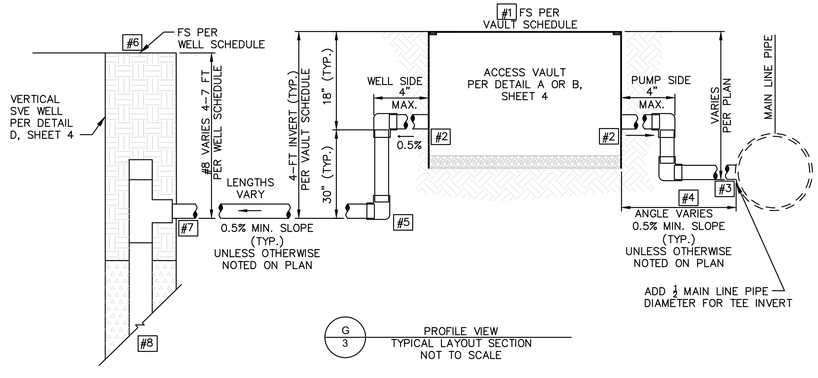
SUMP SCHEDULE:

Sump Well #	FS @ Sump Well	Lateral Invert @ Main (ft)	Lateral Invert @ Sump (ft)	Lateral Length (ft)	Bottom of Sump Elveation (ft)	Approx. Sump Well Depth (ft)
1	18.05	5.20	5.08	6.0	1.20	16.85
2	16.70	8.18	8.06	6.0	4.18	12.52
3	20.93	15.49	15.43	3.0	11.49	9.44

PIPE LENGTHS:

Pipe Size (dia-inch)	Length (ft)
2	1394
4	534
6	824
8	1032

*8" PIPE LENGTH IS MEASURED FROM PUMP STATION NOT SHOWN ON THIS SHEET.



LEGEND

- 2" — PVC PIPE – SIZE AS NOTED WITH DIRECTION OF SLOPE
- VERTICAL SVE WELL
- MOISTURE COLLECTION SUMP
- VSVE VAULT
- 21.6 FS / 17.2 INV SD / 15.0 INV SVE — UTILITY CROSSING, FINISH SURFACE AND INVERT ELEVATIONS
- 21.6 FS / 17.2 INV — VSVE PIPING INVERT ELEVATION
- VSVE-A1 / 14.4 INV — VSVE WELL NUMBER WITH CONNECTING PIPE INVERT
- HP — HIGH POINT
- LP — LOW POINT

SCALE: 1"=40'
0 40 80 120

CONSTRUCTION NOTES

1. VERTICAL SOIL VAPOR EXTRACTION (SVE) WELL PER DETAIL D, SHEET 4.
2. SINGLE ACCESS VAULT PER DETAIL A, SHEET 4.
3. DOUBLE ACCESS VAULT PER DETAIL B, SHEET 4.
4. MOISTURE COLLECTION SUMP AND ACCESS VAULT PER DETAIL C, SHEET 4.
5. CONSTRUCT 8" SCHEDULE 40 PVC PIPE FOR VSVE, 1" SCHEDULE 40 PIPE FOR CONDENSATION WATER CONVEYANCE AND 1.5" SCHEDULE 40 PVC ELECTRICAL CONDUIT FOR SUMP WELL #3.
6. CONSTRUCT SCHEDULE 40 PVC PIPE, SIZE AS INDICATED ON PLAN, PER TYPICAL TRENCH SECTION DETAILS ON SHEET 5.

NOTE:
1. ALL PIPING MATERIAL IS TO BE SCHEDULE 40 PVC UNLESS OTHERWISE STATED ON PLAN.
2. ALL PIPING FROM VAULT TO WELL IS TO BE 2" DIAMETER WITH A 0.5% MINIMUM SLOPE UNLESS OTHERWISE STATED ON PLAN.
3. PVC JOINTS SHALL BE GLUED.

APPROVAL

PROJECT ADDRESS
MPL PROPERTY HOLDINGS LLC
NORTH SHORE - MANDALAY BAY
1 S HARBOR BOULEVARD
OXNARD CALIFORNIA

PROJECT OWNER INFORMATION
MPL PARTNERS
23 2 MORSE AVENUE
IRVINE CALIFORNIA

SCALE: 1"=40'
0 40 80 120

DRAWN BY: ZJG
CHECKED BY: CER
PROJECT NAME: NORTH SHORE AT MANDALAY BAY
PROJECT NO.: S121-001

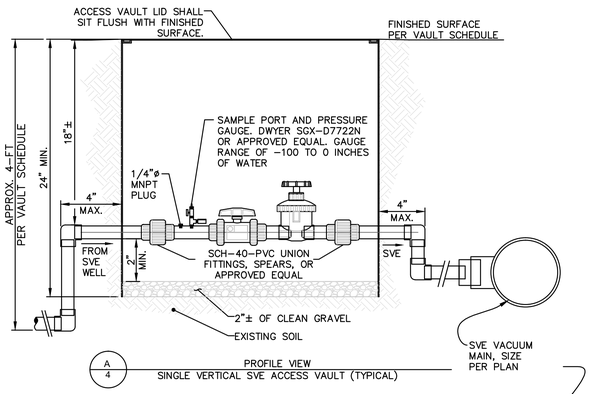
SHEET TITLE
SVE AREA-B PIPE LAYOUT
TRACT 55 2, OXNARD, CALIFORNIA

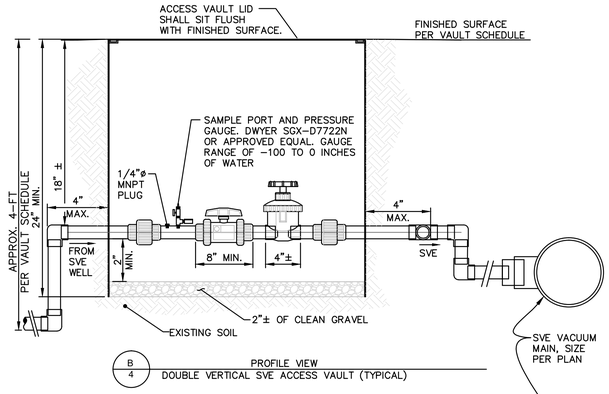
SoundEarth Strategies
WWW.SOUNDEARTHINC.COM

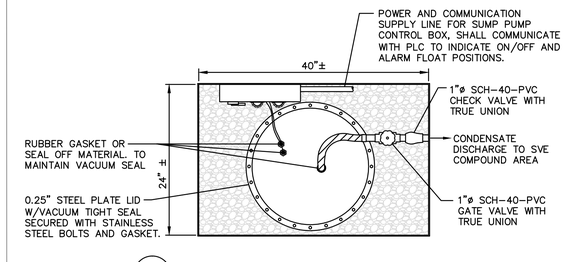
SOUNDEARTH STRATEGIES INC
CALIFORNIA OFFICE:
2 MAUCHLY, SUITE 213
IRVINE, CALIFORNIA 2

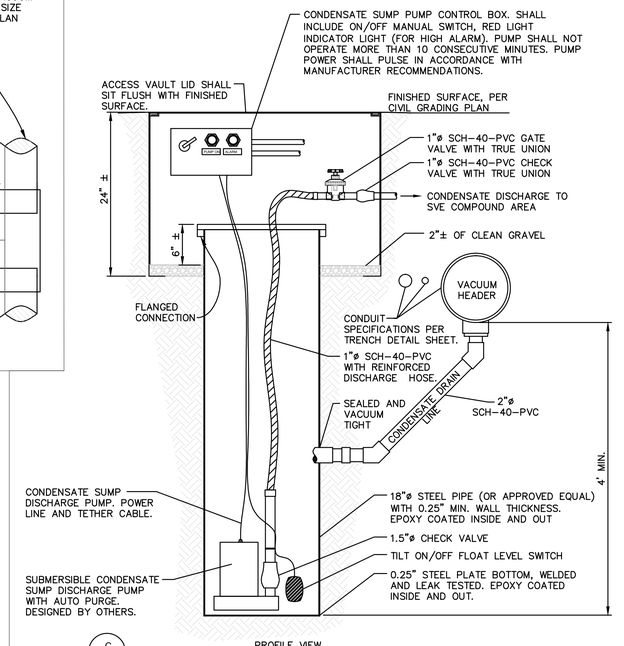
	DATE	REVISION
B	12-0-1	AS-BUILTS
A	0-15-1	SOIL VAPOR EXTRACTION SYSTEM PLANS

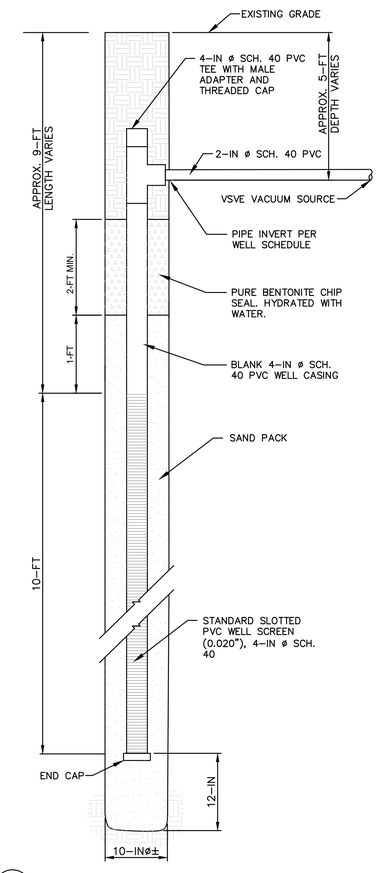
SHEET NO. 3





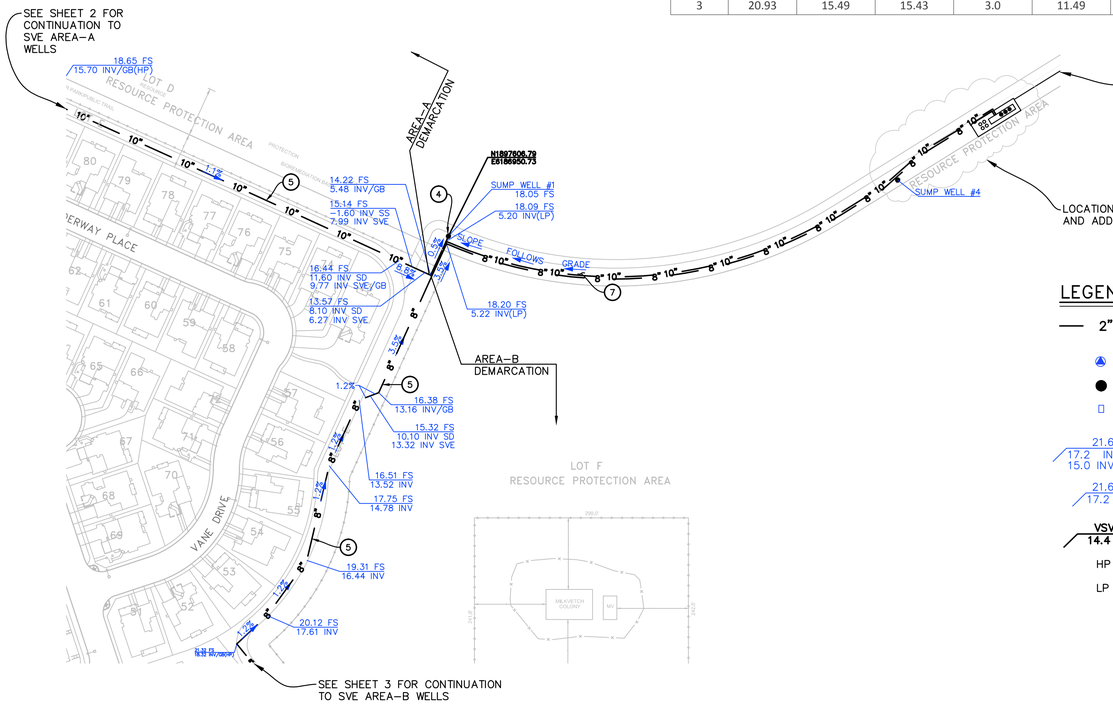






SUMP SCHEDULE:

Sump Well #	FS @ Sump Well	Lateral Invert @ Main (ft)	Lateral Invert @ Sump (ft)	Lateral Length (ft)	Bottom of Sump Elveation (ft)	Approx. Sump Well Depth (ft)
1	18.05	5.20	5.08	6.0	1.20	16.85
2	16.70	8.18	8.06	6.0	4.18	12.52
3	20.93	15.49	15.43	3.0	11.49	9.44



LEGEND

2"	PVC PIPE – SIZE AS NOTED WITH DIRECTION OF SLOPE
	VERTICAL SVE WELL
	MOISTURE COLLECTION SUMP
	VSVE VAULT
21.6 FS / 17.2 INV SD / 15.0 INV SVE	UTILITY CROSSING, FINISH SURFACE AND INVERT ELEVATIONS
21.6 FS / 17.2 INV	VSVE PIPING INVERT ELEVATION
VSVE-A1 / 14.4 INV	VSVE WELL NUMBER WITH CONNECTING PIPE INVERT
HP	HIGH POINT
LP	LOW POINT

CONSTRUCTION NOTES

4. MOISTURE COLLECTION SUMP AND ACCESS VAULT PER DETAIL C, SHEET 4.
5. CONSTRUCT 10" OR 8" (AS NOTED ON PLAN) SCHEDULE 40 PVC PIPE FOR VSVE, 2" SCHEDULE 40 PIPE FOR CONDENSATION WATER CONVEYANCE AND 2" SCHEDULE 40 PVC ELECTRICAL CONDUIT FOR SUMP WELL #1.
7. CONSTRUCT ONE 10" SCHEDULE 40 PVC PIPE, ONE 1" SCHEDULE 40 PVC PIPE AND ONE 1.5" SCHEDULE 40 PVC ELECTRIC CONDUIT CONTINUED FROM AREA-A. CONSTRUCT ONE 8" SCHEDULE 40 PVC PIPE, ONE 1" SCHEDULE 40 PVC PIPE AND ONE 1.5" PVC ELECTRICAL CONDUIT CONTINUED FROM AREA-B. CONSTRUCT ONE 1" SCHEDULE 40 PVC PIPE AND ONE 1.5" SCHEDULE 40 PVC ELECTRICAL CONDUIT FROM SYSTEM PUMPS TO SUMP WELL NO. 1.

GENERAL NOTES:

1. ACCESS VAULTS SHALL NOT BE ALLOWED IN TRAFFIC AREAS AND PLACED ONLY IN AREAS OF LANDSCAPING. HARDSCAPE PLACEMENT IS NOT PERMITTED WITHOUT APPROPRIATE TRAFFIC RATING AND APPROVAL.
2. VAULTS SHALL BE INSTALLED WITH LIDS FLUSH WITH FINISHED SURFACE ELEVATIONS.
3. ALL PIPING SHALL BE SLOPED AT 0.5% MINIMUM DOWN FROM VAULT TO HEADER OR SVE WELL.
4. ALL PIPING SHALL HAVE A 3"± MINIMUM CLEARANCE ALL AROUND, UNLESS AUTHORIZED APPROVAL IS AGREED UPON BY BOTH THE OWNER AND ENGINEER.
5. ALL PIPING, VALVES, AND FITTINGS SHALL BE SCH-40-PVC. ALL CONNECTIONS SHALL BE CEMENTED AND PASS PRESSURE TEST PRIOR TO SYSTEM USE.
6. WITH AUTHORIZATION FROM ENGINEER (OR INSPECTOR) TEE AND ANGLE FITTINGS CAN BE PLACED OUTSIDE OF VAULT, BELOW GRADE SURFACE, TO ALLOW FOR MORE ROOM INSIDE THE VAULT AND POSSIBLY A SMALLER VAULT BOX. AN APPROXIMATE 3" CLEARANCE BETWEEN ALL VALVES, FITTINGS, AND UNIONS ARE STILL REQUIRED FOR OPERATION AND MAINTENANCE.
7. SMALLER VAULTS ARE ALLOWABLE, WITH WRITTEN AUTHORIZATION FROM ENGINEER. GIVEN A CONTRACTOR PROVIDED FIGURE SHOWING ADEQUATE PIPE, FITTING, AND VALVE SIZING CONFORMING WITH GENERAL NOTE 4 SPECIFIED ABOVE.

PROJECT ADDRESS
MPL PROPERTY HOLDINGS LLC
NORTH SHORE - MANDALAY BAY
1□□S HARBOR BOULEVARD
O NARD CALIFORNIA

PROJECT OWNER INFORMATION
MPL PARTNERS
23 2 MORSE AVENUE
IRVINE, CALIFORNIA

APPROVAL

SCALE: 1"=100'
0 100 200 300

DRAWN BY: ZJG
CHECKED BY: CER
PROJECT NAME: NORTH SHORE AT MANDALAY BAY
PROJECT NO.: S121-001

SVE PIPE LA□OUT AND DETAILS
TRACT 55□2, OXNARD, CALIFORNIA

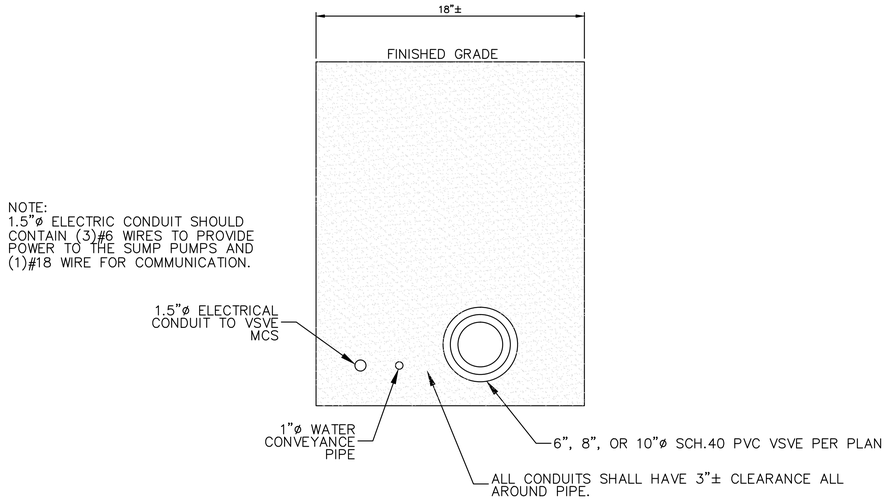
SHEET TITLE

SoundEarth Strategies
WWW.SOUNDEARTHINC.COM

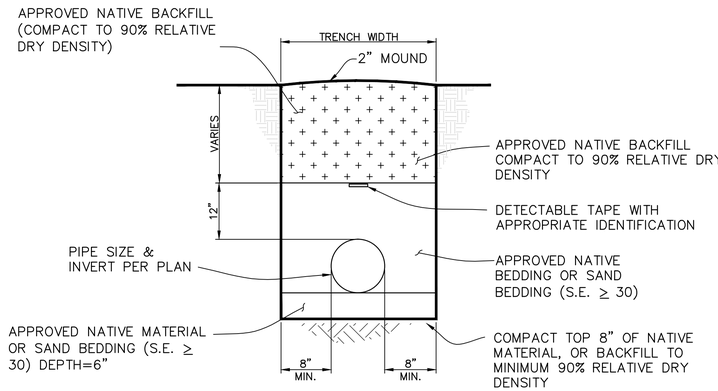
SOUNDEARTH STRATEGIES INC.
CALIFORNIA OFFICE:
2□ MAUCHLY, SUITE 213
IRVINE, CALIFORNIA □2□□

	DATE	REVISION
B	12-0□-1□	AS-BUILTS
A	0□-15-1□	SOIL VAPOR EXTRACTION SYSTEM PLANS

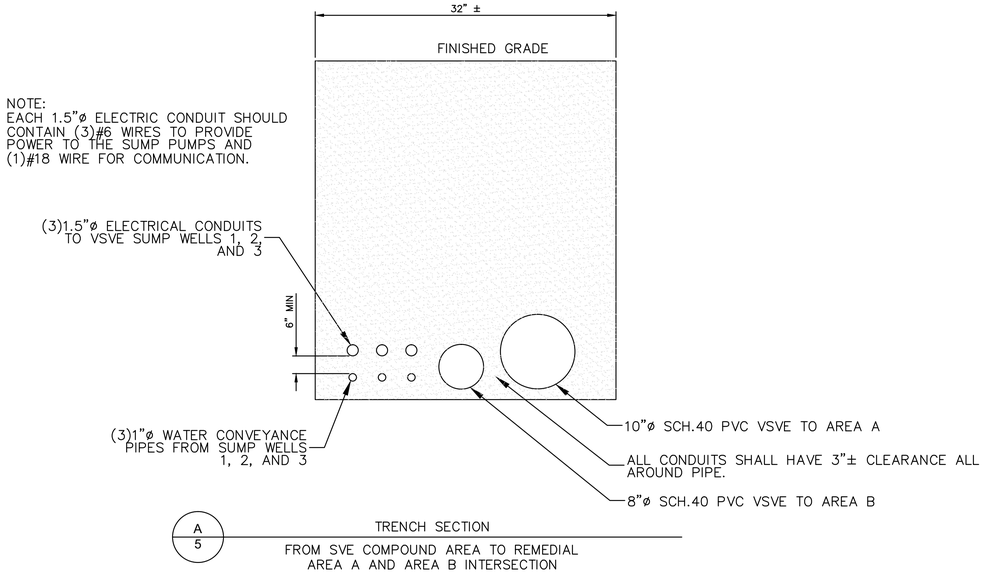
SHEET NO.
4



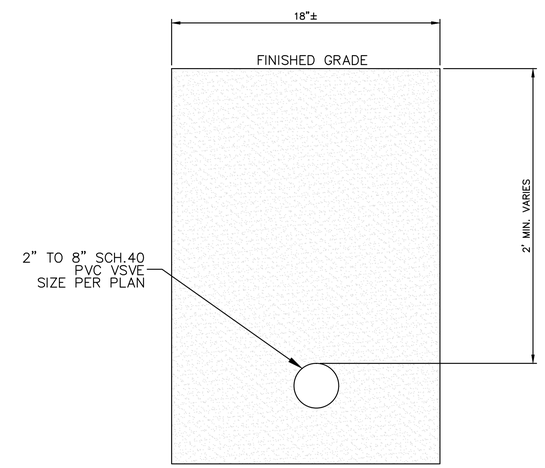
B/5 TRENCH SECTION
FROM DEMARCATION TO REMEDIAL AREA–A AND AREA–B



D/5 TYPICAL TRENCH SECTION FOR SVE PIPE
SCALE: N.T.S.



A/5 TRENCH SECTION
FROM SVE COMPOUND AREA TO REMEDIAL AREA A AND AREA B INTERSECTION



C/5 TRENCH SECTION
SCH.40 PVC TRENCH DETAIL

APPROVAL

PROJECT ADDRESS
MPL PROPERTY HOLDINGS LLC
NORTH SHORE - MANDALAY BAY
1[illegible] S HARBOR BOULEVARD
O[illegible]NARD, CALIFORNIA

PROJECT OWNER INFORMATION
MPL PARTNERS
23[illegible]2 MORSE AVENUE
IRVINE, CALIFORNIA

NOT TO SCALE

SCALE

DRAWN BY: ZJG
CHECKED BY: CER
PROJECT NAME: NORTH SHORE AT MANDALAY BAY
PROJECT NO.: S121-001

SHEET TITLE
TRENCH SECTIONS AND DETAILS
TRACT 55[illegible]2, OXNARD, CALIFORNIA

SoundEarth Strategies
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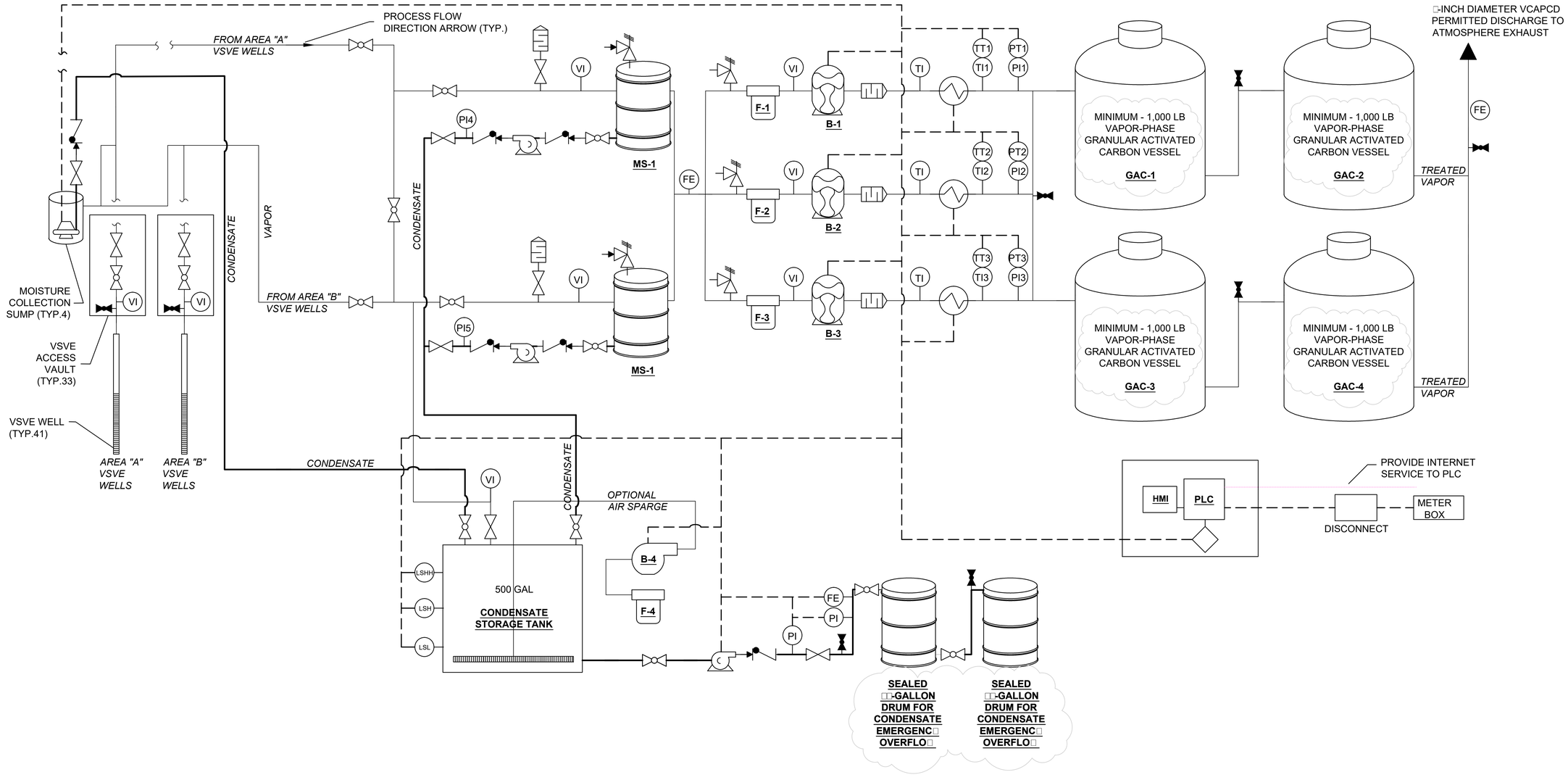
SOUNDEARTH STRATEGIES, INC.
CALIFORNIA OFFICE:
2[illegible] MAUCHLY, SUITE 213
IRVINE, CALIFORNIA [illegible]2[illegible]1[illegible]

	DATE	REVISION
B	12-0[illegible]-1[illegible]	AS-BUILTS
A	0[illegible]15-1[illegible]	SOIL VAPOR EXTRACTION SYSTEM PLANS

SHEET NO.



LEGEND

FE	FLOW ELEMENT
GAC	GRANULAR ACTIVATED CARBON
HMI	HUMAN MACHINE INTERFACE
HSVE	HORIZONTAL SOIL VAPOR EXTRACTION
LSL	LEVEL SWITCH LOW
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH HIGH
PI	PRESSURE INDICATOR
PLC	PROCESS LOGIC CONTROLLER
VCAPCD	VENTURA COUNTY AIR POLLUTION CONTROL DISTRICT
VI	VACUUM INDICATOR
VSVE	VERTICAL SOIL VAPOR EXTRACTION
MS	MOISTURE SEPARATOR
SSG	SANITARY SEWER
TI	TEMPERATURE INDICATOR
TYP	TYPICAL

BALL VALVE
CHECK VALVE
GATE VALVE
SAMPLE PORT
RELIEF VALVE
SILENCER
FILTER
VACUUM BLOWER (REGERATIVE)
VACUUM BLOWER (ROTARY LOBE)
AIR TO AIR HEAT EXCHANGER
CENTRIFUGAL PUMP
SUBMERSIBLE PUMP
LIQUID PROCESS LINE
VACUUM PROCESS LINE
ELECTRIC/SIGNAL
COMMUNICATION

APPROVAL

PROJECT ADDRESS
MPL PROPERT□ HOLDINGS, LLC
NORTH SHORE - MANDALA□ BA□
1□□□S HARBOR BOULEVARD
O□NARD, CALIFORNIA

PROJECT OWNER INFORMATION
MPL PARTNERS
23□2 MORSE AVENUE
IRVINE, CALIFORNIA

SCALE

DRAWN BY: ZJG
CHECKED BY: CER
PROJECT NAME: NORTH SHORE AT MANDALAY BAY
PROJECT NO.: S121-001

SHEET TITLE
PROCESS AND INSTRUMENTATION DIAGRAM P□ID□
TRACT 55□2, OXNARD, CALIFORNIA

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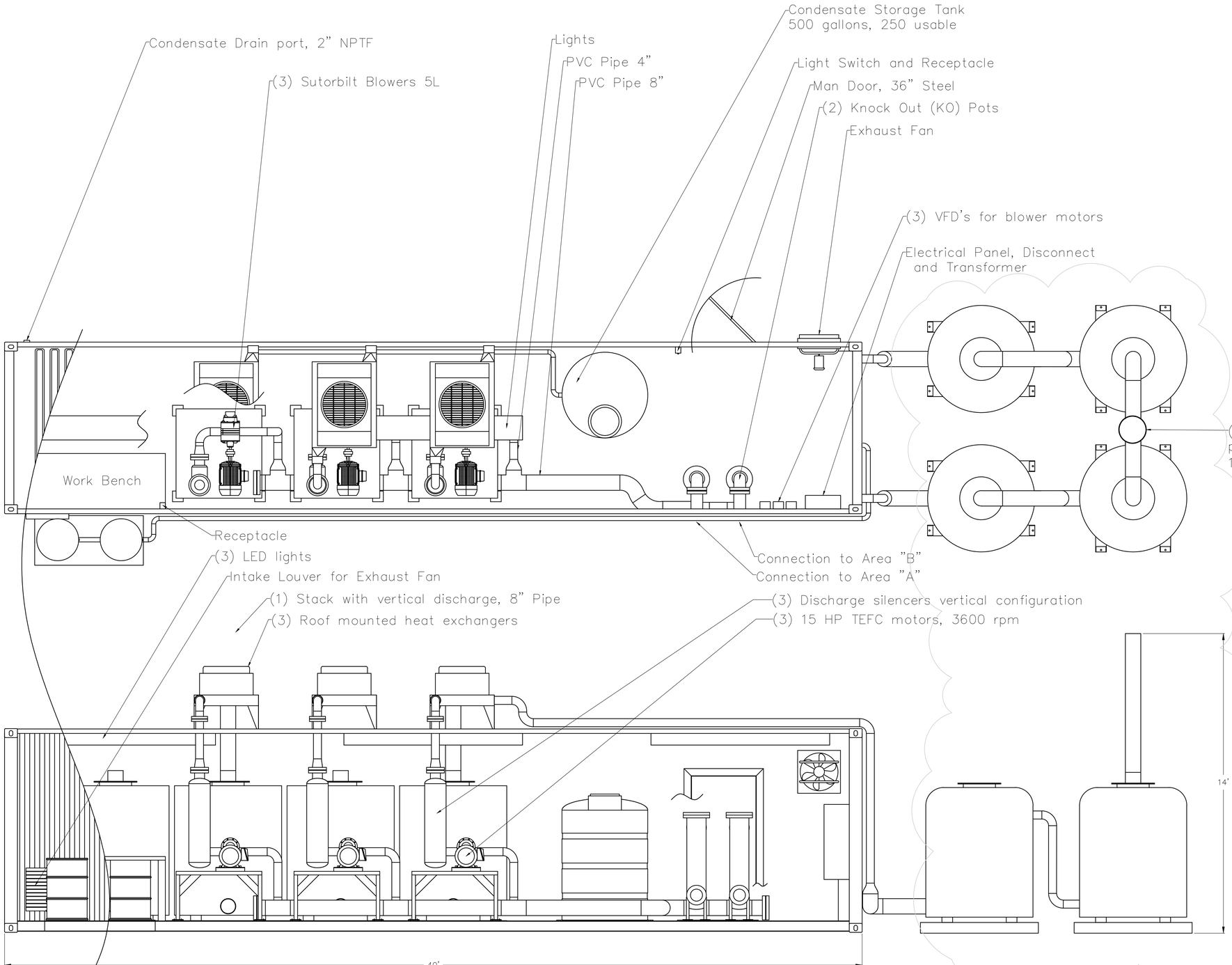
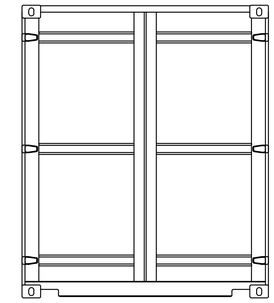
SOUNDEARTH STRATEGIES, INC□
CALIFORNIA OFFICE
2□□MAUCHLY, SUITE 213
IRVINE, CALIFORNIA □2□□

	DATE	REVISION
B	12-0□-1□	AS-BUILTS
A	0□-15-1□	SOIL VAPOR EXTRACTION SYSTEM PLANS
□		SHEET NO.

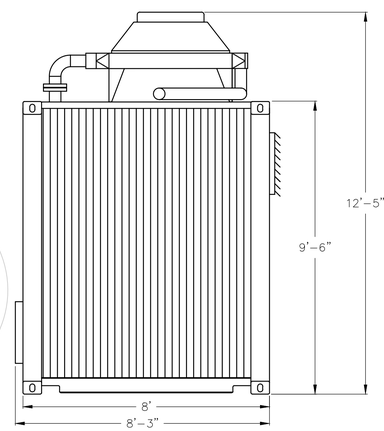
Top View



Cargo Door View



NOTE:
1- REFER TO STRUCTURAL DESIGN SPECIFICATIONS (SHEET 1 OF 1) FOR SVE CONEX BOX FOUNDATION DESIGN, BY STANTEC, DATED JULY, 1, 2016.
2- INTERNAL COMPONENTS SHALL BE SECURELY WELDED, BOLTED, OR STRAPPED DOWN TO CONEX BOX.



APPROVAL

PROJECT ADDRESS
MPL PROPERTY HOLDINGS LLC
NORTH SHORE - MANDALAY BAY
1 S HARBOR BOULEVARD
OXNARD CALIFORNIA

PROJECT OWNER INFORMATION
MPL PARTNERS
23 2 MORSE AVENUE
IRVINE, CALIFORNIA

SCALE

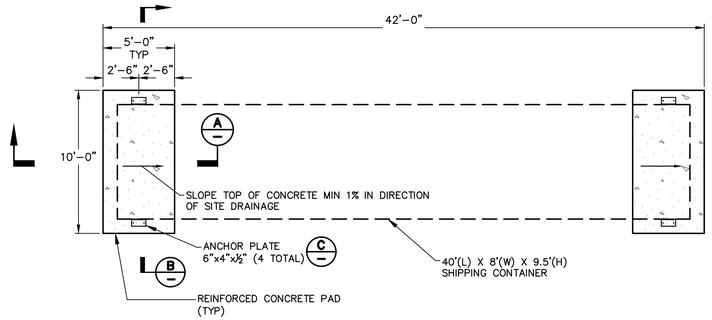
DRAWN BY: ZJG
CHECKED BY: CER
PROJECT NAME: NORTH SHORE AT MANDALAY BAY
PROJECT NO.: S121-001

SHEET TITLE
GENERAL ARRANGEMENT GA-1
SVE EQUIPMENT COMPOUND LAOUT
TRACT 55 2, OXNARD, CALIFORNIA

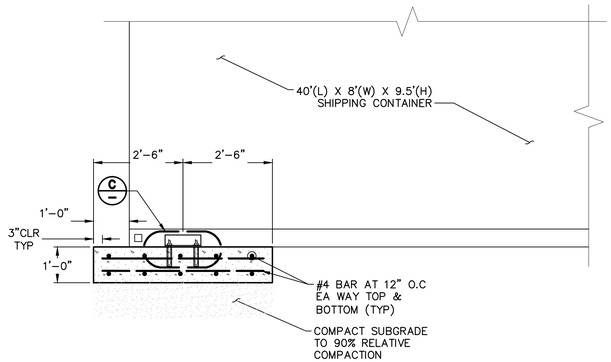
SoundEarth Strategies
WWW.SOUNDEARTHINC.COM

SOUNDEARTH STRATEGIES INC
CALIFORNIA OFFICE
2 MAUCHLY, SUITE 213
IRVINE, CALIFORNIA 2 1

	DATE	REVISION
B	12-01-	AS-BUILTS
A	8-15-1	SOIL VAPOR EXTRACTION SYSTEM PLANS
-		SHEET NO.

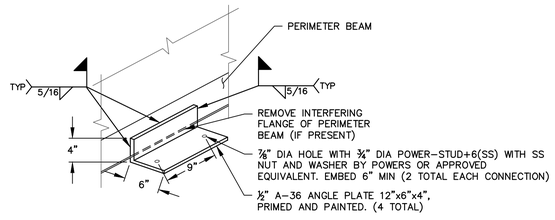


PLAN
SCALE: 1"=5'



SECTION A
SCALE: 1"=2'

SECTION B
SCALE: 1"=2'



BRACKET DETAIL C
SCALE: NTS

Construction Observation Certification

Prior to electrical connection the Professional Engineer of Responsible Charge of Work shall certify in writing adequate Quality Control and Construction Observation that all work for Structural Anchorage of the Shipping/Storage Container and the Equipment within it conform with the final plans, specifications and purpose of design.

GENERAL NOTES:
1. CONSTRUCTION SHALL CONFORM TO THE 2013 CALIFORNIA BUILDING CODE AND SHALL BE PERFORMED IN ACCORDANCE WITH THE CURRENT EDITION OF THE STATE OF CALIFORNIA CONSTRUCTION SAFETY ORDERS.
2. EXISTING UNDERGROUND FEATURES NOT SHOWN ON PLANS.
3. ALL STEEL EXPOSED SHALL BE PRIMED AND PAINTED.
4. WELDING: PER AWS D1.1, E70XX ELECTRODE ALL WELDS TYPICAL UNLESS NOTED OTHERWISE (U.N.O)
5. CONTRACTOR SHALL CONFIRM ALL EXISTING DIMENSIONS PRIOR TO FABRICATION AND NOTIFY THE ENGINEER IMMEDIATELY OF ANY DISCREPANCIES
6. CONCRETE ANCHORS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS GUIDELINES.
7. CONCRETE: f'c=2,500 PSI (MIN) AT 28 DAYS, TYPE ⅝ CEMENT, ¾" AGGREGATE, AND SAND PER ASTM C-33, MEDIUM BROOM FINISH.
8. REINFORCING BARS: ASTM A615, GR 60. BARS SHALL BE CLEAN OF RUST, GREASE, OR OTHER MATERIAL THAT MAY IMPAIR BOND.

REGISTERED PROFESSIONAL ENGINEER
BENJAMIN T. PISORETTI
NO 69360
CIVIL
STATE OF CALIFORNIA

Stantec
1327 Del Norte Road, Suite 200, Camarillo, CA 93010
Phone: (805) 981-0706 Fax: (805) 981-0251
DAVID W. RUNDLE DATE: 7/1/16
PROJECT ENGINEER
R.C.E. 48,540 (EXP. 6/30/18)
W.O. 2064011811

DIGALERT
DIAL TOLL FREE
1-800-422-4133
AT LEAST TWO DAYS BEFORE YOU DIG
UNDERGROUND SERVICE ALERT (USA) OF SOUTHERN CALIFORNIA

RECORD DRAWING

I HEREBY CERTIFY THAT THE WORK SHOWN ON DRAWING No. XX-XXA SHEET No. 1 THROUGH 1, MARKED AS "RECORD DRAWING", HAS BEEN CONSTRUCTED IN CONFORMANCE WITH LINES AND GRADES AS SHOWN ON SAID PLANS, DRAWINGS, REFERENCED SPECIFICATIONS, AND APPROVED CHANGE ORDERS, AS INDICATED IN THE REVISION BLOCK.

DATE SIGNATURE
NAME R.C.E.

REVISIONS

MARK	DATE	DESCRIPTION	BY

ACCEPTANCE RECOMMENDED BY:
DATE
DATE

Development Services Department

TRACT 5592-NORTH SHORE AT MANDALAY BAY
SVE SYSTEM EQUIPMENT FACILITY
OXNARD, CA

ACCEPTED BY:
DEPT-2 DATE

SCALE: HORIZ. VARIES VERT. VARIES
SHEET NO. 1 OF 1
DRAWN BY: TWK
CHECKED BY: BTF
DRAWING NUMBER

36TTL-DX FILE PATH: W:\2064011811\1181\1811.30 Suncal\Structural\Angle Plate Anchorage\Container Anchorage.dwg

APPENDIX H
SVE SYSTEM PROJECT MANUAL

COMPRESSOR DESIGN AND SERVICES, INC.

74885 JONI DRIVE, SUITE 3
PALM DESERT, CA 92260
(442) 600-2444
INFO@COMPRESSORDS.COM

COMPRESSOR DESIGN AND SERVICES & TOMCO:

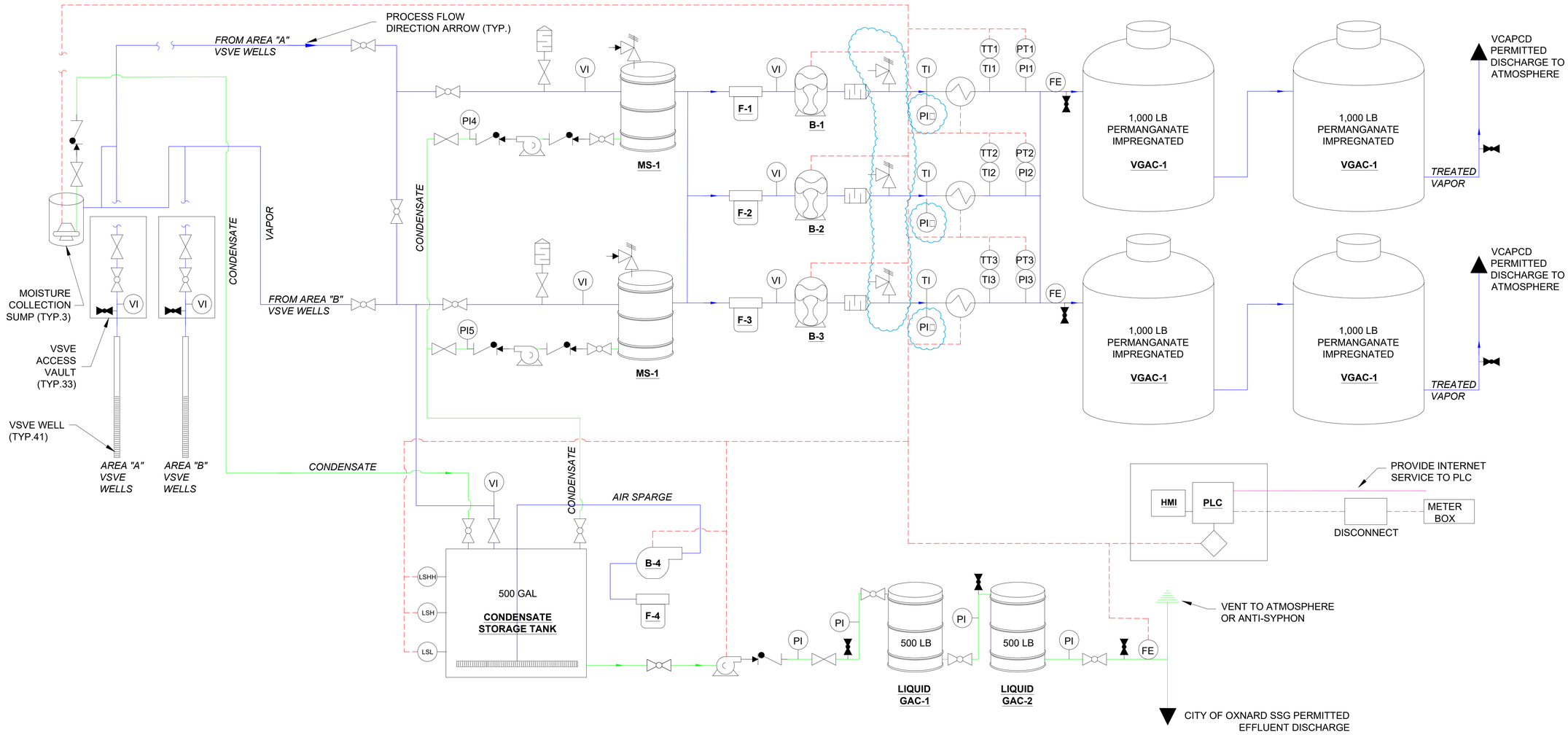
SoundEarth Strategies

MANDALAY BAY REMEDIATION SYSTEM

PROJECT MANUAL

TOMCO LLC

29991 Canyon Hills Rd Suite 1709-260
Lake Elsinore, CA 92532
(951) 775-6535



LEGEND

FE	FLOW ELEMENT	PLC	PROCESS LOGIC CONTROLLER
GAC	GRANULAR ACTIVATED CARBON	VCAPCD	VENTURA COUNTY AIR POLLUTION CONTROL DISTRICT
HMI	HUMAN MACHINE INTERFACE	VI	VACUUM INDICATOR
HSVE	HORIZONTAL SOIL VAPOR EXTRACTION	VSVE	VERTICAL SOIL VAPOR EXTRACTION
LSL	LEVEL SWITCH LOW	MS	MOISTURE SEPARATOR
LSH	LEVEL SWITCH HIGH	SSG	SANITARY SEWER
LSHH	LEVEL SWITCH HIGH HIGH	TI	TEMPERATURE INDICATOR
PI	PRESSURE INDICATOR	TYP	TYPICAL

BALL VALVE
CHECK VALVE
GATE VALVE
SAMPLE PORT
RELIEF VALVE
SILENCER
FILTER
VACUUM BLOWER (REGENERATIVE)
VACUUM BLOWER (ROTARY LOBE)
AIR TO AIR HEAT EXCHANGER
CENTRIFUGAL PUMP
SUBMERSIBLE PUMP
LIQUID PROCESS LINE
VACUUM PROCESS LINE
ELECTRIC/SIGNAL
COMMUNICATION

CLIENT
SOUND EARTH STARTEGIES CA
ZACH GILMER
27 MAUCHLY, SUITE 213
IRVINE, CA 92618
PHONE: (949) 861-8785

COMPRESSOR DESIGN AND SERVICES, INC.
74885 JONI DRIVE, SUITE 3
PALM DESERT, CA 92260
INFO@COMPRESSORDS.COM
(442) 600-2444

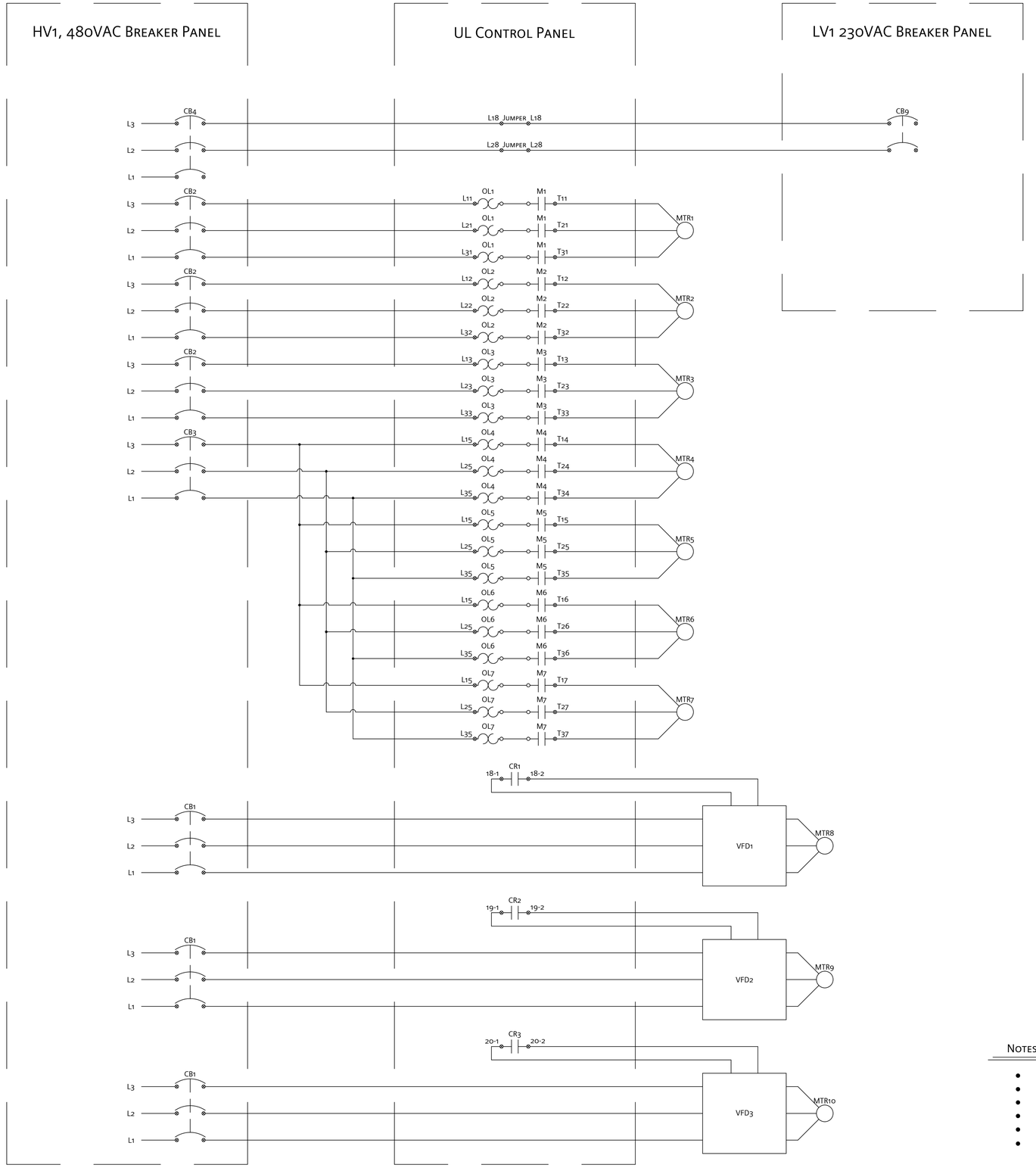
APPROVED

No	DATE	BY	REMARKS
1	2/15/16	WB	ADDED PI6, PI7, AND PI8
2	2/15/16	WB	MOVED PRV'S AFTER SILENCER
3	2/26/16	WB	REMOVED INT. SAMPLE PORT

P & ID
REMEDIATION SYS

DRAWN	WMB
CHECKED	WMB
DATE	02/15/2016
SCALE	NA
PAPER SIZE	ARCH D

PID1



Symbol	Description
CB1	Circuit Breaker, SVE Blower 1, 2 and 3: 40amp
CB2	Circuit Breaker, Heat Exchanger 1, 2 and 3: 15amp
CB3	Circuit Breaker, Pumps and sparge blower: 20amp
CB4	Circuit Breaker, HV1 to transformer: 20amp
CB9	Circuit Breaker, Transformer to LV1: 40amp
CR1	Control Relay, VFD1 control
CR2	Control Relay, VFD2 control
CR3	Control Relay, VFD3 control
HV1	High Voltage Panel, 480VAC 3p
LV1	Low Voltage Panel, 240VAC 2p
M1	Motor starter, Heat exchanger 1
M2	Motor starter, Heat exchanger 2
M3	Motor starter, Heat exchanger 3
M4	Motor starter, Sparge blower
M5	Motor starter, MS-1 transfer pump
M6	Motor starter, MS-2 transfer pump
M7	Motor starter, Condensate transfer pump
MTR1	Motor, Heat exchanger 1
MTR2	Motor, Heat exchanger 2
MTR3	Motor, Heat exchanger 3
MTR4	Motor, Sparge blower
MTR5	Motor, MS-1 transfer pump
MTR6	Motor, MS-2 transfer pump
MTR7	Motor, Condensate transfer pump
MTR8	Motor, SVE blower 1
MTR9	Motor, SVE blower 2
MTR10	Motor, SVE Blower 3
OL1	Overload, Heat exchanger 1
OL2	Overload, Heat exchanger 2
OL3	Overload, Heat exchanger 3
OL4	Overload, Sparge blower
OL5	Overload, MS-1 transfer pump
OL6	Overload, MS-2 transfer pump
OL7	Overload, Condensate transfer pump
OL8	Overload, SVE blower 1
OL9	Overload, SVE blower 2
OL10	Overload, SVE blower 3
VFD1	Variable Frequency Drive, SVE blower 1
VFD2	Variable Frequency Drive, SVE blower 1
VFD3	Variable Frequency Drive, SVE blower 1

Wire Legend

14ga black: 120VAC power in
14ga white: 120VAC neutral in
14ga green: 120VAC ground in
16ga red: 120VAC control, #1, 3-20
16ga white: AC neutral, #2
16ga green: AC ground
16ga blue: 24VDC control, #21, 23-50
14ga gray: DC negative, #22
16ga purple: 24VDC Signal, #51-70
10ga brown: 480VAC L1, CB1, CB3 and LV1
10ga orange: 480VAC L2, CB1, CB3 and LV1
10ga Yellow: 480VAC L3, CB1 and CB3
10ga Green: 480VAC Ground
14ga brown: 480VAC L1, CB2
14ga orange: 480VAC L2, CB2
14ga Yellow: 480VAC L3, CB2

Notes

- Each terminal will only have one 14ga wire or two 16ga wires installed per side.
- The communication wire will be cat5e or better.
- See drawing E110 for panel layout.
- Local Wire ○ ○ Field Wire ⊗ ⊗
- SCCR: 20kA
- Torque Specs: Ground Term (8 in-lb) Wire Term (8 in-lb)

Client
Sound Earth
Mandalay Bay

Compressor Design And Services, Inc.
74885 Joni Drive, Suite 3
Palm Desert, CA 92260
Info@compressords.com
(442) 600-2444

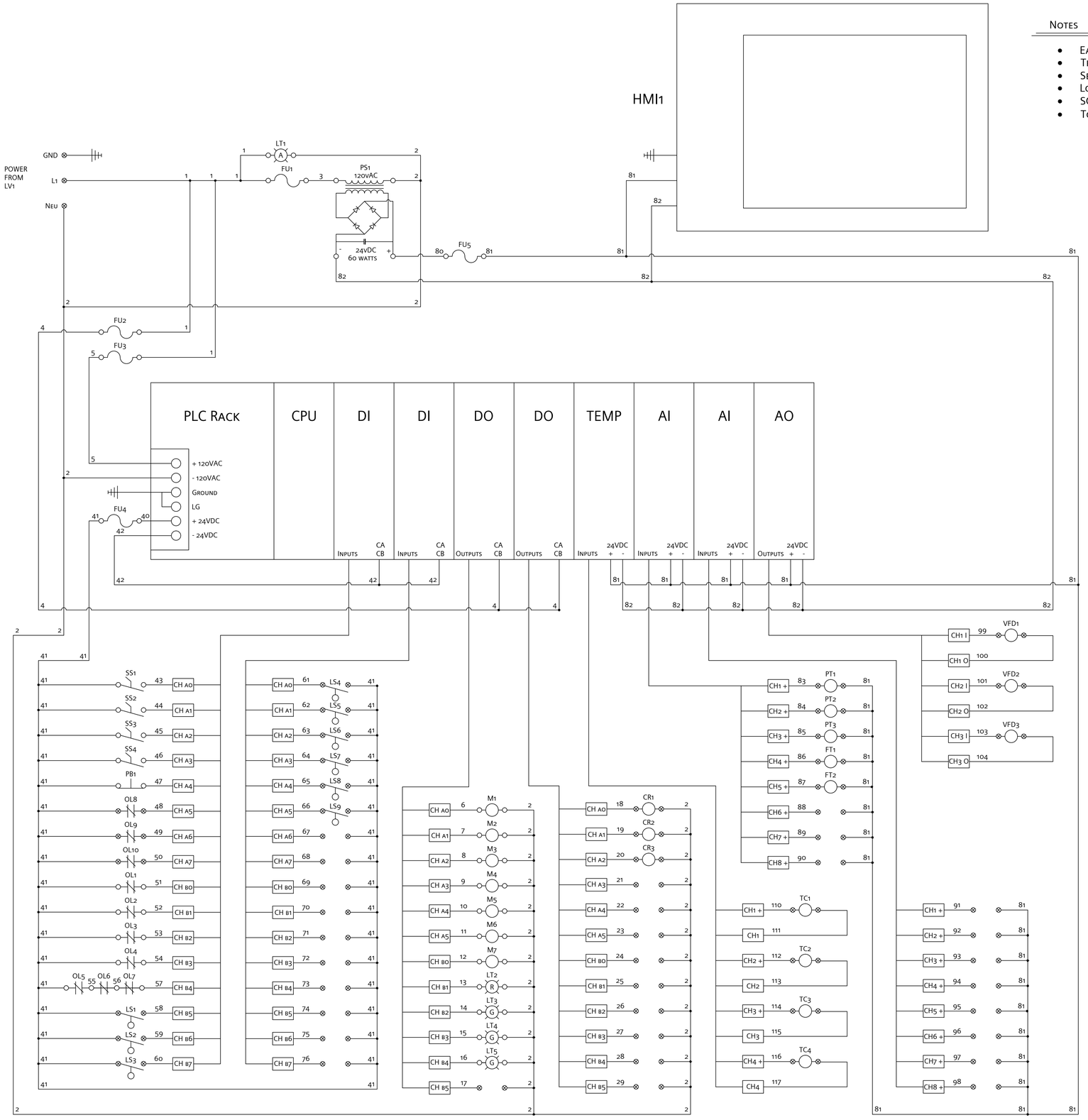
Approved

No	Date	By	Remarks

UL Control Panel
SVE System
Sheet 2 of 3

Drawn	WMB
Checked	WMB
Date	05/10/2016
Scale	NA
Paper Size	Arch D

E205



Notes

- Each terminal will only have one 14ga wire or two 16ga wires installed per side.
- The communication wire will be cat5e or better.
- See drawing E720 for panel layout.
- Local Wire ○ ○ Field Wire ⊗ ⊗
- SCCR: 10kA
- Torque Specs: Ground Term (8 in-lb) Wire Term (8 in-lb)

Symbol	Description
CR1	Control Relay, VFD1 control
CR2	Control Relay, VFD2 control
CR3	Control Relay, VFD3 control
HMI1	Human machine interface
FT1	Flow Transmitter, Left side discharge
FT2	Flow Transmitter, Right side discharge
FU1	Fuse, Power to power supply, 2amp
FU2	Fuse, Power to output relays, 5amp
FU3	Fuse, Power to PLC, 2amp
FU4	Fuse, Power From PLC, .5amp
FU5	Fuse, Power From power supply, 5amp
LS1	Level Switch, Condensate low
LS2	Level Switch, Condensate High
LS3	Level Switch, Condensate High High
LS4	Level Switch, MS-1 low
LS5	Level Switch, MS-1 High
LS6	Level Switch, MS-1 High High
LS7	Level Switch, MS-2 low
LS8	Level Switch, MS-2 High
LS9	Level Switch, MS-2 High High
LT1	Light Amber, Power on
LT2	Light Red, Fault and warning (flashing-warning / solid-fault)
LT3	Light Green, SVE blower 1 running
LT4	Light Green, SVE blower 2 running
LT5	Light Green, SVE blower 3 running
M1	Motor starter, Heat exchanger 1
M2	Motor starter, Heat exchanger 2
M3	Motor starter, Heat exchanger 3
M4	Motor starter, Sparge blower
M5	Motor starter, MS-1 transfer pump
M6	Motor starter, MS-2 transfer pump
M7	Motor starter, Condensate transfer pump
OL1	Overload, Heat exchanger 1
OL2	Overload, Heat exchanger 2
OL3	Overload, Heat exchanger 3
OL4	Overload, Sparge blower
OL5	Overload, MS-1 transfer pump
OL6	Overload, MS-2 transfer pump
OL7	Overload, Condensate transfer pump
OL8	Overload, SVE blower 1
OL9	Overload, SVE blower 2
OL10	Overload, SVE blower 3
PB1	Push button, E-stop
PLC1	Programmable Logic Controller
PS1	Power supply, 120-230VAC in 24VDC out, 5amp
PT1	Pressure transmitter, SVE blower 1 discharge
PT2	Pressure transmitter, SVE blower 2 discharge
PT3	Pressure transmitter, SVE blower 3 discharge
SS1	Selector switch, SVE blower 1 on - off
SS2	Selector switch, SVE blower 2 on - off
SS3	Selector switch, SVE blower 3 on - off
SS4	Selector switch, Condensate transfer on - off
TC1	Thermocouple, SVE blower 1 discharge
TC2	Thermocouple, SVE blower 1 discharge
TC3	Thermocouple, SVE blower 1 discharge
TC4	Thermocouple, Ambient
VFD1	Variable Frequency Drive, SVE blower 1
VFD2	Variable Frequency Drive, SVE blower 1
VFD3	Variable Frequency Drive, SVE blower 1

Wire Legend

14GA BLACK: 120VAC POWER IN
14GA WHITE: 120VAC NEUTRAL IN
14GA GREEN: 120VAC GROUND IN
16GA RED: 120VAC CONTROL, #1, 3-20
16GA WHITE: AC NEUTRAL, #2
16GA GREEN: AC GROUND
16GA BLUE: 24VDC CONTROL, #21, 23-50
14GA GRAY: DC NEGATIVE, #22
16GA PURPLE: 24VDC SIGNAL, #51-70

Client
Sound Earth
Mandalay Bay

Compressor Design And Services, Inc.
74885 Joni Drive, Suite 3
Palm Desert, CA 92260
(442) 600-2444
Info@compressords.com

Approved

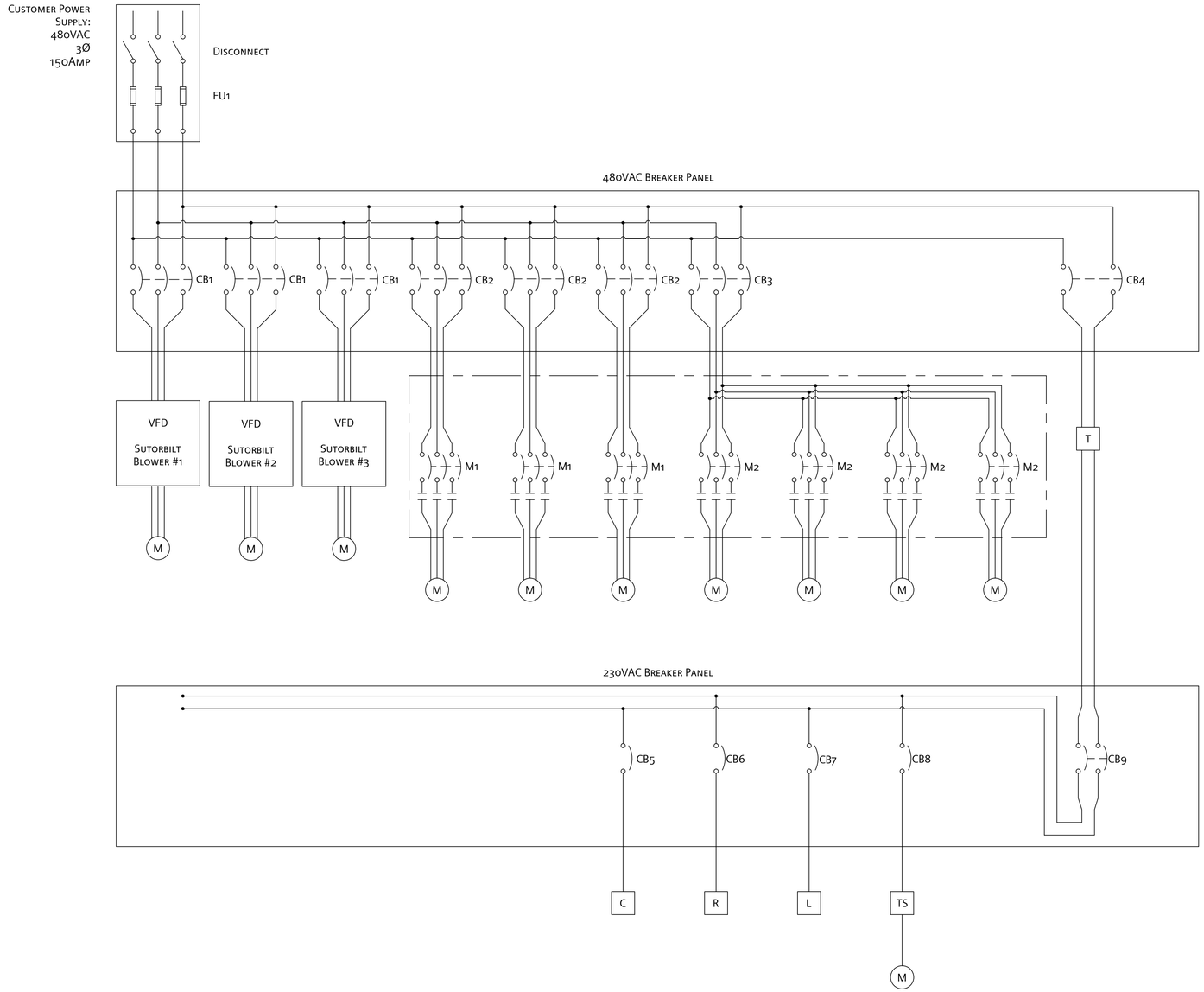
No	Date	By	Remarks

UL Control Panel
SVE System
Sheet 1 of 3

Drawn	WMB
Checked	WMB
Date	05/10/2016
Scale	NA
Paper Size	Arch D

E200

Electrical Single Line Diagram for Mandaly Bay Remediation System



No	Symbol	Qty	Description
1	CB1	3	Circuit Breaker, GHB3040, 40 Amp: Variable Frequency Drive
2	CB2	3	Circuit Breaker, GHB3015, 15 Amp: Heat Exchangers
3	CB3	1	Circuit Breaker, GHB3020, 20 Amp: Motor Starters, Price pump and Rotron Blower
4	CB4	1	Circuit Breaker, GHB2020, 20 Amp: Transformer
5	CB5	1	Circuit Breaker, BAB1020, 20 Amp: Control Panel
6	CB6	1	Circuit Breaker, BAB1020, 20 Amp: Recepticals
7	CB7	1	Circuit Breaker, BAB1015, 15 Amp: Overhead Lights
8	CB8	1	Circuit Breaker, BAB1015, 15 Amp: Exhaust Fan
9	CB9	1	Circuit Breaker, BAB2040H, 40 Amp: 230VAC Panel Main
10	FU1	3	Fuse, TRS150R 600V RK5, 150 Amp: Main
11	M1	3	Motor Starter, 3RA1115-1EA15-1AK6, 2 HP: Heat Exchangers
12	M2	4	Motor Starter, 3RA1115-1JA15-1AK6, 1/2 HP: Price pump and Rotron Sparge Blower

Symbols:

C - UL Control Panel for PLC
R - Recepticals for power connection inside container
L - Lighting circuit for overhead lights
TS - Thermostat for control of container exhaust system
M - Motors for various components: see table
VFD - Variable Frequency Drive for Sutorbilt blowers
T - Transformer, Buck 480VAC to 230VAC

TOMCO LLC
The Operations & Maintenance Company

Sound Earth Strategies
Mandalay Bay- Soil Vapor Extraction System

TOMCO SVE System Load Calculations:

Item	Name	Description	Qty	HP	FLA	Breaker size	System Load
B-1	Vacuum Blower	Sutorbilt 5L	3	15	21.3	40	63.9
B-2	Sparge Blower	Rotron DR303AE72M	1	0.5	1.1	15	1.1
HE-1	Heat Exchanger	ACAC 500 SCFM	3	3	6.8	15	21.4
TP-3	Moisture Sep. Transfer pump	Price Pump HP75SS	2	0.5	1.1	15	2.2
LVT	Transformer	460 to 230VAC Transformer 7.5kVA	1			30	20
						Total System Load	**108.60**
						25% Load	**27.15**
						System Load Rating	**135.75**

TOMCO LLC. 29991 Canyon Hills Rd # 1709-260 Lake Elsinore California 92532

Client
Sound Earth
Zach Gilmer
27 Mauchly, Suite 213
Irvine, CA 92618
Phone: (949) 861-8785

Compressor Design And Services, Inc.
74885 Joni Drive, Suite 3
Palm Desert, CA 92260
Info@compressords.com
(442) 600-2444

Approved

No	Date	By	Remarks
A	03/30/16	WB	Added Load Calcs

Single Line

Drawn	WMB
Checked	WMB
Date	03/17/2016
Scale	NA
Paper Size	Arch D

E100

COMPRESSOR DESIGN AND SERVICES, INC.

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Remediation System Service Schedule

Task	
Change Sutorbilt Blower Oil	Drain oil from all four plugs below each side of the blower. Requires allen key. Replace with Aeon PD-XD Blower Oil.
Solberg Filter Element - Replace	Replace filter element every 500 hours or as needed. This will be determined once the system is operational.

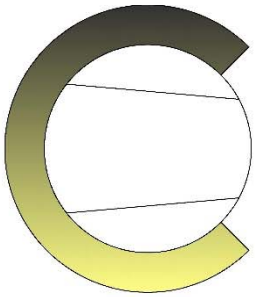
AEON PD-XD can be purchased through CDSI or an Authorized Gardner Denver Distributor.

Convenient Package Sizes	AEON PD Part No.	AEON PD-FG Part No.	AEON PD-XD Part No.
1 quart	28G23	28H97	28G46
Case 12 quarts	28G24	28H98	28G47
1 gallon	28G40	28H333	28G42
Case 6 gallons	28G41	28H334	28G43
5 gallon pail	28G25	28H99	28G44
55 gallon drum	28G28	28H100	28G45

235P Filter Elements can be purchased through CDSI or an Authorized Solberg Distributor.

Element Part Number		Element m^3/h	Surface Area m^2		Dimensions - mm			STD Endcap
Polyester	Paper	Rating	Polyester	Paper	ID	OD	HT	Features
235P	234P	970	0.8	2.1	121	200	244	M
335P	334P	1360	1.1	3.2	121	200	368	M
237	236	935	0.8	2.1	119	197	216	GBN
239P	238P	970	1.1	4.8	124	235	254	GBN
245P	244P	1500	1.3	3.3	152	248	244	GN | M
345P	344P	1870	2.1	5.3	152	248	368	GN
275P	274P	1870	1.8	4.2	203	298	244	GN
375P	374P	2550	2.6	6.3	203	298	368	GN
377P	376P	3105	4.6	12	229	371	368	GN
385P	384P	5610	4.6	13	356	498	368	GN
485P	484P	8000	7.0	19	356	498	546	GN
685P	--	11220	9.3	--	356	498	724	GN

For Maintenance Information on Heat Xchanger's refer to page 307 of this manual, or click here



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Feel free to contact us here at Compressor Design and Services if you require any emergency service, compressor parts, or if you have and questions. We're happy to assist!

Compressor Design and Services, Inc.

74885 Joni Drive, Suite 3

Palm Desert CA, 92260

www.Compressords.com

Parts, Questions, and Service: 442-600-2444

COMPRESSOR DESIGN AND SERVICES, INC.

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Section 1 - Motors, Blowers, and Pumps

1-1 WEG Motor
Variable Frequency Drives
Drive Coupling
1-2 Sutorbilt Blower
Aeon PD XD Oil for Sutorbilt Blowers
1-3 Rotron Blower
1-4 Price Pumps

Section 2 - Moisture Separators

2-1 Float Switches

Section 3 - Control Panels

3-1 UL Rated Breaker Boxes
3-2 UL Rated Fuse Enclosure
Fuses
3-3 UL Rated Panel Board Enclosure
C-More HMI
Do-More PLC
Hazardous Pilot Devices
Line Voltage Thermostat
3RV Circuit Breakers
3RT Screw Terminals
3-4 Distribution Transformer

Section 4 - Silencers

Section 5 - Solberg Filters

Section 6 - Heat Exchangers

Section 7 - Thermocouples and Transmitters

Section 8 - Additional Items

8-1 40' High Cube Container
8-2 Exhaust and Louver System
8-3 Liquid Storage Tank
8-4 Check Valves
8-5 Clamps and Fittings
8-6 Ceiling Lighting
8-7 Piping Couplings

COMPRESSOR
DESIGN AND
SERVICES, INC.

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MOTORS, BLOWERS, AND PUMPS

OMPRESSOR
DESIGN AND
SERVICES, INC.

74885 JONI DRIVE, SUITE 3
PALM DESERT, CA 92260
(442) 600-2444
INFO@COMPRESSORDS.COM

WEG MOTOR

01536ET3E254T-W22

Severe Duty is **Standard** with **WEG W22** motors.

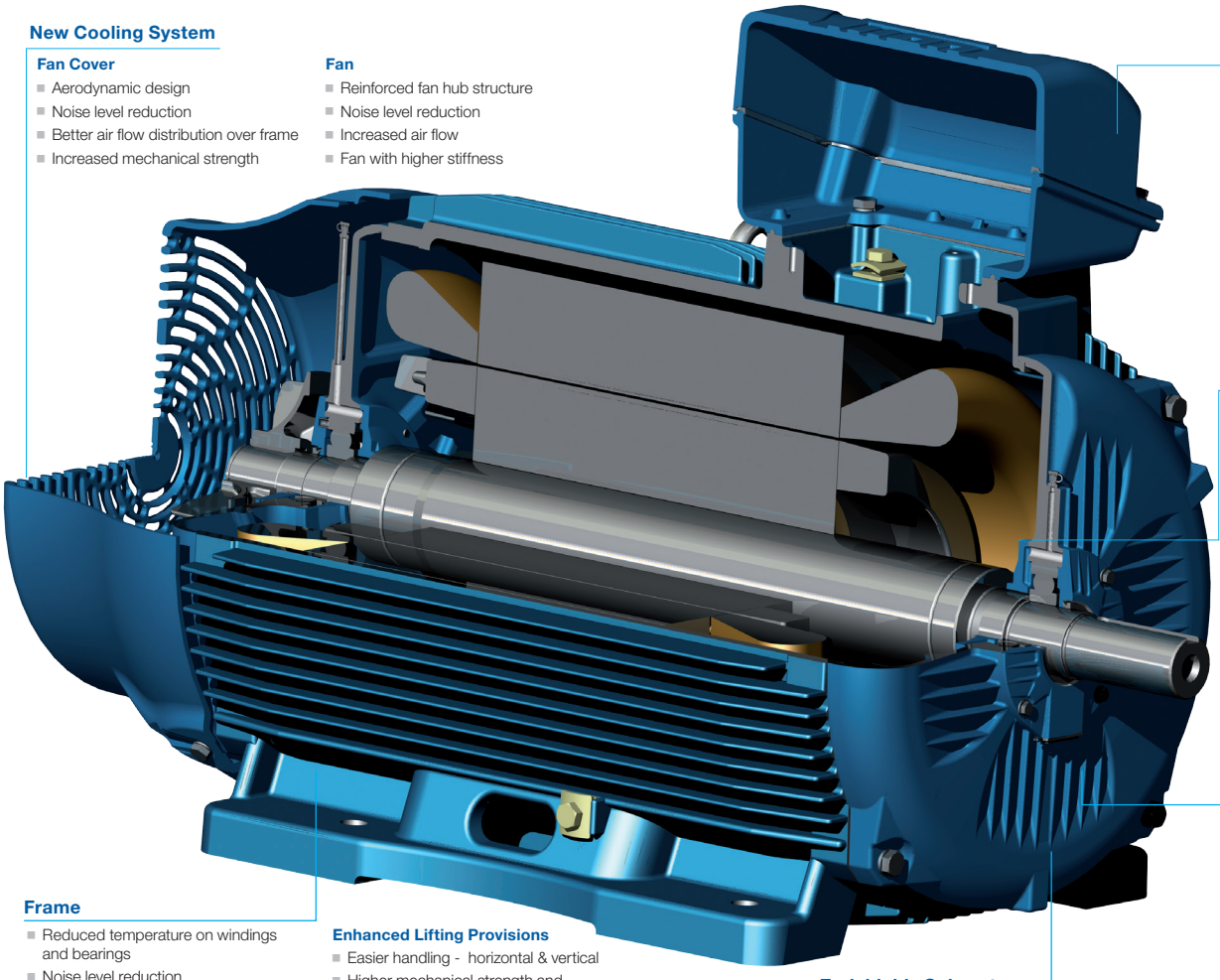
You do not need a special motor for severe duty. Severe Duty is standard with WEG W22 motors.

You do not need a special motor for severe duty. Severe Duty is standard with WEG.

Features that make a difference:

- All NEMA Premium ratings have a 1.25 service factor (up to 100 HP) resulting in cooler operation and extended life of the motor
- All Cast Iron Construction, including Terminal Box and Fan Cover (*)
- Solid feet for reduced vibration levels and impact absorption
- Optimized ventilation system for cooler operation and extended life
- High Grade FC200 cast iron provides superior mechanical strength and heat dissipation
- All WEG W22 motors are Totally Enclosed Fan Cooled with a true IP55 rating against dust and moisture. (IPW56, IPW65 and IPW66 available as optional)
- Exclusive W-Seal 364T and larger provides superior bearing protection
- Taconite Labyrinth seal 586 Frame and larger
- Exclusive WEG painting system exceed 200hrs ASTM 117 corrosion test (Exceeds IEEE841 standard)
- Balanced to 0.08 inches per second vibration limits (Meets IEEE841 standard)
- Four Bolt Conduit Cover with glued Neoprene Gasket
- Impregnation Resin and magnet wire are insulation class H
- Stainless Steel Nameplate - Laser edged with high contrast background
- Corrosion Proof Drains
- Inverter Duty per NEMA MG1, Part 31
- Certified Class I Div 2, Groups A, B, C & D; Class II, Div 2, Groups F & G

**cast iron fan cover available as an option on 143-215T frames*



New Cooling System

Fan Cover
- Aerodynamic design
- Noise level reduction
- Better air flow distribution over frame
- Increased mechanical strength

Fan
- Reinforced fan hub structure
- Noise level reduction
- Increased air flow
- Fan with higher stiffness

Terminal Box
- Better connection quality
- Easier cable handling during installation
- More space available for accessory installation
- Easier Maintenance
- Mounting F1/F2/F3
- Rotation on 90° stages

Bearing Caps

External
- Finned surface for improved bearing heat dissipation

Internal
- Change of grease path for positive lubrication
- Bearing lubrication quality improvement
- Reduced bearing temperature

Seal Subsystem
- Increased dust and moisture protection
- Increased protection to high-pressure cleaning

Frame
- Reduced temperature on windings and bearings
- Noise level reduction
- Terminal box position outlet on top

Pad for vibration sensor
- Displaced 90º from each other

Enhanced Lifting Provisions
- Easier handling - horizontal & vertical
- Higher mechanical strength and handling safety

Solid feet
- More impact resistance
- Ideal for high vibration level applications

Endshields Subsystem

DE (Drive Endshield)
- New fin design
- Bearing moved outwards for better load support
- Improved bearing heat dissipation for reduced bearing temperature
- Reinforced endshield structure

NDE (Non-Drive Endshield)
- New design with smooth exterior surface
- Improved air flow
- Noise level reduction
- Improved structural rigidity for low vibration

WEG Optimal Match Warranty

WEG Optimal Match Warranty is a thirty six (36) month warranty available when a low voltage motor is applied with a WEG low voltage drive or soft starter. In order to qualify for the warranty, the products must be registered and approved by WEG's warranty department with this form.

Drives and motors that qualify for this Optimal Match Warranty are W22 motors coupled with CFW11 up to 600HP (720A); all CFW500/501, CFW700/701; CFW08; and CFW09 drives.

Soft starters and motors that qualify for this Optimal Match Warranty are W22 motors coupled with SSW06 up to 550HP (670A); and all SSW07 soft starters. This offer is available in the US Only.

Please fill in the following information completely, otherwise this application will be void. Please send this form to automationtech@weg.net or fax it to WEG service department at 678.249.1171.

DATE		**STORE #**	
COMPANY		**ACCOUNT #**	
CONTACT			
EMAIL			

LOCATION OF APPLICATION					
ADDRESS					
CITY		**STATE**		**ZIP**	

ORDER INFORMATION			
PURCHASE DATE	03/09/2016	**ORDER #**	ONS000125411

PRODUCT INFORMATION
(Once approved further information will be needed)

DRIVE		**MOTOR**	
MODEL #	WEG CFW 700	**MODEL #**	WEG W22 MOTOR
SERIAL #		**SERIAL #**	
INVOICE #	7371688-01	**INVOICE #**	7371678-01

Severe Duty is standard with WEG.

SEVERE DUTY/ GENERAL PURPOSE – NEMA PREMIUM EFFICIENCY

FEATURES – ELECTRICAL			
Features	**Standard**	**Optional**	**Special**
Poles	2 up to 8	–	–
Voltage	208–230/460V (up to 215T–9 terminals and from 254 up is 12 terminals)	575V and others	–
Insulation	F (DT=80K)	H	–
Service Factor	1.25 (up to 100HP)	–	
	1.15 (from 125HP and up)	–	
Impregnation	Dip and bake (up to 326T)	Continuous Resin Flow	–
	Continuous Resin Flow (364T+	–	–
Features	**Standard**	**Optional**	**Special**
Thermal Protection		PTC, Thermostat, PT100 and KTY	–
NEMA Design	B	C	

MECHANICAL			
Features	**Standard**	**Optional**	**Special**
Frame	143 – 588/9	–	–
Mounting	F1	F2, F3, any	–
Flange	–	C and D	–
Drain Plug	Manual Rubber	Stainless	Threaded
Eyebolt	182 – 588/9	–	–
Enclosure	IP55	IPW56, IPW65, IPW66	–
Sealing	V-ring 143T–326T WSeal 364T–L449T Taconite Labyrinth 586/7–588/9	Lip Seal or Oil(143 – 444/5) InproSeal (143 – 588/9) Labyrinth Tachonite Seal (143 – 588/9) W3 Seal (143 – 588/9)	Viton Oil Seal (143 – 588/9)
Fan	Plastic (143 – 504/5) Aluminum (5008, 586/7 and 588/9)	Aluminum, Bronze and Cast Iron Bronze and Cast Iron	–
Fan Cover	Steel Cover (143 – 215) Cast Iron Cover (254 – 588/9)	–	Cast Iron Cover (143 – 215) –
Bearing	Ball Bearing (ZZ up to 215)	Roller Bearing (254 – 588/9) **	–
	Ball Bearing (143/5– 588/9)	–	
Bearing Cap	254 – 588/9	143 – 215 (Std with flange)	–
Grease	Polyrex	Aeroshell, Krytox, WT/Ens	–
Regreasable Bearings	254 – 588/9	143 – 215	–
Shaft Material	SAE 1040/45 (143 – 364/5) 4140 (404/5 – 588/9)	4140, AISI 304/316/420 AISI 304/316/420	–
Shaft End	T (TS – 2 Poles 284 – 588/9)	TS – 4 and up (284 – 588/9)	
Key Type	A (143 – 326), B (364/5 – 588/9)	B (143 – 326), C (143 – 588/9)	–
Balancing	Precision with Half Key (143 – 326) Precision with Half Key (364/5 – 588/9)	Others	–
Center Hole	Threaded (364/5 – 588/9)	Threaded (143 – 326)	–
Terminal Box	143 – 215 (Style W22) 254 – 588/9 (Type diagonal)	–	–
Terminal Box Thread	NPT	RWG, Metric and PG	–
Terminal Box Plug	Plastic Smooth	Cable glands	Plastic Threaded
Leads outlet protection	Self–extinguishing Foam	Epoxy	–
Frame grounding	Single Grounding (143 – 326) Double Grounding (364//5 – 588/9)	Double Grounding (143 – 326)	–
Terminal Block	–	BMC (6 terminals) and 12 terminals	–
Features	**Standard**	**Optional**	**Special**
Painting plan / Color	207A / RAL 5009 (up to 215)	Others	–
	203A / RAL 5009 (254 and up)		
Packing	Cardboard Box (143 and 215T) Crate (254T – 588/9)	–	Pallet –

** Only to 4 Poles and up (2 poles used ball Bearing and Shaft material SAE 1040/45)

Others Optional Features:	
Additional Terminal Box	Encoder
Space Heater	Double Shaft End
Internal Tropicalized Painting	
Permatex Sealed Endshields	
Slinger – Shaft up	
Drip Cover (Canopy) – Shaft down	

Nameplate Details:

WITH W22 MOTORS SEVERE DUTY IS STANDARD

SEVERE DUTY - THREE PHASE

TEFC – Foot Mount

Epact Efficiency
NEMA Premium Efficiency
Super Premium Efficiency

HP	kW	RPM	NEMA Frame	Catalog Number	List Price	Mult. Symbol	Approx. Shipping Weight (lbs)	Service Factor	FL Amps	FL. Eff (%)	"C" Dimension (in)	Voltage (V)	Notes
1	0.75	3600	143T	00136ET3E143T-W22	538	N1	43	1.25	1.43	78.5	12.346	208-230/460	
1	0.75	3600	143T	00136EG3E143T-W22	669	N1	42	1.25	1.35	84.0	12.346	208-230/460	
1	0.75	1800	143T	00118ET3E143T-W22	527	N1	54	1.25	1.41	85.5	12.346	208-230/460	
1	0.75	1800	L143T	00118EG3EL143T-W22	580	N1	53	1.25	1.33	87.5	13.566	208-230/460	
1	0.75	1200	145T	00112ET3E145T-W22	608	N1	56	1.25	1.73	82.5	13.346	208-230/460	
1	0.75	900	182T	00109ET3E182T-W22	1,043	N1	104	1.25	2.30	78.5	14.860	208-230/460	
1.5	1.1	3600	143T	00156ET3E143T-W22	543	N1	45	1.25	1.91	84.0	12.346	208-230/460	
1.5	1.1	3600	143T	00156EG3E143T-W22	597	N1	44	1.25	1.92	86.5	12.346	208-230/460	
1.5	1.1	1800	145T	00158ET3E145T-W22	551	N1	56	1.25	2.02	86.5	13.346	208-230/460	
1.5	1.1	1800	L145T	00158EG3EL145T-W22	606	N1	57	1.25	1.93	88.5	14.566	208-230/460	
1.5	1.1	1200	182T	00152ET3E182T-W22	754	N1	79	1.25	2.39	87.5	14.860	208-230/460	
1.5	1.1	900	184T	00159ET3E184T-W22	1,207	N1	120	1.25	2.70	82.5	15.860	208-230/460	
1.5	1.1	900	184T	00159EP3E184T-W22	983	W1	75	1.25	2.72	77.0	15.860	230/460	30
2	1.5	3600	145T	00236ET3E145T-W22	591	N1	52	1.25	2.53	85.5	13.346	208-230/460	
2	1.5	3600	145T	00236EG3E145T-W22	650	N1	53	1.25	2.56	87.5	13.346	208-230/460	
2	1.5	1800	145T	00218ET3E145T-W22	612	N1	58	1.25	2.61	86.5	13.346	208-230/460	
2	1.5	1800	L145T	00218EG3EL145T-W22	673	N1	59	1.25	2.64	88.5	14.566	208-230/460	
2	1.5	1200	184T	00212ET3E184T-W22	819	N1	97	1.25	3.23	88.5	15.860	208-230/460	
2	1.5	900	213T	00209ET3E213T-W22	1,848	N1	154	1.25	3.39	85.5	18.021	208-230/460	
2	1.5	900	213T	00209EP3E213T-W22	1,480	W1	155	1.25	3.46	82.5	18.021	230/460	30
3	2.2	3600	182T	00336ET3E182TF3-W22	763	N1	99	1.25	3.63	86.5	14.860	208-230/460	
3	2.2	3600	182T	00336ET3E182T-W22	763	N1	99	1.25	3.63	86.5	14.860	208-230/460	
3	2.2	3600	182T	00336EG3E182T-W22	839	N1	91	1.25	3.67	88.5	14.860	208-230/460	
3	2.2	1800	182T	00318ET3E182T-W22	663	N1	99	1.25	3.88	89.5	14.860	208-230/460	
3	2.2	1800	L182T	00318EG3EL182T-W22	729	N1	96	1.25	3.76	91.0	16.041	208-230/460	
3	2.2	1200	213T	00312ET3E213T-W22	1,129	N1	134	1.25	4.41	89.5	18.021	208-230/460	
3	2.2	1200	L213T	00312EG3EL213T-W22	1,242	N1	175	1.25	4.30	90.2	19.527	208-230/460	11
3	2.2	900	215T	00309ET3E215T-W22	2,115	N1	166	1.25	4.56	85.5	19.517	208-230/460	
3	2.2	900	215T	00309EP3E215T-W22	1,609	W1	156	1.25	4.33	84.0	19.517	230/460	30
5	3.7	3600	184T	00536ET3E184TF3-W22	873	N1	114	1.25	5.9	88.5	15.860	208-230/460	
5	3.7	3600	184T	00536ET3E184T-W22	873	N1	114	1.25	5.90	88.5	15.860	208-230/460	
5	3.7	3600	184T	00536EG3E184T-W22	960	N1	98	1.25	5.99	90.2	15.860	208-230/460	
5	3.7	1800	184T	00518ET3E184TF3-W22	772	N1	108	1.25	6.45	89.5	15.860	208-230/460	
5	3.7	1800	184T	00518ET3E184T-W22	772	N1	108	1.25	6.45	89.5	15.860	208-230/460	
5	3.7	1800	L184T	00518EG3EL184T-W22	849	N1	104	1.25	6.40	91.0	17.041	208-230/460	
5	3.7	1200	215T	00512ET3E215T-W22	1,332	N1	175	1.25	6.83	89.5	19.517	208-230/460	
5	3.7	1200	L215T	00512EG3EL215T-W22	1,465	N1	203	1.25	6.83	91.0	20.905	208-230/460	11
5	3.7	900	254T	00509ET3E254T-W22	3,301	N1	244	1.25	7.58	87.5	23.213	208-230/460	
5	3.7	900	254T	00509EP3E254T-W22	2,703	W1	253	1.25	7.76	85.5	23.213	230/460	30

Please see CATALOG NOTES, page 15

All data subject to change without notice

WITH W22 MOTORS SEVERE DUTY IS STANDARD

SEVERE DUTY - THREE PHASE

TEFC – Foot Mount, CONTINUED

Epact Efficiency
NEMA Premium Efficiency
Super Premium Efficiency

HP	kW	RPM	NEMA Frame	Catalog Number	List Price	Mult. Symbol	Approx. Shipping Weight (lbs)	Service Factor	FL Amps	FL. Eff (%)	"C" Dimension (in)	Voltage (V)	Notes
7.5	5.5	3600	184T	00736ET3E184T-W22	1,074	N1	93	1.25	8.76	89.5	15.860	208-230/460	
7.5	5.5	3600	213T	00736ET3E213T-W22	1,125	N1	134	1.25	8.76	89.5	18.021	208-230/460	
7.5	5.5	3600	213T	00736EG3E213T-W22	1,238	N1	146	1.25	8.82	91.0	18.021	208-230/460	
7.5	5.5	1800	213T	00718ET3E213T-W22	1,089	N1	165	1.25	9.00	91.7	18.021	208-230/460	
7.5	5.5	1800	L213T	00718EG3EL213T-W22	1,198	N1	177	1.25	8.94	93.0	19.527	208-230/460	
7.5	5.5	1200	254T	00712ET3E254T-W22	2,065	N1	282	1.25	9.48	91.0	23.213	208-230/460	
7.5	5.5	1200	254T	00712EG3E254T-W22	2,272	N1	324	1.25	9.46	92.4	23.213	208-230/460	11
7.5	5.5	900	256T	00709ET3E256T-W22	3,658	N1	302	1.25	11.1	87.5	24.945	208-230/460	
7.5	5.5	900	256T	00709EP3E256T-W22	2,856	W1	304	1.25	11.5	85.5	24.945	230/460	30
10	7.5	3600	215T	01036ET3E215T-W22	1,332	N1	173	1.25	11.6	90.2	19.517	208-230/460	
10	7.5	3600	215T	01036EG3E215T-W22	1,465	N1	177	1.25	11.5	91.7	19.517	208-230/460	
10	7.5	1800	215T	01018ET3E215T-W22	1,273	N1	172	1.25	12.4	91.7	19.517	208-230/460	
10	7.5	1800	L215T	01018EG3EL215T-W22	1,400	N1	186	1.25	12.0	93.0	20.905	208-230/460	
10	7.5	1200	256T	01012ET3E256T-W22	2,396	N1	316	1.25	12.9	91.0	24.945	208-230/460	
10	7.5	1200	256T	01012EG3E256T-W22	2,636	N1	364	1.25	12.7	92.4	24.945	208-230/460	11
10	7.5	900	284T	01009ET3E284T-W22	4,634	N1	413	1.25	13.4	90.2	26.433	208-230/460	
10	7.5	900	284T	01009EP3E284T-W22	3,786	W1	410	1.25	13.0	88.5	26.433	230/460	30
15	11	3600	215T	01536ET3E215T-W22	1,697	N1	174	1.25	17.0	91.0	19.517	208-230/460	
15	11	3600	254T	01536ET3E254T-W22	1,824	N1	280	1.25	17.2	91.0	23.213	208-230/460	
15	11	3600	254T	01536EG3E254T-W22	2,006	N1	293	1.25	17.4	92.4	23.213	208-230/460	
15	11	1800	254T	01518ET3E254TF3-W22	1,848	N1	291	1.25	18	92.4	23.213	208-230/460	
15	11	1800	254T	01518ET3E254T-W22	1,848	N1	291	1.25	18.0	92.4	23.213	208-230/460	
15	11	1800	254T	01518EG3E254T-W22	2,033	N1	300	1.25	17.8	93.6	23.213	208-230/460	
15	11	1200	284TS	01512ET3E284TS-W22	3,291	N1	360	1.25	17.9	91.7	25.061	208-230/460	
15	11	1200	284T	01512ET3E284T-W22	3,291	N1	360	1.25	17.9	91.7	26.433	208-230/460	
15	11	1200	284T	01512EG3E284T-W22	3,620	N1	437	1.25	18.1	93.0	26.433	208-230/460	11
15	11	900	286T	01509ET3E286T-W22	5,368	N1	463	1.25	19.4	90.2	27.929	208-230/460	
15	11	900	286T	01509EP3E286T-W22	4,291	W1	408	1.25	19.0	88.5	27.929	230/460	30
20	15	3600	256T	02036ET3E256T-W22	2,382	N1	313	1.25	23.2	91.0	24.945	208-230/460	
20	15	3600	256T	02036EG3E256T-W22	2,620	N1	331	1.25	23.0	93.0	24.945	208-230/460	
20	15	1800	256T	02018ET3E256TF3-W22	2,201	N1	324	1.25	24.1	93.0	24.945	208-230/460	
20	15	1800	256T	02018ET3E256T-W22	2,201	N1	324	1.25	24.1	93.0	24.945	208-230/460	
20	15	1800	256T	02018EG3E256T-W22	2,421	N1	346	1.25	24.7	94.1	24.945	208-230/460	
20	15	1200	286T	02012ET3E286T-W22	3,962	N1	503	1.25	24.2	91.7	27.929	208-230/460	
20	15	1200	286T	02012EG3E286T-W22	4,358	N1	501	1.25	24.4	93.0	27.929	208-230/460	11
20	15	900	324T	02009ET3E324T-W22	6,339	N1	557	1.25	28.3	91.0	29.620	208-230/460	
20	15	900	324T	02009EP3E324T-W22	5,277	W1	563	1.25	28.4	89.5	29.620	230/460	30

MOTOR HAS BEEN CHANGED FROM A 1800RPM TO A 3600RPM DESIGN: SEE HIGHLIGHT

Please see CATALOG NOTES, page 15

WITH W22 MOTORS SEVERE DUTY IS STANDARD

SEVERE DUTY - THREE PHASE

TEFC – Foot Mount, CONTINUED

Epact Efficiency
NEMA Premium Efficiency
Super Premium Efficiency

HP	kW	RPM	NEMA Frame	Catalog Number	List Price	Mult. Symbol	Approx. Shipping Weight (lbs)	Service Factor	FL Amps	FL. Eff (%)	"C" Dimension (in)	Voltage (V)	Notes
25	18.5	3600	284TS	02536ET3E284TSF3-W22	2,998	N1	353	1.25	28.5	91.7	25.061	208-230/460	
25	18.5	3600	284TS	02536ET3E284TS-W22	2,998	N1	353	1.25	28.5	91.7	25.061	208-230/460	
25	18.5	3600	284TS	02536EG3E284TS-W22	3,298	N1	413	1.25	28.5	93.6	25.061	208-230/460	
25	18.5	1800	284TS	02518ET3E284TS-W22	2,743	N1	481	1.25	29.5	93.6	25.061	208-230/460	
25	18.5	1800	284T	02518ET3E284T-W22	2,743	N1	481	1.25	29.5	93.6	26.433	208-230/460	
25	18.5	1800	284T	02518EG3E284T-W22	3,017	N1	433	1.25	30.3	94.5	26.433	208-230/460	
25	18.5	1200	324T	02512ET3E324T-W22	4,737	N1	605	1.25	30.4	93.0	29.620	208-230/460	
25	18.5	1200	324T	02512EG3E324T-W22	5,211	N1	557	1.25	30.8	94.1	29.620	208-230/460	11
25	18.5	900	326T	02509ET3E326T-W22	7,315	N1	632	1.25	35.9	91.0	31.116	208-230/460	
25	18.5	900	326T	02509EP3E326T-W22	5,924	W1	541	1.25	35.5	89.5	31.116	230/460	30
30	22	3600	286TS	03036ET3E286TSF3-W22	3,561	N1	428	1.25	33.8	91.7	26.557	208-230/460	
30	22	3600	286TS	03036ET3E286TS-W22	3,561	N1	428	1.25	33.8	91.7	26.557	208-230/460	
30	22	3600	286TS	03036EG3E286TS-W22	3,917	N1	464	1.25	33.5	93.6	26.557	208-230/460	
30	22	1800	286T	03018ET3E286TS-W22	3,223	N1	525	1.25	35.1	93.6	27.929	208-230/460	
30	22	1800	286T	03018ET3E286T-W22	3,223	N1	525	1.25	35.1	93.6	27.929	208-230/460	
30	22	1800	286T	03018EG3E286T-W22	3,545	N1	477	1.25	35.6	94.5	27.929	208-230/460	
30	22	1200	326T	03012ET3E326T-W22	5,273	N1	673	1.25	35.8	93.0	31.116	208-230/460	
30	22	1200	326T	03012EG3E326T-W22	5,800	N1	614	1.25	36.7	94.1	31.116	208-230/460	11
30	22	900	364/5T	03009ET3E364T-W22	11,215	N1	992	1.25	37.0	92.4	34.251	208-230/460	
30	22	900	364/5T	03009EP3E364T-W22	8,446	K1	970	1.25	37.0	91.0	34.251	230/460	30
40	30	3600	324TS	04036ET3E324TSF3-W22	4,725	N1	561	1.25	45.8	92.4	28.120	208-230/460	
40	30	3600	324TS	04036ET3E324TS-W22	4,725	N1	561	1.25	45.8	92.4	28.120	208-230/460	
40	30	3600	324TS	04036EG3E324TS-W22	5,198	N1	577	1.25	46.5	94.1	28.12	208-230/460	
40	30	1800	324T	04018ET3E324TS-W22	4,178	N1	640	1.25	48.2	94.1	29.620	208-230/460	
40	30	1800	324T	04018ET3E324T-W22	4,178	N1	640	1.25	48.2	94.1	29.620	208-230/460	
40	30	1800	324T	04018EG3E324T-W22	4,596	N1	564	1.25	48.9	95	29.620	208-230/460	
40	30	1200	364/5T	04012ET3E364T-W22	7,284	N1	1,076	1.25	46.5	94.1	34.251	208-230/460	
40	30	1200	364/5T	04012EG3E364T-W22	8,012	N1	989	1.25	48.9	95	34.251	208-230/460	11
40	30	900	364/5T	04009ET3E365T-W22	12,194	N1	1,063	1.25	50.0	92.4	34.251	208-230/460	
40	30	900	364/5T	04009EP3E365T-W22	9,973	K1	1,047	1.25	49.9	91.0	39.730	230/460	30
50	37	3600	326TS	05036ET3E326TSF3-W22	5,316	N1	607	1.25	56.1	93.0	29.616	208-230/460	
50	37	3600	326TS	05036ET3E326TS-W22	5,316	N1	607	1.25	56.1	93.0	29.616	208-230/460	
50	37	3600	326TS	05036EG3E326TS-W22	5,848	N1	636	1.25	57.1	94.5	29.616	208-230/460	
50	37	1800	326T	05018ET3E326TS-W22	5,100	N1	662	1.25	59.2	94.5	31.116	208-230/460	
50	37	1800	326T	05018ET3E326T-W22	5,100	N1	662	1.25	59.2	94.5	31.116	208-230/460	
50	37	1800	326T	05018EG3E326T-W22	5,610	N1	628	1.25	60.1	95.4	31.116	208-230/460	
50	37	1200	364/5T	05012ET3E365T-W22	8,518	N1	1,127	1.25	57.4	94.1	34.251	208-230/460	
50	37	1200	364/5T	05012EG3E365T-W22	9,370	N1	1,009	1.25	60.3	95	34.251	208-230/460	11
50	37	900	404/5T	05009ET3E404T-W22	17,648	N1	1,295	1.25	60.0	93.0	39.730	208-230/460	
50	37	900	404/5T	05009EP3E404T-W22	11,339	K1	1,253	1.25	61.0	91.7	39.730	230/460	30
50	37	900	404/5T	05009EP3EKD404T-W22	8,310	K1	1,116	1.15	61.0	91.7	39.730	230/460	14;30

Please see CATALOG NOTES, page 15

All data subject to change without notice

WITH W22 MOTORS SEVERE DUTY IS STANDARD

SEVERE DUTY - THREE PHASE

TEFC – Foot Mount, CONTINUED

Epact Efficiency
NEMA Premium Efficiency
Super Premium Efficiency

HP	kW	RPM	NEMA Frame	Catalog Number	List Price	Mult. Symbol	Approx. Shipping Weight (lbs)	Service Factor	FL Amps	FL. Eff (%)	"C" Dimension (in)	Voltage (V)	Notes
60	45	3600	364/5TS	06036ET3E364TSF3-W22	7,552	N1	992	1.25	67	93.6	32.276	208-230/460	
60	45	3600	364/5TS	06036ET3E364TS-W22	7,552	N1	992	1.25	67.0	93.6	32.276	208-230/460	
60	45	3600	364/5TS	06036ET3G364TS-W22	7,552	N1	992	1.25	67.0	93.6	32.276	460	
60	45	3600	364/5TS	06036EG3E364TS-W22	8,307	N1	1,040	1.25	66.8	95	32.276	208-230/460	
60	45	1800	364/5TS	06018ET3E364TS-W22	7,389	N1	963	1.25	68.3	95.0	32.276	208-230/460	
60	45	1800	364/5T	06018ET3E364T-W22	7,389	N1	1,036	1.25	68.3	95.0	34.251	208-230/460	
60	45	1800	364/5T	06018ET3G364T-W22	7,389	N1	1,036	1.25	68.3	95.0	34.251	460	
60	45	1800	364/5T	06018EG3E364T-W22	8,128	N1	1,011	1.25	70.2	95.8	34.251	208-230/460	
60	45	1200	404/5T	06012ET3E404T-W22	10,497	N1	1,346	1.25	69.5	94.5	39.730	208-230/460	
60	45	1200	404/5T	06012ET3ERB404T-W22	10,497	N1	1,346	1.25	69.5	94.5	39.730	208-230/460	14
60	45	1200	404/5T	06012ET3G404T-W22	10,497	N1	1,346	1.25	69.5	94.5	39.730	460	
60	45	1200	404/5T	06012ET3ERB404T-W22	10,497	N1	1,157	1.25	69.5	94.5	39.730	208-230/460	14
60	45	1200	404/5T	06012EG3E404T-W22	11,547	N1	1,231	1.25	72.2	95.4	39.73	208-230/460	11
60	45	900	404/5T	06009ET3E405T-W22	20,443	N1	1,463	1.25	73.0	93.0	39.730	208-230/460	
60	45	900	404/5T	06009EP3E405T-W22	12,908	K1	1,438	1.25	74.2	91.7	39.730	230/460	30
60	45	900	404/5T	06009EP3EKD405T-W22	9,397	K1	1,169	1.15	74.2	91.7	39.730	230/460	14;30
75	55	3600	364/5TS	07536ET3E365TS-W22	9,091	N1	1,025	1.25	81.9	93.6	32.276	208-230/460	
75	55	3600	364/5TS	07536ET3G365TS-W22	9,091	N1	1,025	1.25	81.9	93.6	32.276	460	
75	55	3600	364/5TS	07536EG3E365TS-W22	10,000	N1	1,051	1.25	82.6	95	32.276	208-230/460	
75	55	1800	364/5TS	07518ET3E365TS-W22	8,705	N1	1,047	1.25	84.1	95.4	32.276	208-230/460	
75	55	1800	364/5T	07518ET3E365T-W22	8,705	N1	1,047	1.25	84.1	95.4	34.251	208-230/460	
75	55	1800	364/5T	07518ET3G365T-W22	8,705	N1	1,047	1.25	84.1	95.4	34.251	460	
75	55	1800	364/5T	07518EG3E365T-W22	9,576	N1	1,033	1.25	86.8	95.8	34.251	208-230/460	
75	55	1200	404/5T	07512ET3E405T-W22	12,058	N1	1,478	1.25	84.9	94.5	39.730	208-230/460	
75	55	1200	404/5T	07512ET3ERB405T-W22	12,058	N1	1,478	1.25	84.9	94.5	39.730	208-230/460	14
75	55	1200	404/5T	07512ET3G405T-W22	12,058	N1	1,478	1.25	84.9	94.5	39.730	460	
75	55	1200	404/5T	07512ET3GRB405T-W22	12,058	N1	1,478	1.25	84.9	94.5	39.730	460	14
75	55	1200	404/5T	07512ET3ERB405T-W22	12,058	N1	1,210	1.25	84.9	94.5	39.730	208-230/460	14
75	55	1200	404/5T	07512ET3GRB405T-W22	12,058	N1	1,210	1.25	84.9	94.5	39.730	460	14
75	55	1200	404/5T	07512EG3E405T-W22	13,264	N1	1,245	1.25	89.3	95.4	39.73	208-230/460	11
75	55	900	444/5T	07509ET3E444T-W22	23,334	N1	1,660	1.25	93.0	93.6	44.950	208-230/460	
75	55	900	444/5T	07509EP3E444T-W22	16,918	K1	1,631	1.25	92.8	93.0	44.950	230/460	30
75	55	900	444/5T	07509EP3GKD444T-W22	13,733	K1	1,595	1.15	92.8	93.0	44.950	460	14;30

Please see CATALOG NOTES, page 15

WITH W22 MOTORS SEVERE DUTY IS STANDARD

SEVERE DUTY - THREE PHASE

TEFC – Foot Mount, CONTINUED

Epact Efficiency
NEMA Premium Efficiency
Super Premium Efficiency

HP	kW	RPM	NEMA Frame	Catalog Number	List Price	Mult. Symbol	Approx. Shipping Weight (lbs)	Service Factor	FL Amps	FL. Eff (%)	"C" Dimension (in)	Voltage (V)	Notes
100	75	3600	404/5TS	10036ET3E405TS-W22	12,002	N1	1,361	1.25	110	94.1	36.732	208-230/460	
100	75	3600	404/5TS	10036ET3G405TS-W22	12,002	N1	1,361	1.25	110	94.1	36.732	460	
100	75	3600	404/5TS	10036EG3E405TS-W22	13,202	N1	1,300	1.25	110	95.4	36.732	208-230/460	
100	75	1800	404/5TS	10018ET3E405TS-W22	11,689	N1	1,273	1.25	111	95.4	36.732	208-230/460	
100	75	1800	404/5T	10018ET3E405T-W22	11,689	N1	1,302	1.25	111	95.4	39.730	208-230/460	
100	75	1800	404/5T	10018ET3ERB405T-W22	11,689	N1	1,302	1.25	111	95.4	39.730	208-230/460	14
100	75	1800	404/5T	10018ET3G405T-W22	11,689	N1	1,302	1.25	111	95.4	39.730	460	
100	75	1800	404/5T	10018ET3GRB405T-W22	11,689	N1	1,302	1.25	111	95.4	39.730	460	14
100	75	1800	404/5T	10018ET3ERB405T-W22	11,689	N1	1,302	1.25	111	95.4	39.730	208-230/460	14
100	75	1800	404/5T	10018ET3GRB405T-W22	11,689	N1	1,302	1.25	111	95.4	39.730	460	14
100	75	1800	404/5T	10018EG3E405T-W22	12,858	N1	1,308	1.25	116	96.2	39.73	208-230/460	
100	75	1200	444/5T	10012ET3E444T-W22	15,631	N1	2,006	1.25	121	95.0	44.950	208-230/460	
100	75	1200	444/5T	10012ET3ERB444T-W22	15,631	N1	2,006	1.25	121	95.0	44.950	208-230/460	14
100	75	1200	444/5T	10012ET3G444T-W22	15,631	N1	2,006	1.25	121	95.0	44.950	460	
100	75	1200	444/5T	10012ET3GRB444T-W22	15,631	N1	2,006	1.25	121	95.0	44.950	460	14
100	75	1200	444/5T	10012ET3ERB444T-W22	15,631	N1	1,741	1.25	121	95.0	44.950	208-230/460	14
100	75	1200	444/5T	10012ET3GRB444T-W22	15,631	N1	1,741	1.25	121	95.0	44.950	460	14
100	75	1200	444/5T	10012EG3E444T-W22	17,194	N1	2,046	1.25	124	95.8	44.95	208-230/460	11
100	75	900	444/5T	10009ET3E445T-W22	26,988	N1	1,900	1.25	127	94.1	44.950	208-230/460	
100	75	900	444/5T	10009ET3G445T-W22	26,988	N1	1,900	1.25	127	94.1	44.950	460	
100	75	900	444/5T	10009EP3E445T-W22	21,909	K1	1,896	1.25	127	93.0	44.950	230/460	30
100	75	900	444/5T	10009EP3G445T-W22	21,909	K1	1,896	1.25	127	93.0	44.950	460	30
100	75	900	444/5T	10009EP3GKD445T-W22	16,009	K1	1,896	1.15	127	93.0	44.950	460	14;30

Please see CATALOG NOTES, page 15

All data subject to change without notice

WITH W22 MOTORS SEVERE DUTY IS STANDARD

SEVERE DUTY - THREE PHASE

TEFC – Foot Mount, CONTINUED

Epact Efficiency
NEMA Premium Efficiency
Super Premium Efficiency

HP	kW	RPM	NEMA Frame	Catalog Number	List Price	Mult. Symbol	Approx. Shipping Weight (lbs)	Service Factor	FL Amps	FL. Eff (%)	"C" Dimension (in)	Voltage (V)	Notes
125	90	3600	444/5TS	12536ET3E444TS-W22	15,350	N1	1,801	1.15	134	95.0	41.200	208-230/460	
125	90	3600	444/5TS	12536ET3G444TS-W22	15,350	N1	1,794	1.15	134	95.0	41.200	460	
125	90	3600	444/5TS	12536EG3G444TS-W22	16,885	N1	1,830	1.25	136	95.8	41.200	460	
125	90	1800	444/5TS	12518ET3E444TS-W22	14,748	N1	1,545	1.15	139	95.4	41.200	208-230/460	
125	90	1800	444/5T	12518ET3E444T-W22	14,748	N1	1,841	1.15	139	95.4	44.950	208-230/460	
125	90	1800	444/5T	12518ET3ERB444T-W22	14,748	N1	1,841	1.15	139	95.4	44.950	208-230/460	14
125	90	1800	444/5T	12518ET3G444T-W22	14,748	N1	1,841	1.15	139	95.4	44.950	460	
125	90	1800	444/5T	12518ET3GRB444T-W22	14,748	N1	1,841	1.15	139	95.4	44.950	460	14
125	90	1800	444/5T	12518ET3Q444T-W22	14,748	N1	1,617	1.15	139	95.4	44.950	460	
125	90	1800	444/5T	12518ET3ERB444T-W22	15,563	N1	1,841	1.15	139	95.4	44.950	208-230/460	14
125	90	1800	444/5T	12518ET3GRB444T-W22	14,748	N1	1,841	1.15	139	95.4	44.950	460	14
125	93	1800	444/5T	12518EG3G444T-W22	16,223	N1	1,872	1.25	144	96.2	44.95	460	
125	90	1200	444/5T	12512ET3E445T-W22	17,947	N1	2,082	1.15	143	95.0	44.950	208-230/460	
125	90	1200	444/5T	12512ET3ERB445T-W22	17,947	N1	2,082	1.15	143	95.0	44.950	208-230/460	14
125	90	1200	444/5T	12512ET3G445T-W22	17,947	N1	2,082	1.15	143	95.0	44.950	460	
125	90	1200	444/5T	12512ET3GRB445T-W22	17,947	N1	2,082	1.15	143	95.0	44.950	460	14
125	90	1200	444/5T	12512ET3ERB445T-W22	18,939	N1	2,082	1.15	143	95.0	44.950	208-230/460	14
125	90	1200	444/5T	12512ET3GRB445T-W22	18,939	N1	2,082	1.15	143	95.0	44.950	460	14
125	93	1200	444/5T	12512EG3G445T-W22	19,742	N1	2,095	1.25	152	95.8	44.95	460	11
125	90	900	445/7T	12509ET3G447T-W22	28,175	N1	2,242	1.15	151	94.5	48.701	460	
125	90	900	445/7T	12509EP3E447T-W22	25,308	K1	2,248	1.15	151	93.6	48.701	230/460	30
125	90	900	445/7T	12509EP3G447T-W22	25,308	K1	2,248	1.15	151	93.6	48.701	460	30
125	90	900	445/7T	12509EP3GKD447T-W22	22,808	K1	2,132	1.15	151	93.6	48.701	460	14;30

Please see CATALOG NOTES, page 15

WITH W22 MOTORS SEVERE DUTY IS STANDARD

SEVERE DUTY - THREE PHASE

TEFC – Foot Mount, CONTINUED

Epact Efficiency
NEMA Premium Efficiency
Super Premium Efficiency

HP	kW	RPM	NEMA Frame	Catalog Number	List Price	Mult. Symbol	Approx. Shipping Weight (lbs)	Service Factor	FL Amps	FL. Eff (%)	"C" Dimension (in)	Voltage (V)	Notes
150	110	3600	444/5TS	15036ET3E445TS-W22	18,882	N1	1,774	1.15	161	95.0	41.200	208-230/460	
150	110	3600	444/5TS	15036ET3G445TS-W22	18,882	N1	1,865	1.15	161	95.0	41.200	460	
150	110	3600	444/5TS	15036ET3Q445TS-W22	18,882	N1	1,858	1.15	161	95.0	41.200	460	
150	110	3600	444/5TS	15036EG3G445TS-W22	20,770	N1	2,013	1.25	163	96.2	41.200	460	
150	110	1800	444/5T	15018ET3E445T-W22	17,420	N1	1,900	1.15	170	95.8	44.950	208-230/460	
150	110	1800	444/5TS	15018ET3G445TS-W22	17,420	N1	1,841	1.15	170	95.8	41.200	460	
150	110	1800	444/5T	15018ET3G445T-W22	17,420	N1	1,841	1.15	170	95.8	44.950	460	
150	110	1800	444/5T	15018ET3GRB445T-W22	17,420	N1	1,841	1.15	170	95.8	44.950	460	14
150	110	1800	444/5T	15018ET3Q445T-W22	17,420	N1	1,841	1.15	170	95.8	44.950	460	
150	110	1800	444/5T	15018ET3GRB445T-W22	17,420	N1	1,841	1.15	170	95.8	44.950	460	14
150	110	1800	444/5T	15018EG3G445T-W22	19,162	N1	2,101	1.25	170	96.5	44.95	460	
150	110	1200	445/7T	15012ET3E447T-W22	20,639	N1	2,166	1.15	176	95.8	48.701	208-230/460	
150	110	1200	445/7T	15012ET3G447T-W22	20,639	N1	2,738	1.15	176	95.8	48.701	460	
150	110	1200	445/7T	15012ET3GRB447T-W22	20,639	N1	2,738	1.15	176	95.8	48.701	460	14
150	110	1200	445/7T	15012ET3GRB447T-W22	20,639	N1	2,210	1.15	176	95.8	48.701	460	14
150	110	1200	447/9T	15012EG3G449T-W22	22,703	N1	2,438	1.25	179	96.2	56.338	460	11
150	110	900	447/9T	15009ET3G449T-W22	30,677	N1	2,471	1.15	185	94.5	56.338	460	
150	110	900	447/9T	15009EP3G449T-W22	28,688	K1	2,500	1.15	184	93.6	56.338	460	30
150	110	900	445/7T	15009EP3GKD447T-W22	25,429	K1	2,337	1.15	184	93.6	48.701	460	14;30
200	150	3600	445/7TS	20036ET3E447TS-W22	23,562	N1	2,061	1.15	219	95.4	44.951	208-230/460	
200	150	3600	445/7TS	20036ET3G447TS-W22	23,562	N1	2,072	1.15	219	95.4	44.951	460	
200	150	3600	504/5S	20036ET3G504S-W22	23,562	N1	2,072	1.15	222	95.4	48.215	460	
200	150	3600	445/7TS	20036EG3G447TS-W22	25,918	N1	2,207	1.25	217	96.2	44.951	460	
200	150	1800	445/7T	20018ET3E447T-W22	21,098	N1	2,063	1.15	230	96.2	48.701	208-230/460	
200	150	1800	445/7T	20018ET3G447TS-W22	21,098	N1	2,063	1.15	230	96.2	48.701	460	
200	150	1800	445/7T	20018ET3G447T-W22	21,098	N1	2,063	1.15	230	96.2	48.701	460	
200	150	1800	504/5	20018ET3G504-W22	21,098	N1	2,063	1.15	228	96.2	54.095	460	
200	150	1800	445/7T	20018ET3GRB447T-W22	21,098	N1	2,063	1.15	230	96.2	48.701	460	14
200	150	1800	445/7T	20018ET3GRB447T-W22	21,098	N1	1,850	1.15	230	96.2	48.701	460	14
200	150	1800	447/9T	20018EG3G449T-W22	23,208	N1	2,475	1.25	234	96.8	56.338	460	
200	150	1200	447/9T	20012ET3E449T-W22	25,255	N1	2,495	1.15	237	95.8	56.338	208-230/460	
200	150	1200	445/7T	20012ET3G447T-W22	25,133	N1	2,467	1.15	237	95.8	48.701	460	
200	150	1200	447/9T	20012ET3G449T-W22	25,255	N1	2,467	1.15	237	95.8	56.338	460	
200	150	1200	504/5	20012ET3G505-W22	25,255	N1	2,467	1.15	237	95.8	54.095	460	
200	150	1200	445/7T	20012ET3GRB447T-W22	25,133	N1	2,467	1.15	237	95.8	48.701	460	14
200	150	1200	447/9T	20012ET3GRB449T-W22	25,255	N1	2,467	1.15	237	95.8	56.338	460	14
200	150	1200	504/5Z	20012EP3GKD505Z-W22	20,945	K1	2,495	1.15	236	95.0	55.090	460	14;18;30
200	150	1200	445/7T	20012ET3GRB447T-W22	25,133	N1	2,467	1.15	237	95.8	48.701	460	14
200	150	1200	447/9T	20012ET3GRB449T-W22	25,255	N1	2,467	1.15	237	95.8	56.338	460	14
200	150	1200	447/9T	20012EG3G449T-W22	27,646	N1	2,508	1.25	245	96.2	56.338	460	11
200	150	900	447/9T	20009ET3G449T-W22	49,899	N1	4,212	1.15	254	95.0	56.338	460	
200	150	900	447/9T	20009EP3G449T-W22	43,236	K1	3,509	1.15	252	94.5	56.338	460	30
200	150	900	447/9T	20009EP3GKD449-W22	34,001	K1	3,706	1.15	262	94.5	56.338	460	14;30

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WITH W22 MOTORS SEVERE DUTY IS STANDARD

SEVERE DUTY - THREE PHASE

TEFC – Foot Mount, CONTINUED

Epact Efficiency
NEMA Premium Efficiency
Super Premium Efficiency

HP	kW	RPM	NEMA Frame	Catalog Number	List Price	Mult. Symbol	Approx. Shipping Weight (lbs)	Service Factor	FL Amps	FL. Eff (%)	"C" Dimension (in)	Voltage (V)	Notes
250	185	3600	445/7TS	25036ET3G447TS-W22	29,846	N1	2,266	1.15	266	95.8	44.951	460	
250	185	3600	447/9TS	25036ET3G449TS-W22	33,173	N1	2,266	1.15	266	95.8	52.588	460	
250	185	3600	445/7TS	25036EP3E447TS-W22	21,318	W1	2,172	1.15	270	95.4	44.951	230/460	30
250	185	3600	447/9TS	25036EP3E449TS-W22	24,878	K1	2,172	1.15	270	95.4	52.588	230/460	30
250	185	3600	445/7TS	25036EP3G447TS-W22	21,318	W1	2,266	1.15	270	95.4	44.951	460	30
250	185	3600	447/9TS	25036EP3G449TS-W22	24,878	K1	2,266	1.15	270	95.4	52.588	460	30
250	185	3600	445/7TS	25036EP3Q447TS-W22	21,318	W1	2,275	1.15	270	95.4	44.951	460	30
250	185	3600	447/9TS	25036EP3Q449TS-W22	24,878	K1	2,275	1.15	270	95.4	52.588	460	30
250	185	3600	445/7TS	25036EG3G447TS-W22	32,831	N1	2,361	1.25	267	96.5	44.951	460	
250	185	1800	445/7T	25018ET3G447T-W22	26,716	N1	2,414	1.15	281	96.2	48.701	460	
250	185	1800	447/9T	25018ET3G449T-W22	26,803	N1	2,414	1.15	281	96.2	56.338	460	
250	185	1800	445/7T	25018ET3GRB447T-W22	26,716	N1	2,414	1.15	281	96.2	48.701	460	14
250	185	1800	447/9T	25018ET3GRB449T-W22	26,803	N1	2,414	1.15	281	96.2	56.338	460	14
250	185	1800	445/7T	25018EP3G447T-W22	23,492	K1	2,513	1.15	283	95.4	48.701	460	30
250	185	1800	447/9T	25018EP3G449T-W22	25,315	K1	2,513	1.15	283	95.4	56.338	460	30
250	185	1800	445/7T	25018EP3GRB447T-W22	23,435	W1	2,513	1.15	283	95.4	48.701	460	14;30
250	185	1800	447/9T	25018EP3GRB449T-W22	25,315	K1	2,513	1.15	283	95.4	56.338	460	14;30
250	185	1800	445/7T	25018EP3GKD447T-W22	21,399	K1	2,425	1.15	285	95.8	48.701	460	14;30
250	185	1800	504/5Z	25018EP3GKD505Z-W22	22,190	K1	2,475	1.15	285	95.8	55.090	460	14;18;30
250	185	1800	447/9T	25018EG3G449T-W22	29,388	N1	2,718	1.25	286	96.8	56.338	460	
250	185	1200	447/9T	25012ET3E449T-W22	35,555	N1	3,966	1.15	292	95.8	56.338	208-230/460	
250	185	1200	447/9T	25012ET3G449T-W22	35,555	N1	4,002	1.15	292	95.8	56.338	460	
250	185	1200	586/7	25012ET3G586/7-W22	39,631	N1	4,002	1.15	299	95.8	61.902	460	
250	185	1200	447/9T	25012ET3GRB449T-W22	35,555	N1	4,002	1.15	292	95.8	56.338	460	14
250	185	1200	447/9T	25012EP3G449T-W22	35,744	K1	4,002	1.15	291	95.0	56.338	460	30
250	185	1200	447/9T	25012EP3GRB449T-W22	35,744	K1	4,002	1.15	291	95.0	56.338	460	14;30
250	185	1200	447/9T	25012EP3GKD449-W22	28,784	K1	3,805	1.15	300	95.4	56.338	460	14;30
250	185	1200	586/7Z	25012EP3GKD580Z-W22	36,377	K1	3,710	1.15	304	95.4	61.902	460	14;18;30
250	185	900	L447/9T	25009ET3G449T-W22	56,168	N1	4,639	1.15	308	95.4	57.181	460	
250	185	900	586/7	25009EP3GKD586/7-W22	45,434	K1	4,123	1.15	308	95.4	61.902	460	14;30

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WITH W22 MOTORS SEVERE DUTY IS STANDARD

SEVERE DUTY - THREE PHASE

TEFC – Foot Mount, CONTINUED

Epact Efficiency
NEMA Premium Efficiency
Super Premium Efficiency

HP	kW	RPM	NEMA Frame	Catalog Number	List Price	Mult. Symbol	Approx. Shipping Weight (lbs)	Service Factor	FL Amps	FL. Eff (%)	"C" Dimension (in)	Voltage (V)	Notes
300	220	3600	447/9TS	30036ET3G449TS-W22	38,269	N1	3,374	1.15	320	95.8	52.588	460	
300	220	3600	447/9TS	30036EP3G449TS-W22	33,348	K1	3,350	1.15	322	95.4	52.588	460	30
300	220	1800	447/9TS	30018ET3G449TS-W22	31,384	N1	3,837	1.15	330	96.2	52.588	460	
300	220	1800	447/9T	30018ET3G449T-W22	31,384	N1	3,837	1.15	330	96.2	56.338	460	
300	220	1800	447/9T	30018ET3GRB449T-W22	31,384	N1	3,837	1.15	330	96.2	56.338	460	14
300	220	1800	447/9T	30018EP3G449T-W22	29,765	K1	2,816	1.15	337	95.4	56.338	460	30
300	220	1800	447/9T	30018EP3GRB449T-W22	29,765	K1	3,837	1.15	337	95.4	56.338	460	14;30
300	220	1800	447/9T	30018EP3GKD449-W22	29,957	K1	3,104	1.15	335	95.8	56.338	460	14;30
300	220	1800	586/7Z	30018EP3GKD580Z-W22	34,713	K1	3,422	1.15	335	95.8	61.902	460	14;18;30
300	220	1200	447/9T	30012ET3G449T-W22	38,437	N1	4,487	1.15	347	95.8	56.338	460	
300	220	1200	586/7	30012ET3G586/7-W22	44,301	N1	4,487	1.15	356	95.8	61.902	460	
300	220	1200	447/9T	30012ET3GRB449T-W22	38,437	N1	4,487	1.15	347	95.8	56.338	460	14
300	220	1200	447/9T	30012EP3G449T-W22	36,229	K1	3,358	1.15	350	95.0	56.338	460	30
300	220	1200	447/9T	30012EP3GRB449T-W22	36,229	K1	4,487	1.15	350	95.0	56.338	460	14;30
300	220	1200	447/9T	30012EP3GKD449-W22	37,574	K1	3,495	1.15	362	95.4	56.338	460	14;30
300	220	1200	586/7Z	30012EP3GKD580Z-W22	42,320	K1	3,953	1.15	362	95.4	61.902	460	14;18;30
300	220	1200	586/7	30012EP3GKD586/7-W22	42,320	K1	3,903	1.15	362	95.4	61.902	460	14;30
300	220	900	L447/9T	30009ET3G449T-W22	70,362	N1	4,873	1.15	371	95.4	57.181	460	
300	220	900	586/7	30009EP3GKD586/7-W22	56,876	K1	4,293	1.15	366	95.4	61.902	460	14;30
350	260	3600	447/9TS	35036ET3G449TS-W22	43,805	N1	3,605	1.15	377	96.2	52.588	460	
350	260	3600	447/9TS	35036EP3G449TS-W22	36,622	K1	3,333	1.15	378	95.8	52.588	460	30
350	260	1800	447/9T	35018ET3G449TS-W22	36,517	N1	4,300	1.15	394	96.2	56.338	460	
350	260	1800	447/9T	35018ET3G449T-W22	36,517	N1	4,300	1.15	394	96.2	56.338	460	
350	260	1800	447/9T	35018ET3GRB449T-W22	36,517	N1	4,300	1.15	394	96.2	56.338	460	14
350	260	1800	447/9T	35018EP3G449T-W22	36,337	K1	3,333	1.15	396	95.8	56.338	460	30
350	260	1800	447/9T	35018EP3GRB449T-W22	36,337	K1	4,300	1.15	396	95.8	56.338	460	14;30
350	260	1800	447/9T	35018EP3GKD449-W22	33,207	K1	3,472	1.15	396	95.8	56.338	460	14;30
350	260	1800	586/7Z	35018EP3GKD580Z-W22	37,249	K1	3,810	1.15	401	95.8	61.902	460	14;18;30
350	260	1200	L447/9T	35012ET3G449T-W22	47,633	N1	4,723	1.15	415	95.8	57.181	460	
350	260	1200	L447/9T	35012ET3GRB449T-W22	47,633	N1	4,723	1.15	415	95.8	57.181	460	14
350	260	1200	586/7	35012EP3G586/7-W22	47,249	W1	4,719	1.15	422	95.4	61.902	460	30
350	260	1200	586/7Z	35012EP3GKD580Z-W22	46,284	K1	4,405	1.15	428	95.4	61.902	460	14;18;30
350	260	900	586/7	35009ET3G586/7-W22	86,909	N1	5,028	1.00	426	95.8	61.902	460	1
350	260	900	586/7	35009EP3G586/7-W22	65,217	K1	5,093	1.00	429	95.0	61.902	460	1;30
350	260	900	586/7	35009EP3GKD586/7-W22	59,819	K1	4,717	1.15	429	95.0	61.902	460	14;30

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WITH W22 MOTORS SEVERE DUTY IS STANDARD

SEVERE DUTY - THREE PHASE

TEFC – Foot Mount, CONTINUED

Epact Efficiency
NEMA Premium Efficiency
Super Premium Efficiency

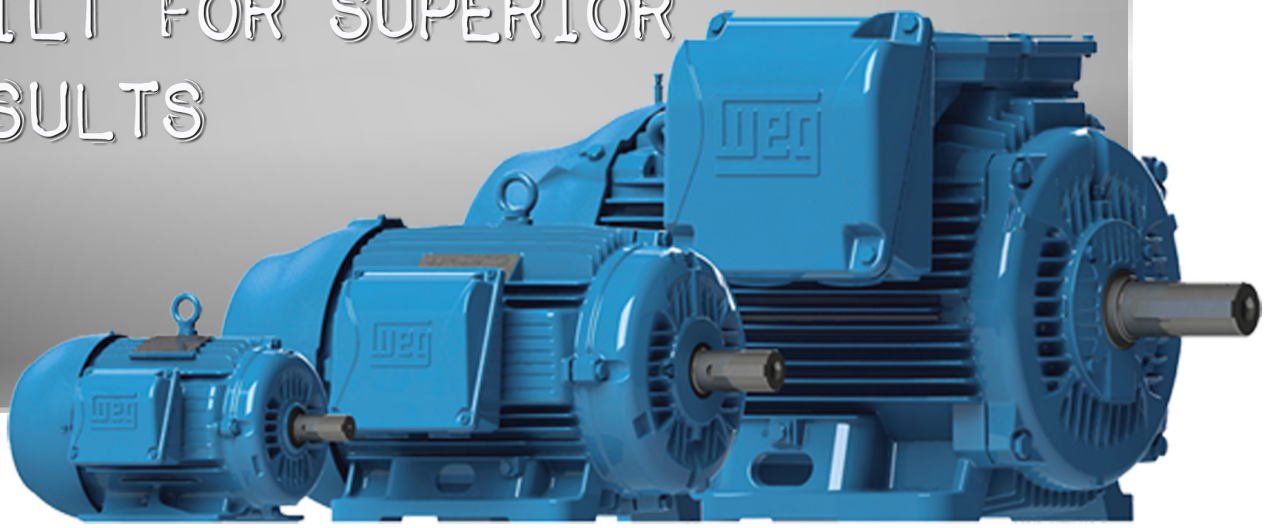
HP	kW	RPM	NEMA Frame	Catalog Number	List Price	Mult. Symbol	Approx. Shipping Weight (lbs)	Service Factor	FL Amps	FL. Eff (%)	"C" Dimension (in)	Voltage (V)	Notes
400	300	3600	L447/9TS	40036ET3G449TS-W22	44,605	N1	3,308	1.15	432	95.8	53.431	460	
400	300	1800	L447/9TS	40018ET3G449TS-W22	43,805	N1	4,686	1.15	455	96.2	53.431	460	
400	300	1800	L447/9T	40018ET3G449T-W22	43,805	N1	4,686	1.15	455	96.2	57.181	460	
400	300	1800	L447/9T	40018ET3GRB449T-W22	43,805	N1	4,686	1.15	455	96.2	57.181	460	14
400	300	1800	586/7Z	40018EP3GKD580Z-W22	43,272	K1	4,218	1.15	452	95.8	61.902	460	14;18;30
400	300	1200	L447/9T	40012ET3G449T-W22	52,307	N1	4,961	1.15	477	95.8	57.181	460	
400	300	1200	586/7	40012ET3G586/7-W22	56,201	N1	4,961	1.15	483	96.2	61.902	460	
400	300	1200	L447/9T	40012ET3GRB449T-W22	52,307	N1	4,961	1.15	477	95.8	57.181	460	14
400	300	1200	586/7Z	40012EP3GKD580Z-W22	50,817	K1	4,548	1.15	485	95.4	61.902	460	14;18;30
400	300	1200	586/7	40012EP3GKD586/7-W22	50,817	K1	4,498	1.15	485	95.4	61.902	460	14;30
400	300	900	588/9	40009ET3G588/9-W22	66,123	N1	3,308	1.00	498	95.7	69.381	460	1
450	330	3600	L447/9TS	45036ET3G449TS-W22	49,610	N1	3,418	1.00	475	95.8	53.431	460	1
450	330	1800	L447/9T	45018ET3G449T-W22	48,010	N1	5,204	1.15	501	96.2	57.181	460	
450	330	1800	L447/9T	45018ET3GRB449T-W22	48,010	N1	5,204	1.15	501	96.2	57.181	460	14
450	330	1800	586/7	45018EP3G586/7-W22	46,053	W1	5,204	1.15	503	95.8	61.902	460	30
450	330	1800	586/7Z	45018EP3GKD580Z-W22	46,410	K1	4,438	1.15	497	95.8	61.902	460	14;18;30
450	330	1800	586/7	45018EP3GKD586/7-W22	46,410	K1	4,513	1.15	497	95.8	61.902	460	14;30
450	330	1200	586/7	45012ET3G586/7-W22	62,251	N1	5,248	1.00	532	96.2	61.902	460	1
450	330	1200	586/7	45012ET3GRB586/7-W22	62,251	N1	5,248	1.00	532	96.2	61.902	460	1;14
450	330	1200	586/7	45012EP3G586/7-W22	48,977	K1	5,248	1.00	536	95.4	61.902	460	1;30
450	330	1200	586/7	45012EP3GRB586/7-W22	48,977	K1	5,248	1.00	536	95.4	61.902	460	1;14;30
450	330	1200	586/7Z	45012EP3GKD580Z-W22	54,954	K1	4,670	1.15	540	95.4	61.902	460	14;18;30
450	330	900	588/9	45009ET3G588/9-W22	68,715	N1	3,308	1.00	554	95.8	69.381	460	1
500	370	3600	586/7S	50036ET3G586/7S-W22	56,305	N1	4,236	1.15	530	96.2	55.027	460	
500	370	1800	L447/9T	50018ET3G449T-W22	50,594	N1	5,424	1.00	561	96.2	57.181	460	1;19
500	370	1800	L447/9T	50018ET3GRB449T-W22	50,594	N1	5,424	1.00	561	96.2	57.181	460	1;14
500	370	1800	586/7Z	50018EP3GKD580Z-W22	47,713	K1	4,637	1.15	557	95.8	61.902	460	14;18;30
500	370	1200	586/7	50012ET3G586/7-W22	62,962	N1	5,248	1.00	603	96.2	61.902	460	1
500	370	1200	586/7Z	50012EP3GKD580Z-W22	58,329	K1	5,115	1.15	598	95.8	61.902	460	
600	450	3600	588/9S	60036ET3G588/9S-W22	64,635	N1	4,580	1.00	650	96.5	62.506	460	1
600	450	1800	586/7	60018ET3G586/7-W22	60,316	N1	5,248	1.00	665	96.5	61.902	460	1
600	450	1200	588/9	60012ET3G588/9-W22	71,374	N1	3,308	1.00	743	96.2	69.381	460	1
650	480	3600	588/9S	65036ET3G588/9S-W22	66,835	N1	4,805	1.00	685	96.6	62.506	460	1
650	480	1800	588/9	65018ET3G588/9-W22	66,701	N1	3,308	1.00	734	96.6	69.381	460	1
700	515	3600	588/9S	70036ET3G588/9S-W22	71,254	N1	4,975	1.00	736	96.6	62.506	460	1
700	515	1800	588/9	70018ET3G588/9-W22	71,185	N1	3,308	1.00	788	96.6	69.381	460	1
750	550	1800	588/9	75018ET3G588/9-W22	74,025	N1	3,308	1.00	840	96.7	69.381	460	1

Please see CATALOG NOTES, page 15

All data subject to change without notice

Severe Duty is Standard with WEG W22 motors.

SUPERIOR SPECIFICATIONS BUILT FOR SUPERIOR RESULTS



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Catalog Notes:

1 *1.0 Service Factor*

11 *Product Might Not be Available in Stock*

14 *Roller Bearing*

18 *Z-Frame; Bigger Shaft Diameter and Bearings*

19 *105K Tempature Rise*

30 *High Efficiency (EPACT)*

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Low Voltage Motors, Single and 3-Phase, 1/8 – 700HP

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Explosion Proof Motors
Crusher Duty Motors
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P-Base Pump Motors
Oil Well Pumping Motors
Pool & Spa Motors
Brake Motors
Compressor Duty Motors
Farm Duty Motors
Poultry Fan Motors
Auger Drive Motors
IEEE 841 Motors
Stainless Steel Wash Down Motors
Saw Arbor Motors
Cooling Tower Motors
Commercial HVAC Motors
Pad Mounted Motors
Vector Duty Motors

Large Electric Motors

Low Voltage 3-phase motors up to 2,500HP
Induction Motors up to 70,000HP and 13,200V
Wound Rotor Systems (including starters) up to 70,000HP and 13,200V
Synchronous Motors up to 200,000HP and 13,200V
Explosion proof motors (Ex-d) up to 1,500kW and 11kV
Ex-n, Ex-e, Ex-p motors

Variable Frequency Drives

Low Voltage 1/4 to 2500HP, 230V – 480V
Medium Voltage 500-10,000HP
Multi-pump systems
NEMA 4X
Dynamic braking resistors
Line and load reactors
Plug and play technology
Network communications: Profibus-DP, DeviceNet, Modbus-RTU
PLC functions integrated
Complete line of options and accessories

Soft Starters

3-1500HP
Oriented start-up
Built-in bypass contactor
Universal source voltage (230-575V, 50/60Hz)
Network communications: Profibus-DP, DeviceNet, Modbus-RTU
Complete Line of options and accessories
MV Soft-starter 3.3kV, 4.16kV: up to
3500HP, Withdrawable Power Stacks, & 8x PT100 Temperature monitoring

Controls

Mini – Contactors
IEC Contactors
Thermal Overload Relays
Manual Motor Protectors
Molded Case Circuit Breakers
Smart Relays
Enclosed Starters: combination & non-combination
Pushbuttons & Pilot Lights
Timing & Motor Protection Relays
Terminal Blocks

Custom Panels

Custom configured to your specification.
NEMA 1, 12, 3R, 4 and 4X cabinets
Quick delivery of preconfigured drives and soft starters
UL 508 certified
Low Voltage (230-460)
Made in the U.S.A.

Generators

Brushless Synchronous Generators for diesel gen-sets up to 4,200kVA
Hydro-generators up to 25,000kVA
Turbo-generators up to 175,000kVA

Power Transformers

Built and engineered in North America
Voltages < 345kV
Ratings 5-250MVA
Station class, oil filled, round core, copper windings
Special configurations and designs available!
Ask your WEG Sales Representative for details.
Designed, built, and engineered to ANSI standards.

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WEG can package any of its products for ease of sale! Enjoy a single point of contact for the entire package of products and assistance from quote through after-sales support. Ask your WEG Sales Representative for details.

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VARIABLE FREQUENCY DRIVES

CFW700B24P0T4DBN1

CFW700
General Purpose Drive

Variable Speed Drives

CFW700 - General Purpose Drive

The CFW700 was developed for controlling squirrel cage three-phase induction motors, it is a general purpose drive that gives customers the fexibility needed for the control of applications ranging from simple speed control to more demanding ones as torque control. Designed for exclusively industrial or professional use the CFW700 features Sensorless and Closed Loop control as standard utilising the internal micro PLC, the SoftPLC means that the CFW700 can be used for more sophisticated applications like overhead cranes, PCP (Progressive Cavity Pump), pump jack and many more.

Own Technology

Vectrue Technology® - WEG Variable Speed Drive Control Technology

- Four control modes in one drive, linear and adjustable V/F, VVW (Voltage Vector WEG), sensorless vector and closed loop vector (encoder interface factory built)
- Sensorless vector control allows for high torque and quick response in open loop, even at low speeds
- Self-tuning function automatically matches VSD with motor - load when on Sensorless, VVW and closed loop vector mode
- Through adjustable V/F control it is possible to adjust a quadratic V/F curve and that implies energy saving when quadratic torque loads (e.g.: centrifugal pumps and fans) are being driven

Optimal Braking®
WEG Frequency Inverters Braking Technology

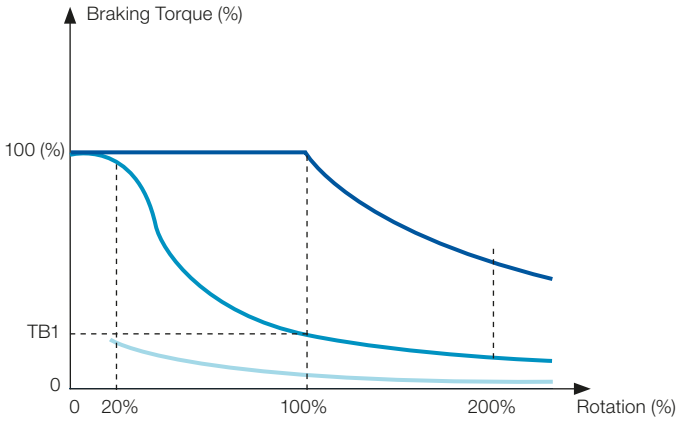
In applications where high inertia and short deceleration times are involved, a large amount of energy is returned from the motor to the VSD.

To handle this energy traditional VSDs have to dissipate it as heat in power resistors, such resistors are usually large and very expensive also the heat dissipation has to be taken into consideration during installation.

As an alternative to the use of braking resistors the CFW700 features a special braking method in vector control mode named Optimal Braking®.

This innovation delivers rated torque with high performance requiring no resistor.

The graph illustrated shows a comparison of the braking torque offered by the different braking methods used.



Typical Braking Torque x Speed Graph for a 10 HP / 7.5 kW motor driven by a CFW700

- Dynamic Braking Torque Curve
- Optimal Braking® Torque Curve
- DC Braking Torque Curve

Optimal Flux® - WEG Technology for the Control of High Efficiency Induction Motors Applied to Constant Torque Load

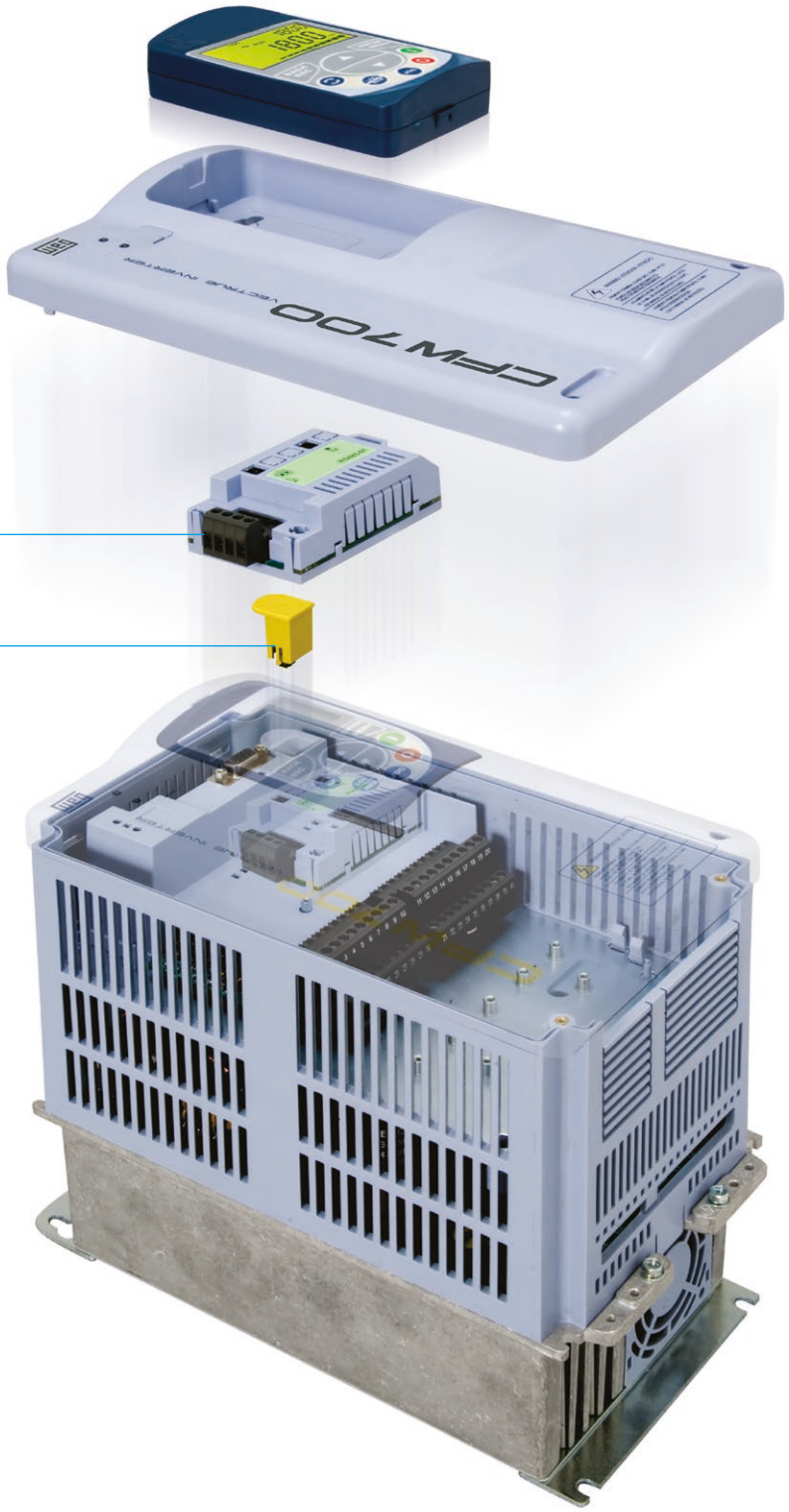
- Rated torque at very low speed discarding the use for forced ventilation or even motor oversizing, thus costs are reduced.
- Better performance results can be achieved with the set motor + VSD, as losses are decreased (tests were conducted based on the set WEG high efficiency MOTOR + WEG VSD).

Simplicity

The new CFW700 was designed based on the Plug & Play technology concept where by plugging in expansion modules hardware and software recognize it automatically. Also this feature allows for easy installation and safe operation with no need for additional configuration.

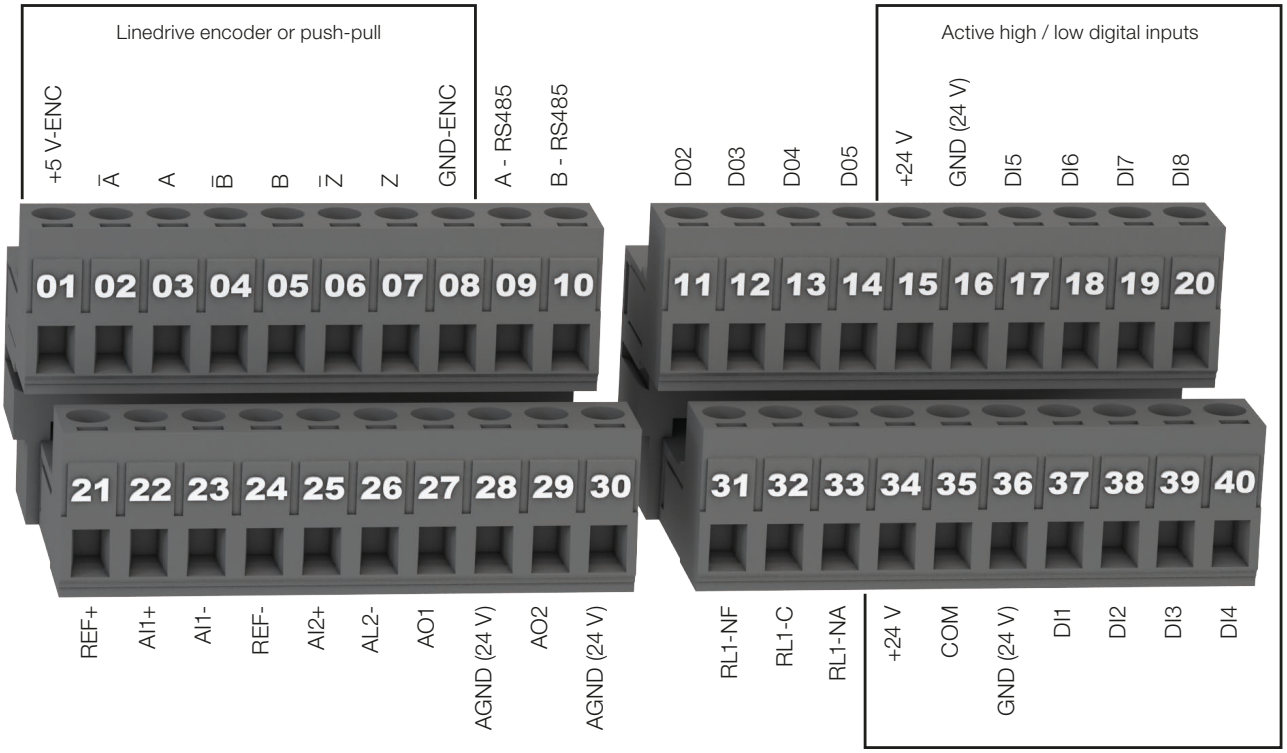
Certifications

- 1.1 to 2.2 kW (1.5 to 3 HP):
  - 200-240 V ac - Single-phase
- 1.1 to 55 kW (1.5 to 75 HP):
  - 220-240 V ac - Three-phase
- 1.5 to 132 kW (2 to 175 HP):
  - 380-480 V ac - Three-phase
- 1.5 to 110 kW (2 to 150 HP):
  - 500-600 V ac - Three-phase



Technical Features

Characteristics Integrated in the Standard Product



Encoder Interface

- For applications requiring closed loop control the encoder module is available at the control terminals
- No need for external power supply for the encoder module (5 V dc)
- 5 V line drive or push pull types can be used

RS485 Port Built-In

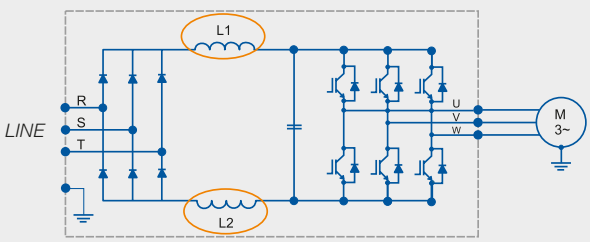
- Modbus-RTU communication protocol ready

I/Os Capability

- 8 digital inputs / 5 digital outputs
- 2 analog inputs / 2 analog outputs

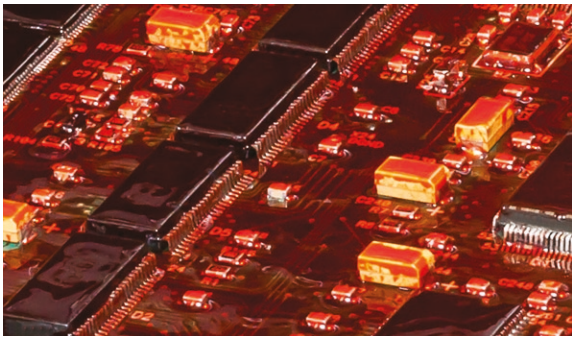
Built-in DC Link Reactor

- Allows the VSD to be installed in any network (no restriction for power supply impedance)
- Typical power factor (PF) for steady condition:
  - 0.94 for three-phase models
  - 0.70 for single-phase and single/three-phase
  - Models fed from single-phase power supply
- Displacement power factor >0.98
- It meets 61000-3-12 standard (limits for harmonic currents)
- No need for an extra line reactor

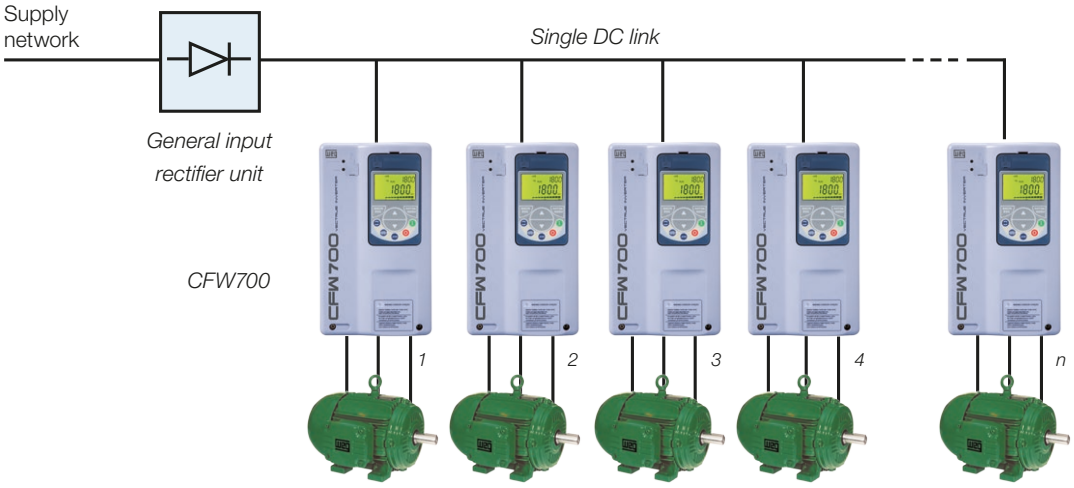


Technical Features

USB Port Built-In
- USB connection in the display ready



Conformal Coating
- Increasing the lifetime, protecting the electronic boards against corrosive atmospheres. Classified as 3C2 according to IEC 60721-3-3



Common DC Bus Connection

In multi motor applications it is possible to supply the CFW700 (AC drive) with DC voltage, this offers extra flexibility and energy savings. By sharing a common DC bus in some applications the energy consumption can be lowered as the power needed to run any of the motors can be drawn from the stored energy at the VSD DC link.

Note: an external pre-charge circuit must be added to each of the VSDs.

Thermal Management
- It is possible to monitor heat sink and inside air temperature thus ensuring protection to critical components e.g. IGBTs and control board
- Fans installed closed to heatsink are turned on and off depending on the temperature of power modules
- Readings of fan operation hours can be analyzed through parameters as well as alarm or fault messages are displayed
- Easy removal of fans makes maintenance and/or replacement a lot faster

Technical Features

Drive Features

- **Multi-Speed:** up to 8 preset speeds can be programmed.
- **PID Regulation:** eliminates the use of an external controller for closed loop control, thus great performance of speed and torque can be achieved.
- **Ride Through:** embedded in the CFW700 control this function prevents the drive from tripping during some power outage. It uses the kinetic energy stored through a forced deceleration imposed to the load by the VSD control algorithm.
- **Speed/Torque Regulation:** open and closed loop (encoder feedback required).
- **Flying Start:** it is able to start smoothly a motor connected to a rotating load regardless of rotation direction.
- **Control Options for DC Bus Regulation:** prevents the drive from tripping when short deceleration time is required, vital for applications with high inertia loads.
- **S ramp:** the smoothness at the starting can be mandatory for process e.g. the beverage industry, by setting up properly this functionality production losses caused by traditional starting methods can be avoided.
- **Three-Wire Start/Stop Control:** no retentive contact can command the drive to start/stop the motor.
- **Electronic Potentiometer:** the drive keeps increasing motor speed as long as the digital input remains closed.
- **Skip Frequency:** for some applications specific frequencies must be avoided in order to protect the machine against resonance effect.
- **Motor Thermal Curve Adjustment:** the possibility for separate adjustment between motor and drive allows for a much more effective protection for overload cycles.
- **Copy Function:** by using the flash memory card MMF-02 parameter settings can be easily stored ensuring integrity and safety in case of replacement of the drive is needed.

Applications

Pumps and Fans

- Precise control of process variables (pressure, flow, temperature, etc.) through a PID regulator superposed to the speed control
- Optimization of power consumption through speed control with an adjustable V/F curve
- Safety and maintenance signaling and alarms of pumps and fans
- Availability of PID regulators to control other process accessories like valves, dumpers, other VSDs, etc.

Compressors

- Optimization of system pressurization control with energy savings and improvement of compressor efficiency
- Reduction of motor startup current minimizing wear and tear of the mechanical system avoiding fees charged by the power supplier company
- Safety and maintenance signaling and alarms available for pressurization system
- Provides startup system control of other compressor units with an increased efficiency of the pressurization system

Pulp & Paper / Wood

- Precise speed and torque control.
- Flexible hardware programming and confguration, making applications where syncronism is required easier
- Can be integrated in a variety of communication protocols commonly used in the industry
- Provided in a compact design the CFW700 series allows for side by side assembly
- Quick and simplified programming
- Highly reliable and robust

Chemical & Petrochemical

- Highly reliable and robust
- Plug & Play system for additional modules, ensuring greater flexibility in adapting to existing system
- Possibility to be integrated in a variety of communication protocols commonly used in the industry

Ironworks and Metallurgy

- Highly precise speed and torque control
- Large overload capacity (models sized in HD)
- Flexible hardware programming and configuration
- Possibility to be integrated in a variety of communication protocols mainly used in the industry

Keypad

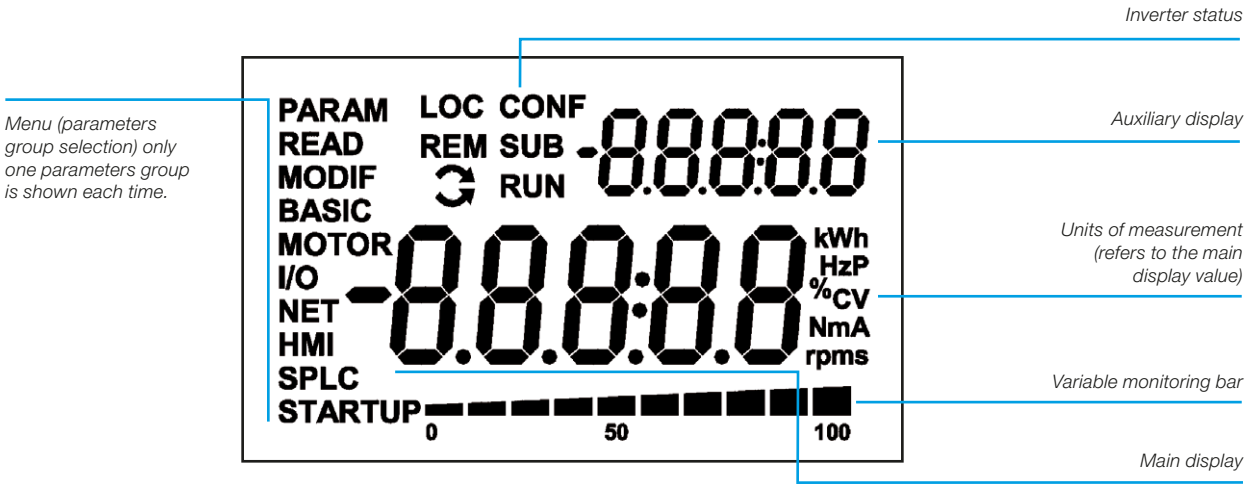
The CFW700 comes equipped with a LCD display capable of providing readings for programming, guided start-up and troubleshooting.
This customized numeric LCD display features the following functionalities:

- LCD display with backlight
- Allows adjust programming through menu separate in folders
- Remote mounting for panel assembly solutions (it can be placed 30 m distant from the drive)

Remote Keypad

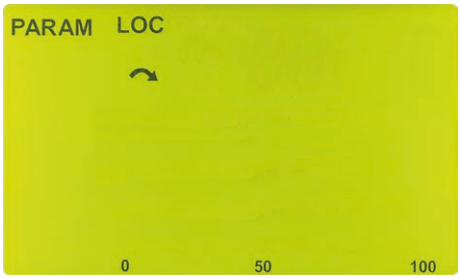
The keypad can be remote assembled by using this configuration, degree of protection IP56 can be achieved.

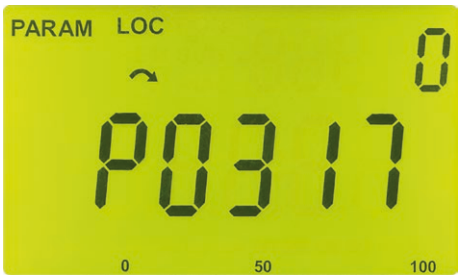
Allows for Showing 3 Variables at Once Through Three Viewing Modes

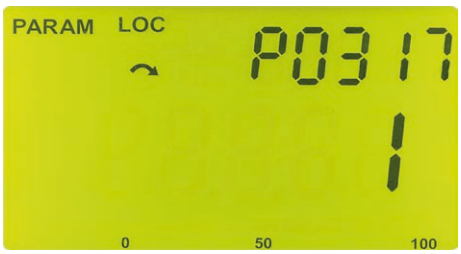


Viewing Modes

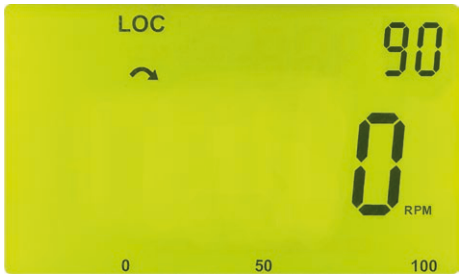
Programming Mode







Monitoring Mode



Accessories

Blank Cover - HMID - 01 [1)]
Used when there is no need for keypad.

Remote Keypad Frame - RHMIF-02
Used when remote keypad is needed, it can be installed at the panel door as well as machine console. IP56 degree of protection.

CAN-01 (CANopen and DeviceNet)
The possibility to connect the CFW700 into a CANopen or DeviceNet network.

Flash Memory Module MMF - 02
This module allows for backup of VSD parameters ensuring the programming to be safely stored.
Also it makes possible the programming to be passed on to other VSDs on the same plant avoiding repetitive programming. The SoftPLC applicative can also be store into this memory.

Profibus-DP-01 (Profibus-DP-V1)
The possibility to connect the CFW700 into a Profibus-DP-01 network.

1) These options must be provided already installed in the CFW700 (please see coding on page 21).

Accessories

Kit for Shielded Cable

PCSA-01	Shielded cable Kit frame size A
PCSB-01	Shielded cable Kit frame size B
PCSC-01	Shielded cable Kit frame size C

Notes: The shielded cable kit for frame Sizes D and E is included in the standard version.
For models with RFI filter fitted in shielded cable kit comes as standard.

Enclosures

Standards	Ratings	Frame sizes				
		A	B	C	D	E
IEC	IP20	x	x	x	x	x
	IP21	KIP21A-01	KIP21B-01	KIP21C-01	KIP21D-01	-
NEMA	Type 1	KN1A-02	KN1B-02	KN1C-02	x	KN1E-01 / KN1E-02

Notes: (x) Standard.
(-) NA.

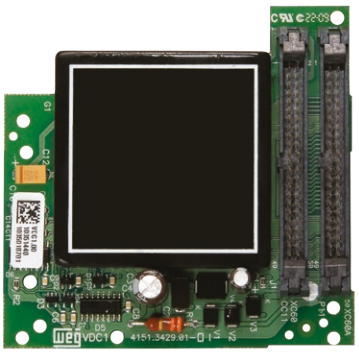
Standard	Accessory	Composition
NEMA Type 1	KN1A-02	Conduit kit frame size A
	KN1B-02	Conduit kit frame size B
	KN1C-02	Conduit kit frame size C
	KN1E-01	Top cover size E models 105, 142 and all 600 V frame size E
	KN1E-02	Top Cover + Conduit kit size E models 180 and 211
IEC	KIP21A-01	Top cover kit frame size A
	KIP21B-01	Top cover kit frame size B
	KIP21C-01	Top cover kit frame size C
	KIP21D-01	Top cover kit frame size D

Note: in the KN1X-01 Conduit kit (frame sizes A,B and C) power cable shielding is also provided.

Optionals (Factory Built)

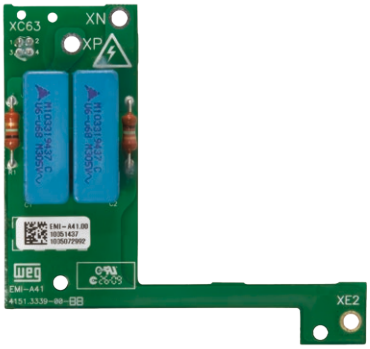
External Control Power Supply 24 V dc

Used mainly for communication networks allowing data exchange even when there is no power at the VSD input (this module must be fed from a power supply different from the one connected to the VSD).



RFI Suppressor Filter (for the VSD to be in Accordance with EN 61800-3 and EN 55011)

When properly installed the CFW700 meet requirements of the electromagnetic compatibility directive - EMC Directive 2004/108/EC.
For models ranging from size A to D, the RFI filter is optional and for size E it is included.



Safety Stop (in Accordance with EN 61800-5-2, EN ISO 13849-1, IEC 62061, IEC 61508 Parts 1-7, EN 50178, IEC 60204-1, Cat. 3/pL d acc. and SIL CL2 acc.)

With this option when the safety circuit is tripped by external causes the IGBT firing circuit is deactivated, thus the power drive system will not provide energy to the motor which can generate torque.

SoftPLC

The new CFW700 incorporates PLC functionalities by means of a factory built micro PLC named SoftPLC. This extra tool gives more flexibility to the product as well as allowing the user to develop his own application through a USB or RS485 ports port available at the control terminal. The SoftPLC features the following characteristics:

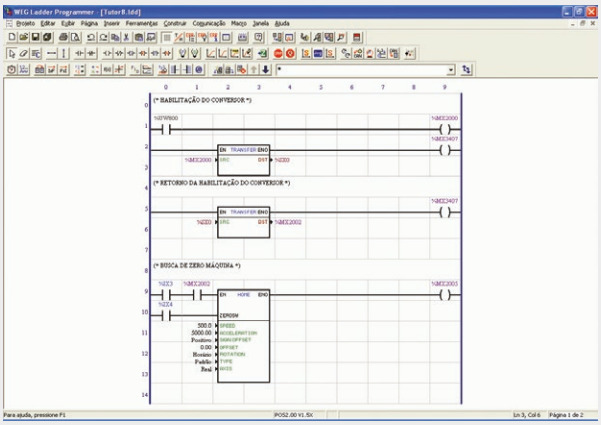
- Access to CFW700 I/Os and parameters
- PLC mathematics and control blocks
- Allows user password
- User can save software in the memory flash card to be downloaded into other VSDs

Free of Charge Software

WLP (WEG Ladder Programmer)

Software designed for development of user application through the micro PLC embedded in the CFW700 hardware.
The WLP tool features the following capabilities:

- Ladder programming
- PLC, math and control blocks are available
- Access to all CFW700 parameters
- On-line monitoring as well as help topics
- RS485 connection with the drive
- 49 user parameters can be individually accessed allowing for creation of a variety of applications



Software SuperDrive G2

It is a windows-based software designed for the programming, commanding and monitoring of WEG VSDs.
The following features the user can benefit from:

- Automatic CFW700 recognition
- CFW700 parameters monitoring
- Off-line/On-line change of parameters
- Reports can be created
- Backup of parameters
- Start/Stop command as well as speed reference can be sent to the drive

Drive Ratings

Normal Duty (ND) Cycle:
- 110% for 60 seconds every 10 minutes
- 150% for 3 seconds every 10 minutes

Heavy Duty (HD) Cycle:
- 150% for 60 seconds every 10 minutes
- 200% for 3 seconds every 10 minutes

Sizing a VFD:

The correct way to size a frequency inverter is by matching its output current with the motor rated current.
However, tables below present the expected motor power for each VSD model.
The purpose of the table below is for guidance as motor rated current may vary with number of poles and manufacturer.

Note: motor power stated on this table is based on IEC standard for IV poles motor.

Motor Voltages 220 V and 230 V

Power supply		Model	Normal Duty (ND)	IEC 50 Hz 220 V 230 V	NEMA 60 Hz 230 V	Heavy Duty (HD)	IEC 50 Hz 220 V 230 V	NEMA 60 Hz 230 V
			A	kW	HP	A	kW	HP
200-240 V	1Ø	CFW700A06P0S2	6	1.1	1.5	5	1.1	1
		CFW700A07P0S2	7	1.5	2	7	1.5	2
		CFW700A10P0S2	10	2.2	3	10	2.2	3
	1/3Ø	CFW700A06P0B2	6	1.1	1.5	5	1.1	1
		CFW700A07P0B2	7	1.5	2	7	1.5	2
	3Ø	CFW700A07P0T2	7	1.5	2	5.5	1.1	1
		CFW700A10P0T2	10	2.2	3	8	1.5	2
		CFW700A13P0T2	13	3	3	11	2.2	3
		CFW700A16P0T2	16	4	5	13	3	3
		CFW700B24P0T2	24	5.5	7.5	20	5.5	5
		CFW700B28P0T2	28	7.5	10	24	5.5	7.5
		CFW700B33P0T2	33.5	9.2	10	28	7.5	10
		CFW700C45P0T2	45	11	15	36	9.2	10
		CFW700C54P0T2	54	15	20	45	11	15
		CFW700C70P0T2	70	18.5	25	56	15	20
		CFW700D86P0T2	86	22	30	70	18.5	25
		CFW700D0105T2	105	30	40	86	22	30
220-230 V	3Ø	CFW700E0142T2	142	37	50	115	30	40
		CFW700E0180T2	180	55	60	142	37	50
		CFW700E0211T2	211	55	75	180	55	60

Motor Voltages 380 V and 460 V

Power supply		Model	Normal Duty (ND)	IEC 50 Hz 380 V 415 V	IEC 60 Hz 440 V 460 V	NEMA 60 Hz 460 V	Heavy Duty (HD)	IEC 50 Hz 380 V 415 V	IEC 60 Hz 440 V 460 V	NEMA 60 Hz 460 V
			A	kW	HP	HP	A	kW	HP	HP
380-480 V	3Ø	CFW700A03P6T4	3.6	1.5	2	2	3.6	1.5	2	2
		CFW700A05P0T4	5	2.2	3	3	5	2.2	3	3
		CFW700A07P0T4	7	3	4	3	5.5	2.2	3	3
		CFW700A10P0T4	10	4	7.5	5	10	4	7.5	5
		CFW700A13P5T4	13.5	5.5	10	7.5	11	4	7.5	7.5
		CFW700B17P0T4	17	7.5	12.5	10	13.5	5.5	10	7.5
		CFW700B24P0T4	24	11	15	15	19	9.2	12.5	10
		CFW700B31P0T4	31	15	20	20	25	11	15	15
		CFW700C38P0T4	38	18.5	30	25	33	15	25	20
		CFW700C45P0T4	45	22	30	30	38	18.5	30	25
		CFW700C58P5T4	58.5	30	40	40	47	22	30	30
		CFW700D70P5T4	70.5	37	50	50	61	30	50	40
		CFW700D88P0T4	88	45	75	60	73	37	60	50
		CFW700E0105T4	105	55	75	75	88	45	75	60
		CFW700E0142T4	142	75	100	100	115	55	75	75
		CFW700E0180T4	180	90	150	150	142	75	100	100
		CFW700E0211T4	211	110	175	150	180	90	150	150

Motor Voltages 500 V and 600 V

Power supply		Model	Normal Duty (ND)	IEC 50 Hz 525 V 575 V	NEMA 60 Hz 575 V	Heavy Duty (HD)	IEC 50 Hz 525 V 575 V	NEMA 60 Hz 575 V
			A	kW	HP	A	kW	HP
500-600 V	3Ø	CFW700B02P9T5	2.9	1.5	2	2.7	1.5	2
		CFW700B04P2T5	4.2	2.2	3	3.8	2.2	2
		CFW700B07P0T5	7	4	5	6.5	4	5
		CFW700B10P0T5	10	5.5	7.5	9	5.5	7.5
		CFW700B12P0T5	12	7.5	10	10	5.5	7.5
		CFW700B17P0T5	17	11	15	17	11	15
		CFW700D22P0T5	22	15	20	19	11	15
		CFW700D27P0T5	27	18.5	25	22	15	20
		CFW700D32P0T5	32	22	30	27	18.5	25
		CFW700D44P0T5	44	30	40	36	22	30
		CFW700E53P0T5	53	37	50	44	30	40
		CFW700E63P0T5	63	45	60	53	37	50
		CFW700E80P0T5	80	55	75	66	45	60
		CFW700E0107T5	107	75	100	90	55	75
		CFW700E0125T5	125	90	125	107	75	100
		CFW700E0150T5	150	110	150	122	90	100

Dimension, Weight and Temperature

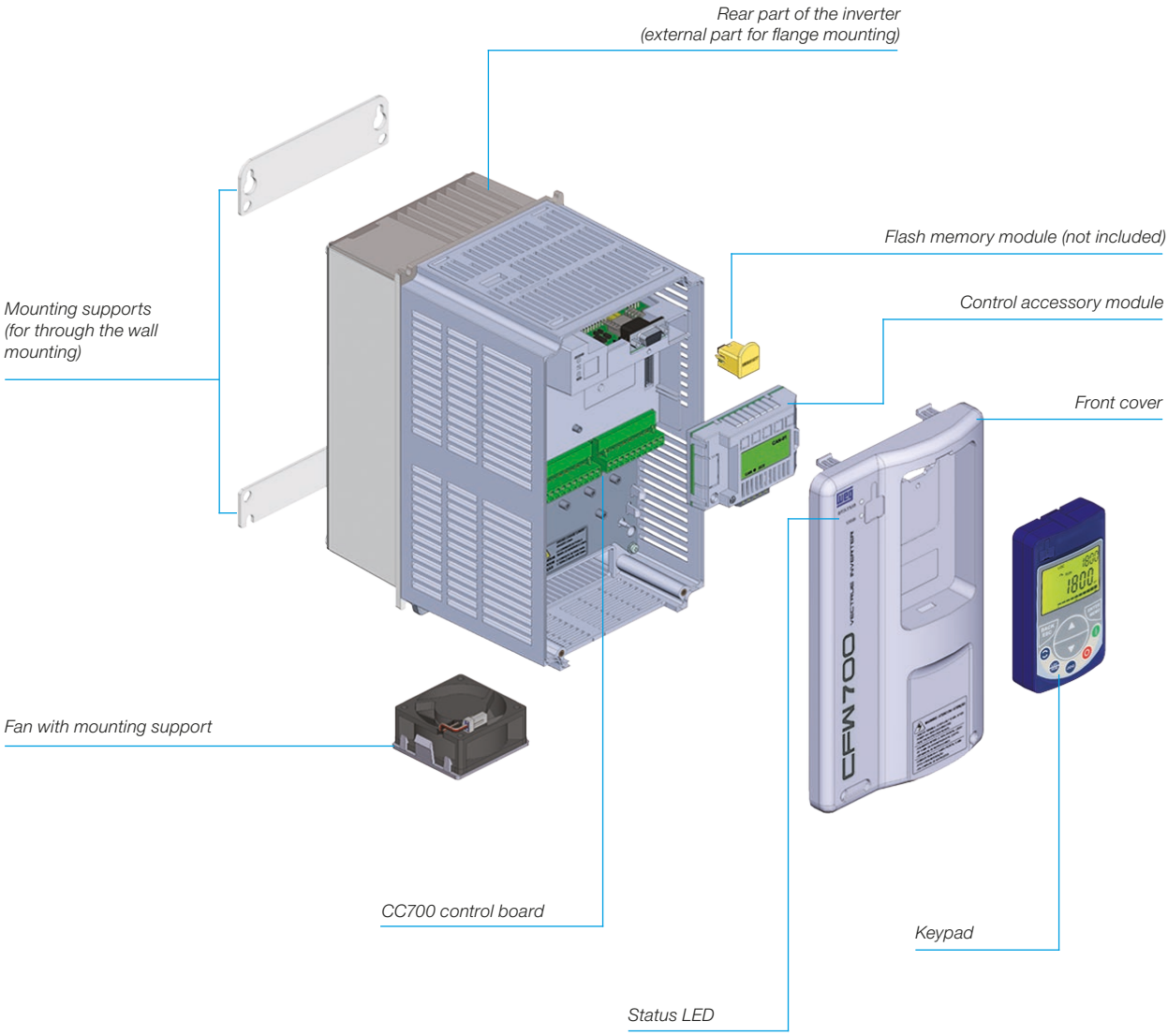
Model	Frame size	NEMA1 Dimension mm (in) H	W	D	IP20 / IP21 Dimension mm (in) H	W	D	IP20 Maximum surrounding air temperature with no derating °C (°F) _ ND/HD	NEMA1 / IP21 Maximum surrounding air temperature with no derating °C (°F) _ ND/HD	Weight kg (lb)	Braking IGBT
CFW700A06P0S2	A	305 (12.02)	145 (5.71)	227 (8.94)	247 (9.73)	145 (5.71)	227 (8.94)	50 (122)_ND/HD	50 (122)_ND/HD	6.3 (13.9)	Standard
CFW700A07P0S2								50 (122)_ND/HD	45 (113)_ND/HD		
CFW700A10P0S2								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700A06P0B2								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700A07P0B2								50 (122)_ND/HD	45 (113)_ND/HD		
CFW700A07P0T2								50 (122)_ND/HD	45 (113)_ND/HD		
CFW700A10P0T2								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700A13P0T2								45 (113)_ND 50 (122)_HD	45 (113)_ND 50 (122)_HD		
CFW700A16P0T2								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700B24P0T2	B	351 (13.82)	190 (7.46)	227 (8.94)	293 (11.53)	190 (7.46)	227 (8.94)	45 (113)_ND/HD	40 (104)_ND/HD	10.4 (22.9)	
CFW700B28P0T2								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700B33P0T2								50 (122)_ND/HD	45 (113)_ND 50 (122)_HD		
CFW700C45P0T2	C	448.1 (17.64)	220 (8.67)	293 (11.52)	378 (14.88)	220 (8.67)	293 (11.52)	50 (122)_ND/HD	50 (122)_ND/HD	20.5 (45.2)	
CFW700C54P0T2								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700C70P0T2								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700D86P0T2	D	550 (21.63)	300 (11.81)	305 (12.00)	504 (19.84)	300 (11.81)	305 (12.00)	50 (122)_ND/HD	50 (122)_ND/HD	32.6 (71.8)	
CFW700D0105T2								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700E0142T2	E	735 (28.94)	335 (13.2)	358 (14.1)	620 (24.4)	335 (13.2)	358 (14.1)	45 (113)_ND/HD	45 (113)_ND/HD	650 (143.3)	Optional
CFW700E0180T2		828.9 (32.63)						45 (113)_ND/HD	45 (113)_ND/HD		
CFW700E0211T2								45 (113)_ND/HD	45 (113)_ND/HD		
CFW700A03P6T4	A	305 (12.02)	145 (5.71)	227 (8.94)	247 (9.73)	145 (5.71)	227 (8.94)	50 (122)_ND/HD	50 (122)_ND/HD	6.3 (13.9)	Standard
CFW700A05P0T4								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700A07P0T4								45 (113)_ND 50 (122)_HD	40 (104)_ND 50 (122)_HD		
CFW700A10P0T4								45 (113)_ND/HD	45 (113)_ND/HD		
CFW700A13P5T4								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700B17P0T4	B	351 (13.82)	190 (7.46)	227 (8.94)	293 (11.53)	190 (7.46)	227 (8.94)	50 (122)_ND/HD	50 (122)_ND/HD	10.4 (22.9)	
CFW700B24P0T4								50 (122)_ND/HD	40 (104)_ND 45 (122)_HD		
CFW700B31P0T4								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700C38P0T4	C	448.1 (17.64)	220 (8.67)	293 (11.52)	378 (14.88)	220 (8.67)	293 (11.52)	50 (122)_ND/HD	50 (122)_ND/HD	20.5 (45.2)	
CFW700C45P0T4								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700C58P5T4								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700D70P5T4	D	550 (21.63)	300 (11.81)	305 (12.00)	504 (19.84)	300 (11.81)	305 (12.00)	50 (122)_ND/HD	50 (122)_ND/HD	32.6 (71.8)	
CFW700D88P0T4								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700E0105T4	E	735 (28.94)	335 (13.2)	358 (14.1)	620 (24.4)	335 (13.2)	358 (14.1)	45 (113)_ND/HD	45 (113)_ND/HD	65.0 (143.3)	Optional
CFW700E0142T4								45 (113)_ND/HD	45 (113)_ND/HD		
CFW700E0180T4		828.9 (32.63)						45 (113)_ND/HD	45 (113)_ND/HD		
CFW700E0211T4								45 (113)_ND/HD	45 (113)_ND/HD		
CFW700B02P9T5	B	351 (13.82)	190 (7.46)	227 (8.94)	293 (11.53)	190 (7.46)	227 (8.94)	50 (122)_ND/HD	50 (122)_ND/HD	10.4 (22.9)	Standard
CFW700B04P2T5								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700B07P0T5								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700B10P0T5								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700B12P0T5								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700B17P0T5								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700D22P0T5	D	550 (21.63)	300 (11.81)	305 (12.00)	504 (19.84)	300 (11.81)	305 (12.00)	50 (122)_ND/HD	50 (122)_ND/HD	32.6 (71.8)	Optional
CFW700D27P0T5								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700D32P0T5								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700D44P0T5								50 (122)_ND/HD	50 (122)_ND/HD		
CFW700E53P0T5	E	735 (28.94)	335 (13.2)	358 (14.1)	675 (26.57)	335 (13.2)	358 (14.1)	45 (113)_ND/HD	45 (113)_ND/HD	65.0 (143.3)	
CFW700E63P0T5								45 (113)_ND/HD	45 (113)_ND/HD		
CFW700E80P0T5								45 (113)_ND/HD	45 (113)_ND/HD		
CFW700E0107T5								45 (113)_ND/HD	45 (113)_ND/HD		
CFW700E0125T5								45 (113)_ND/HD	45 (113)_ND/HD		
CFW700E0150T5								45 (113)_ND/HD	45 (113)_ND/HD		

Note: weight data is for the VSD as IP20 enclosure, if IP21 and NEMA1 kits are being added the total weight will change. Consult the user manual for additional information.

Technical Features

Main Parts

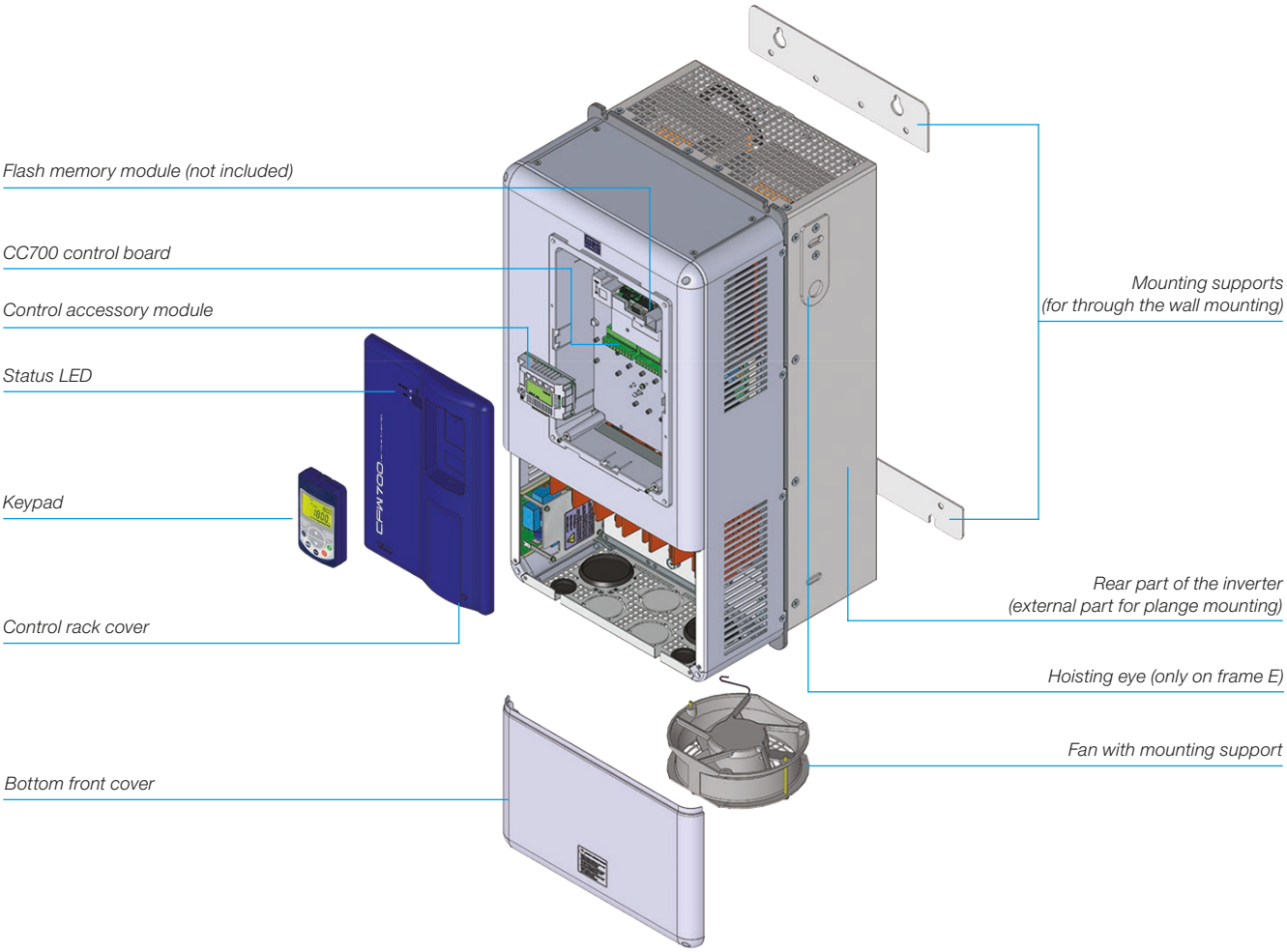
Frames A, B and C



Technical Features

Main Parts

Frames D and E



Mounting Considerations

Standard Installation

Innovative design allows the CFW700 to be assembled in three different ways.

Frame size	Minimum mounting clearance with top cover fitted in			
	A mm (in)	B mm (in)	C mm (in)	D mm (in)
A	25 (0.98)	25 (0.98)	10 (0.39)	30 (1.18)
B	40 (1.57)	45 (1.77)	10 (0.39)	30 (1.18)
C	110 (4.33)	130 (5.12)	10 (0.39)	30 (1.18)
D	110 (4.33)	130 (5.12)	10 (0.39)	30 (1.18)
E	100 (3.94)	250 (9.84)	20 (0.78)	80 (3.15)

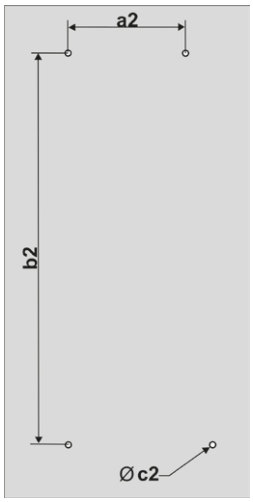
Side by Side Installation

The possibility for installing CFW700 series with no space in between allows for panel space saving.

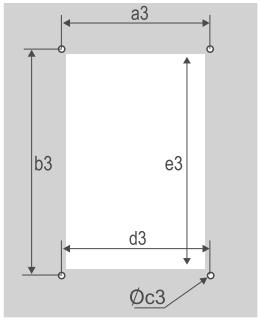
Note: for side by side assembly option check user manual for further operating temperature details.

Mounting Considerations / Panel Assembly

Surface Installation

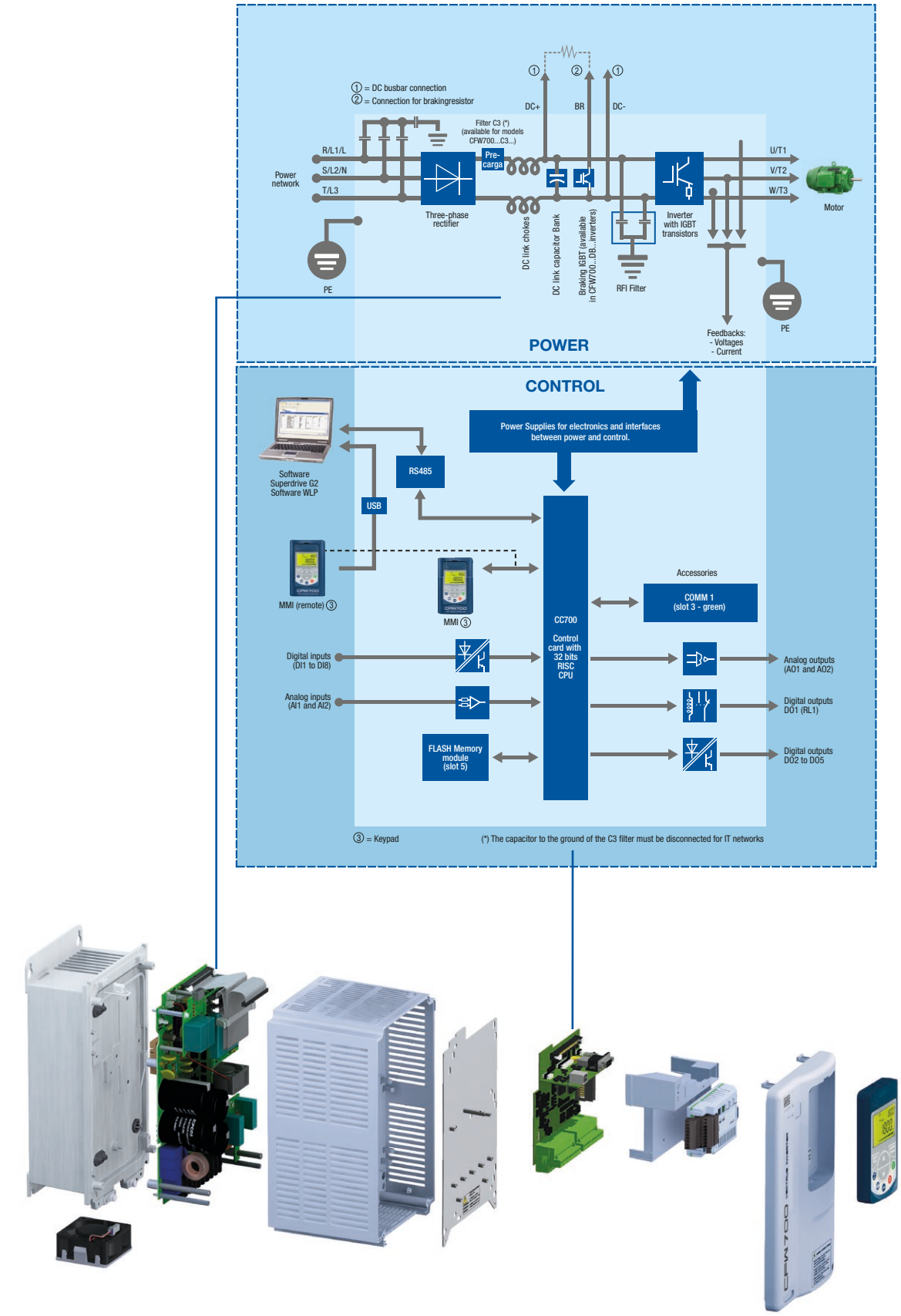


Flange Mounting (IP54 Rated When Mounting the Heatsink Outside the Enclosure)



Frame size	a2 mm (in)	b2 mm (in)	c2 (M)	a3 mm (in)	b3 mm (in)	c3 (M)	d3 mm (in)	e3 mm (in)
A	115 (4.53)	250 (9.85)	M5	130 (5.12)	240 (9.45)	M5	135 (5.32)	225 (8.86)
B	150 (5.91)	300 (11.82)	M5	175 (6.89)	285 (11.23)	M5	179 (7.05)	271 (10.65)
C	150 (5.91)	375 (14.77)	M6	195 (7.68)	365 (14.38)	M6	205 (8.08)	345 (13.59)
D	200 (7.88)	525 (20.67)	M8	275 (10.83)	517 (20.36)	M8	285 (11.23)	485 (19.10)
E	200 (7.8)	650 (25.6)	M8	275 (10.8)	635 (25)	M8	315 (12.40)	615 (24.21)

Technical Features



Notes: 1) Diode type rectifier bridge;
2) Standard for frame sizes A to D;
3) RFI filter factory built for frame size E.

Coding

Product and series	Model identification				Braking	Degree of protection	Conducted emission level [1]	Safety stop [2]	External power supply for control
	Frame size	Rated current	No. of phases	Rated voltage					
CFW700	A	03P6	T	2 / 4 / 5	NB	20	C3	Y1	W1
CFW700	Check table below								
	NB = braking IGBT not available DB = braking IGBT available								
	20 = IP20 21 = IP21 (not available for frame size E) N1 = NEMA1 enclosure *Note: check table enclosures at chapter Accessories.*								
	Blank = with no RFI filter C3 = according to category 3 of IEC 61800-3 standard								
	Blank = with no STO function Y1 = with STO function according to ISO 13849-1, category 3								
	Blank = with no external power supply board W1 = control circuit is supplied through an external 24 V power supply								

Notes: 1) Frame size E comes equipped with RFI filter as standard.
2) This option is not available for models frame size A with the option for NEMA1.

Frame sizes	Output current (ND)	Input	Power supply voltage	Braking	Degree of protection	Conducted emission level
A	06P0 = 6.0 A 07P0 = 7.0 A	B = single/three-phase power supply	2 = 200...240 V	DB	20, 21 or N1	Blank
A	06P0 = 6.0 A 07P0 = 7.0 A	S = single-phase power supply	2 = 200...240 V	DB	20, 21 or N1	C3
	10P0 = 10 A					Blank or C3
A	07P0 = 7.0 A 10P0 = 10 A 13P0 = 13 A 16P0 = 16 A	S = three-phase power supply	2 = 200...240 V	DB	20, 21 or N1	Blank or C3
B	24P0 = 24 A 28P0 = 28 A 33P5 = 33.5 A					
C	45P0 = 45 A 54P0 = 54 A 70P0 = 70 A					
D	86P0 = 86 A				21 or N1	
	0105 = 105 A					
E	0142 = 142 A 0180 = 180 A 0211 = 211 A		2 = 220...230 V	NB or DB	20 or N1	C3
A	06P0 = 6.0 A 07P0 = 7.0 A	B = single/three-phase power supply	2 = 200...240 V	DB	20, 21 or N1	Blank
A	06P0 = 6 A	S = single-phase power supply	2 = 200...240 V	DB	20, 21 or N1	C3
	07P0 = 7.0 A					
	10P0 = 10 A					Blank or C3
A	3P6 = 3.6 A 05P0 = 5.0 A 07P0 = 7.0 A 10P0 = 10 A 13P5 = 13.5 A	T = three-phase power supply	4 = 380...480 V	DB	20, 21 or N1	Blank or C3
B	17P0 = 17 A 24P0 = 24 A 31P0 = 31 A					
C	38P0 = 38 A 45P0 = 45 A 58P5 = 58.5 A					
D	70P5 = 70.5 A				21 or N1	
	88P0 = 88 A					
E	0105 = 105 A 0142 = 142 A 0180 = 180 A 0211 = 211 A			NB or DB	20 or N1	C3

Coding

Frame sizes	Output current (ND)	Input	Power supply voltage	Braking	Degree of protection	Conducted emission level
B	2P9 = 2.9 A	T = three-phase power supply	5 = 500...600 V	DB	20	Blank
	4P2 = 4.2 A					
	7P0 = 7 A					
	10P0 = 10 A					
	12P0 = 12 A					
	17P0 = 17 A					
D	22P0 = 22 A			NB	N1	
	27P0 = 27 A					
	32P0 = 32 A					
	44P0 = 44 A					
E	53P0 = 53 A				20	C3
	63P0 = 63 A					
	80P0 = 80 A					
	0107 = 107 A					
	0125 = 125 A					
	0150 = 150 A					

Technical Data

Voltage and rating features	Voltage	Single-phase	200-220 V ac (+10%-15%)
		Three-phase	200-220 V ac (+10%-15%)
			380-480 V ac (+10%-15%)
			500-600 V ac (+10%-15%)
	Power	Single-phase	1.5 to 3 HP (1.1 to 2.2 kW)
		Three-phase	1.5 to 75 HP (1.1 to 55 kW)
			2 to 150 HP (1.5 to 110 kW)
			2 to 175 HP (1.5 to 110 kW)
	Frequency	50...60 Hz (+/-2%_48 to 63 Hz)	
	Displacement factor	Greater than 0.98	
	Efficiency	Greater than 0.97	
	Power factor	0.94 for three-phase input at nominal conditional 0.70 for single-phase input at nominal conditional	
Control	Frequency range	0 to 3.4 x rated motor frequency (P0403). The rated motor frequency is programmable from 0 Hz to 300 Hz in the V/F and VVW modes and from 30 Hz to 120 Hz in the vector mode. Maximum output frequency limit according to the switching frequency: - 125 Hz (switching frequency = 1.25 kHz) - 250 Hz (switching frequency = 2.5 kHz) - 500 Hz (switching frequency ≥ 5 kHz)	
	Switching frequency	Standard: 5 kHz (A, B, C e D frames)	
		2.5 kHz for all 380 V models frame E	
		2.5 kHz for frame E 220 V models 142/180 Amps (ND)	
		2.5 kHz for frame E 220 V model 211 Amps (ND/HD)	
		5 kHz for frame E 220 V models 142/180 Amps (HD)	
		Available options for 2.5/5/10 kHz (check for derating)	
	Overload	Normal Duty (ND)	110% for 1 min every 10 min 150% for 3 s every 10 min
		Heavy Duty (HD)	150% for 1 min every 10 min 200% for 3 s every 10 min
		Aceleration	0 to 999 s
		Deceleration	0 to 999 s
Environment	Temperature	-10 to 50 °C (14 to 122 °F) for most of models. For operating temperature of each model the table Dimensions, Weight and Temperatureshall be checked.	
		-10...60 ºC for frames A, B, C and D (up to 45 °C without derating for models 13 A and 24 A/200...240 V, 7 and 10 A/380...480 V and up to 50 °C without derating for the other models) and-10...55 °C for frame E (up to 45 °C without derating). If derating has to be considered have 2% current reduction for each °C above the specific operating temperature	
	Humidity	5 to 90% with no condensation	
	Altitude	0 to 1,000 meters with no derating	
		Up to 4,000 meters with current reduction of 1% for each 100 meters above 1,000 meters	
Braking methods	Dynamic braking	Available as standard for frame sizes A, B, C and D for 460 V and D for 600 V. For frame size E "DB"models has to be used. An extra resistor must be fitted in for dynamic braking capability	
	Optimal Braking®	There is no need for braking resistor	
	DC braking	DC current applied to motor	

Technical Data

Performance	V/F	Speed control	Regulation: 1% of rated speed
			Speed variation range 1:20
	Voltage vector VVW		Regulation: 1% of rated speed
			Speed variation range 1:30
	Sensorless vector		Regulation: 0.5% of rated speed
	Vector with encoder (encoder interface built-in)		Speed variation range 1:100 Regulation:+/- 0.1% of rated speed with digital reference (keypad, serial fieldbus, multispeed) Regulation:+/- 0.2% of rated speed with 12 bits analog input
		Torque control	Range: 10 to 180%
			Regulation: +/-5% of rated torque
	Sensorless vector		Range: 20 to 180%
			Regulation: +/-10% of rated torque (above 3 Hz)%
I/Os	Inputs	Digital	8 x isolated bidirectional 24 V
		Analog	2 x +/-10 V, 11 bits + signal (differencial) or 0/4...20 mA, 11 bits (differencial)
			Impedance: 400 kΩ for voltage signal / 500 Ω for current signal
	Output	Relay	1 x relay NO/NC contact (240 V ac / 1 A)
			4 x open drain (24 V/200 mA)
		Analog	2 x 0...10 V or 0/4...20 mA, 11 bits (not isolated from inverter ground)
	24 V power supply capacity	500 mA (available for the user, including I/Os)	
Connectivity	USB	USB in the display / SuperDrive and WLP communication	
	Modbus-RTU	RS485 built-in / SuperDrive and WLP communication	
Communication protocols	Modbus-RTU	RS485 built-in (available at the control terminals)	
	DeviceNet	CAN-01 (slot 3)	
	CANopen	CAN-01 (slot 3)	
	Profibus-DP	Profibus-DP-V1 (slot 3)	
Safety standards	UL 508C Power conversion equipment		
	UL 840 Insulation coordination including clearences and creepage distances for electrical equipment		
	EN 61800-5-1 - Safety requirements electrical, thermal and energy.		
	EN 50178 - Electronic equipment for use in power installations.		
	EN 60204-1 - Safety of machinery. Electrical equipment of machines. Part 1: General requirements. In order to have a machine in conformity with this regulation, the machine builder is resposible forthe installation of na emergency shutdown device and na equipment for power disconnection.		
	EN 60146 (IEC 146) - Semiconductor converters.		
	EN 61800-2 - Adjustable speed electrical power drive systems - Part 2: General requirements - Rating specifications for low voltage adjustable frequency A.C. power drive systems		
Mechanical construction standards eletromagnetic compatibility standards (EMC)	EN 60529 - Degrees of protection provided by enclosures (IP code).		
	UL 50 - Enclosures for electrical equipment		
	EN 61800-3 - Adjustable speed electrical power drive systems - Part 3: EMC product standard including specifc test methods.		
	EN 55011 - Limits and methods of measurement of radio disturbance characteristics of undustrial, scientific and medical (ISM) radio-frequency equipment.		
	CISPR 11 - Industrial, scientifc and medical (ISM) radio-frequency equipment - Eletromagnetic disturbance characteristics - Limits and methods of measurement.		
	EN 61000-4-2 - Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Eletrostatic discharge immunity test.		
	EN 61000-4-3 - Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic feld immunity test.		
	EN 61000-4-4 - Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test.		
	EN 61000-4-5 - Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test.		
	EN 61000-4-6 - Electromagnetic compatibility (EMC)- Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields.		
Protections	Overcurrent / short circuit		
	Under / overvoltage in the power section		
	Phase Loss		
	VSD thermal overload (IGBTs, rectifier and in the eletronics)		
	Motor thermal overload		
	Braking resistor overload		
	IGBTs overload		
	Motor overload		
	Fault / external alarm		
	CPU failure		
	Phase-to-ground short circuit at the output		
	Failure at the heatsink fan		
	Motor overspeed		
	Wrong connection of encoder wiring		

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DRIVE COUPLING

10R - 5/8

Elastomeric Coupling Catalog

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Falk Wrapflex Elastomeric Couplings

(Inch)

Table Of Contents

Falk Wrapflex Elastomeric Couplings

A Simple Way to Increase Productivity

- 9 sizes
- Torque range: 133,000 lb-in (15,028 Nm)
- Bore capacity: 7¼" (186 mm)
- "Replace in place"
- Non-lubricated/low maintenance

Quick, easy installation and replacement set new standards for reduced downtime. Because motors or drives don't need to be moved, our "replace in place" elements even eliminate the need for time-consuming realignment.

Available in close-coupled and spacer designs, Wrapflex couplings accommodate up to 7¼" (186 mm) shafts and torque loads up to 133,000 lb-in (15,028 Nm).

For simplicity and cost-effectiveness over the life of your coupling, it doesn't get any easier than Wrapflex couplings from Rexnord.

Low Initial Cost

- Advanced manufacturing methods and innovative material allow us to offer higher capacity ratings at a more competitive price than ever before possible.

Easy to Install

- The compound root radius in the element teeth (patent #6,342,011) increases flexibility for easier and quicker assembly.
- The coupling can be blind assembled from either direction.

Replace in Place

- Design allows quick and easy element replacement.
- There's no need to remove hubs or realign motors or drives, so downtime is reduced.

No Maintenance Needed

- Non-lubricated design of the tough, flexible polyurethane element lowers periodic maintenance costs.

Protects Equipment

- Compound root radius on inner corners of flex element (patent #6,342,011) acts as a stress relief for longer element life.
- Special hub feature reduces reaction loads transferred to connected equipment (patent #6,648,763).

Tough, Long-Lasting

- Polyurethane element has excellent wear and chemical resistance, and an operating temperature of -40°C (-40°F) to 95°C (200°F).
- Weather-resistant, high-grade nylon cover is standard.
- Optional carbon steel covers with black epoxy coating are suitable for highly-corrosive, severe-duty applications. (Standard for sizes 60-80.)
- Optional stainless steel hubs are available for Type R10 when required in the food industry or corrosive environments.

Safety First

- Two stainless steel button head cap screws, positioned 180° apart, prevent relative motion between cover and element and provide a positive means of retaining the cover to the element.
- Flexible element is retained after failure, helping minimize the potential for damage or personal injury.

Quick and Easy Retrofits

- Compact design eliminates the need for coupling guard redesign on existing applications.
- Stock finished bores in popular sizes. Taper bores for QD and Taper-Lock bushings are available off-the-shelf from our worldwide distribution network.

Falk Wrapflex Coupling Selection

Wrapflex Quick Selection Method

1. Determine Service Factor — Refer to **Table 1**or **4** for motor or turbine driven applications. See **Table 5** for engine drives.
2. Determine Equivalent Horsepower:
   Refer to **Table 2** — Under the actual hp required and opposite the service factor, read the equivalent hp.
3. Determine Coupling Size:
   A. Refer to **Table 3** — Trace horizontally from the required speed to a hp value equal to or larger than the equivalent hp determined in Step 2. Read the coupling size at the top of the column.
   B. Check shaft diameters against coupling maximum bores shown in **Table 3** and on **page 7** thru **11** for the correct coupling size selected.
   C. In **Table 3**, check the required speed against the allowable speed shown below the correct coupling size selected.
4. Determine Coupling Dimensional Requirements:
   A. Determine application/design shaft spacing and check application dimension requirements against selected coupling type dimensions shown on **page 7** thru **11**. Confirm sufficient clearances for coupling.
5. Confirm that application ambient operating temperatures are between -40°C (-40°F) to 95°C (200°F). For applications requiring Service Factor above 1.5 and temperatures above 79°C (175°F), consult Rexnord Engineering for selection assistance or optional high temperature elements.

Service Factors are a guide, based on experience, of the ratio between coupling catalog rating and system characteristics. The system characteristics are best measured with a torque meter.

Table 1 — Service Factors

Torque Demands Driven Machine	Typical applications for electric motor or turbine driven equipment	Typical Service Factor
	Constant torque such as Centrifugal Pumps, Blowers and Compressors.	1.0
	Continuous duty with some torque variations including Plastic Extruders, Forced Draft Fans.	1.5
	Light shock loads from Metal Extuders, Cooling Towers, Cane Knife, Log Haul.	2.0
	Moderate shock loading as expected from a Car Dumper, Stone Crusher, Vibrating Screen.	2.5
	Heavy shock load with some negative torques from Roughing Mills, Reciprocating Pumps, Compressors, Reversing Runout Tables.	3.0
	Applications like Reciprocating Compressors with frequent torque reversals, which do not necessarily cause reverse rotations.	Refer to Factory

Table 2 — Equivalent Horsepower = (Actual HP x Service Factor)

Service Factor ①	Actual HP																										
	3/4	1	1½	2	3	5	7½	10	15	20	25	30	40	50	60	75	100	125	150	200	250	300	350	400	450	500
1.0	0.75	1.0	1.5	2.0	3.0	5.0	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200	250	300	350	400	450	500
1.25	0.94	1.25	1.9	2.5	3.8	6.3	9.4	12.5	19	25	31	38	50	63	75	94	125	156	188	250	312	375	438	500	563	625
1.5	1.1	1.5	2.3	3.0	4.5	7.5	11.3	15	23	30	38	45	60	75	90	113	150	188	225	300	375	450	525	600	675	750
1.75	1.3	1.8	2.6	3.5	5.3	8.8	13.1	18	26	35	44	53	70	88	105	131	175	219	262	350	438	525	613	700	787	875
2.0	1.5	2.0	3.0	4.0	6.0	10.0	15.0	20	30	40	50	60	80	100	120	150	200	250	300	400	500	600	700	800	900	1000
2.5	1.9	2.5	3.8	5.0	7.5	12.5	18.8	25	38	50	63	75	100	125	150	187	250	312	375	500	625	750	875	1000	1125	1250
3.0	2.3	3.0	4.5	6.0	9.0	15.0	22.5	30	45	60	75	90	120	150	180	225	300	375	450	600	750	900	1050	1200	1350	1500
3.5	2.6	3.5	5.3	7.0	10.5	17.5	26.2	35	52	70	87	105	140	175	210	262	350	437	525	700	875	1050	1225	1400	1575	1750

① For service factors not listed, Equivalent HP = Actual HP x Service Factor.

Falk Wrapflex Coupling Selection

Table 3 — Falk Wrapflex Coupling Quick Selection Chart

Size	5R	10R	20R	30R	40R	50R	60R	70R	80R
Max Bore (in)	1.625	1.875	2.375	2.875	3.375	4.125	5.250	6.125	7.250
Max Speed	4500 RPM	4500 RPM	4500 RPM	4500 RPM	3600 RPM	3000 RPM	2500 RPM	2100 RPM	1800 RPM
Torque (lb-in)	550	1,150	2,800	4,600	9,100	22,200	35,500	70,900	133,000
HP/100 RPM	0.873	1.82	4.44	7.30	14.4	35.2	56.3	112	211
RPM	HP Ratings								
4500	39.3	82.1	200	328	–	–	–	–	–
3600	31.4	65.7	160	263	520	–	–	–	–
3000	26.2	54.7	133	219	433	1057	–	–	–
2500	21.8	45.6	111	182	361	881	1408	–	–
2100	18.3	38.3	93.3	153	303	740	1183	2362	–
1800	15.7	32.8	80.0	131	260	634	1014	2025	3798
1750	15.3	31.9	77.7	128	253	616	986	1969	3693
1450	12.7	26.5	64.4	106	209	511	817	1631	3060
1170	10.2	21.3	52.0	85.4	169	412	659	1316	2469
1000	8.73	18.2	44.4	73.0	144	352	563	1125	2110
870	7.59	15.9	38.7	63.5	126	306	490	979	1836
720	6.28	13.1	32.0	52.6	104	254	406	810	1519
650	5.67	11.9	28.9	47.4	93.9	229	366	731	1372
580	5.06	10.6	25.8	42.3	83.7	204	327	652	1224
520	4.54	9.49	23.1	38.0	75.1	183	293	585	1097
420	3.67	7.66	18.7	30.7	60.6	148	237	472	886
350	3.05	6.39	15.5	25.5	50.5	123	197	394	739
280	2.44	5.11	12.4	20.4	40.4	98.6	158	315	591
230	2.01	4.20	10.2	16.8	33.2	81.0	130	259	485
190	1.66	3.47	8.44	13.9	27.4	66.9	107	214	401
155	1.35	2.83	6.89	11.3	22.4	54.6	87.3	174	327
125	1.09	2.28	5.55	9.12	18.0	44.0	70.4	141	264
100	0.873	1.82	4.44	7.30	14.4	35.2	56.3	112	211
84	0.733	1.53	3.73	6.13	12.1	29.6	47.3	94.5	177
68	0.593	1.24	3.02	4.96	9.82	24.0	38.3	76.5	143
56	0.489	1.02	2.49	4.09	8.09	19.7	31.5	63.0	118
45	0.393	0.821	2.00	3.28	6.50	15.9	25.3	50.6	95.0
37	0.323	0.675	1.64	2.70	5.34	13.0	20.8	41.6	78.1
30	0.262	0.547	1.33	2.19	4.33	10.6	16.9	33.7	63.3
25	0.218	0.456	1.11	1.82	3.61	8.81	14.1	28.1	52.8
20	0.175	0.365	0.889	1.46	2.89	7.04	11.3	22.5	42.2
16.5	0.144	0.301	0.733	1.20	2.38	5.81	9.29	18.6	34.8
13.5	0.118	0.246	0.600	0.985	1.95	4.76	7.60	15.2	28.5
11	0.096	0.201	0.489	0.803	1.59	3.87	6.20	12.4	23.2
9	0.079	0.164	0.400	0.657	1.30	3.17	5.07	10.1	19.0
7.5	0.065	0.137	0.333	0.547	1.08	2.64	4.22	8.44	15.8
5	0.044	0.091	0.222	0.365	0.722	1.76	2.82	5.62	10.6

Service Factors

Table 4 — Flexible Coupling Service Factors for Motor ① and Turbine Drives

Service factors listed are typical values based on normal operation of the drive systems.

Application	Service Factor
AERATOR	2.0
AGITATORS	
Vertical and Horizontal Screw, Propeller, Paddle	1.0
BARGE HAUL PULLER	1.5
BLOWERS	
Centrifugal	1.0
Lobe or Vane	1.25
CAR DUMPERS	2.5
CAR PULLERS	1.5
CLARIFIER OR CLASSIFIER	1.0
COMPRESSORS	
Centrifugal	1.0
Rotary, Lobe or Vane	1.25
Rotary, Screw	1.0
Reciprocating	
Direct Connected	Refer to Factory
Without Flywheel	Refer to Factory
② With Flywheel and Gear between Compressor and Prime Mover	
1 cylinder, single acting	3.0
1 cylinder, double acting	3.0
2 cylinders, single acting	3.0
2 cylinders, double acting	3.0
3 cylinders, single acting	3.0
3 cylinders, double acting	2.0
4 or more cly., single act.	1.75
4 or more cyl., double act.	1.75
③ **CONVEYORS**	
Apron, Assembly, Belt, Chain, Flight, Screw	1.0
Bucket	1.25
Live Roll, Shaker and Reciprocating	3.0
③④ **CRANES AND HOIST**	
Main Hoist	1.7 ③
Skip Hoist	1.75 ③
Slope	1.5
Bridge, Travel or Trolley	1.75
DYNAMOMETER	1.0
ELEVATORS	
Bucket, Centrifugal Discharge	1.25
Freight or Passenger	**Not Approved**
Gravity Discharge	1.25
ESCALATORS	**Not Approved**
EXCITER, GENERATOR	1.0
EXTRUDER, PLASTIC	1.5
FANS	
Centrifugal	1.0
Cooling Tower	2.0
Forced Draft — Across the Line start	1.5
Forced Draft Motor driven thru fluid or electric slip clutch	1.0
Gas Recirculating	1.5
Induced Draft with damper control or blade cleaner	1.25
Induced Draft without controls	2.0
FEEDERS	
Apron, Belt, Disc, Screw	1.0
Reciprocating	2.5
GENERATORS	
Even Load	1.0
Hoist or Railway Service	1.5
Welder Load	2.0
HAMMERMILL	1.75
LAUNDRY WASHER OR TUMBLER	2.0
LINE SHAFTS	
Any Processing Machinery	1.5
MACHINE TOOLS	
Auxiliary and Traverse Drive	1.0
Bending Roll, Notching Press, Punch Press, Planer, Plate Reversing	1.75
Main Drive	1.5
MAN LIFTS	**Not Approved**
METAL FORMING MACHINES	
Continuous Caster	1.75
Draw Bench Carriage and Main Drive	2.0
Extruder	2.0
Farming Machine and Forming Mills	2.0
Slitters	1.0
Wire Drawing or Flattening	1.75
Wire Winder	1.5
Coilers and Uncoilers	1.5
MIXERS (see Agitators)	
Concrete	1.75
Muller	1.5
PRESS, PRINTING	1.5
PUG MILL	1.75
PULVERIZERS	
Hammermill and Hog	1.75
Roller	1.5
PUMPS	
Boiler Feed	1.5
Centrifugal — Constant Speed	1.0
Frequent Speed Changes under Load	1.25
Descaling, with accumulators	1.25
Gear, Rotary, or Vane	1.25
Reciprocating, Plunger Piston	
1 cyl., single or double act.	3.0
2 cyl., single acting	2.0
2 cyl., double acting	1.75
3 or more cylinders	1.5
Screw Pump, Progressing Cavity	1.25
Vacuum Pump	1.25
SCREENS	
Air Washing	1.0
Grizzly	2.0
Rotary Coal or Sand	1.5
Vibrating	2.5
Water	1.0
SKI TOWS & LIFTS	**Not Approved**
STEERING GEAR	1.0
STOKER	1.0
TIRE SHREDDER	1.50
TUMBLING BARREL	1.75
WINCH, MANEUVERING	
Dredge, Marine	1.5
WINDLASS	1.5
WOODWORKING MACHINERY	1.0
WORK LIFT PLATFORMS	**Not Approved**

① For engine drives, refer to **Table 5**. Electric motors, generators, engines, compressors and other machines fitted with sleeves or straight roller bearings usually require limited end float couplings. If in doubt, provide axial clearances and centering forces to the Factory for a recommendation.

② For balanced opposed design, refer to the Factory.

③ If people are occasionally transported, refer to the Factory for the selection of the proper size coupling.

④ For high peak load applications (such as Metal Rolling Mills) refer to the Factory.

Table 5 — Engine Drive Service Factors ⑤

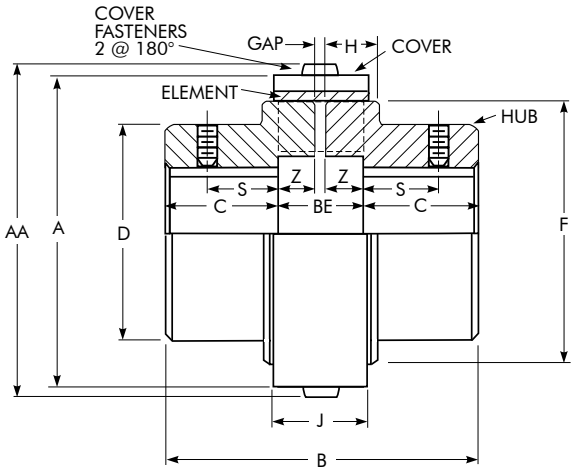
Service Factors (S.F.) for engine drives are those required for applications where good flywheel regulation prevents torque fluctuations greater than ±20%. For drives where torque fluctuations are greater or where the operation is near a serious critical or torsional vibration, a mass elastic study is necessary.

No. of Cylinders	4 or 5 ⑤					6 or more ⑤				
Table 4 S.F.	1.0	1.25	1.5	1.75	2.0	1.0	1.25	1.5	1.75	2.0
Engine S.F.	2.0	2.25	2.5	2.75	3.0	1.5	1.75	2.0	2.25	2.5

⑤ To use **Table 5**, first determine application service factor from **Table 4**. Use that factor to determine Engine S.F. from **Table 5**. When service factor from **Table 4** is greater than 2.0, or where 1, 2, or 3 cylinder engines are involved, refer complete application details to Rexnord Engineering.

Industry	Service Factor
AGGREGATE PROCESSING, CEMENT, MINING KILNS; TUBE, ROD AND BALL MILLS	
Direct or on L.S. shaft of Reducer, with final drive Machined Spur Gears	2.0
Single Helical or Herringbone Gears	1.75
Conveyors, Feeders, Screens, Elevators	See General Listing
Crushers, Ore or Stone	2.5
Dryer, Rotary	1.75
Grizzly	2.0
Hammermill or Hog	1.75
Tumbling Mill or Barrel	1.75
BREWING AND DISTILLING	
Bottle and Can Filling Machines	1.0
Brew Kettle	1.0
Cookers, Continuous Duty	1.25
Lauter Tub	1.5
Mash Tub	1.25
Scale Hopper, Frequent Peaks	1.75
CLAY WORKING INDUSTRY	
Brick Press, Briquette Machine, Clay Working Machine, Pug Mill	1.75
DREDGES	
Cable Reel	1.75
Conveyors	1.25
Cutter head, Jig Drive	2.0
Maneuvering Winch	1.5
Pumps (uniform load)	1.5
Screen Drive, Stacker	1.75
Utility Winch	1.5
FOOD INDUSTRY	
Beet Slicer	1.75
Bottling, Can Filling Machine	1.0
Cereal Cooker	1.25
Dough Mixer, Meat Grinder	1.75
LUMBER	
Band Resaw	1.5
Circular Resaw, Cut-off	1.75
Edger, Head Rig, Hog	2.0
Gang Saw (Reciprocating)	Refer to Factory
Log Haul	2.0
Planer	1.75
Rolls, Non-Reversing	1.25
Rolls, Reversing	2.0
Sawdust Conveyor	1.25
Slab Conveyor	1.75
Sorting Table	1.5
Trimmer	1.75
④ **METAL ROLLING MILLS**	
Coilers (Up or Down) Cold Mills only	1.5
Coilers (Up or Down) Hot Mills only	2.0
Coke Plants	
Pusher Ram Drive	2.5
Door Opener	2.0
Pusher or Larry Car Traction Drive	3.0
Continuous Caster	1.75
Cold Mills — Strip Mills	Refer to Factory
Temper Mills	Refer to Factory
Cooling Beds	1.5
Drawbench	2.0
Feed Rolls - Blooming Mills	3.0
Furnace Pushers	2.0
Hot and Cold Saws	2.0
Hot Mills —	
Strip or Sheet Mills	Refer to Factory
Reversing Blooming	Refer to Factory
Slabbing Mills	Refer to Factory
Edger Drives	Refer to Factory
Ingot Cars	2.0
Manipulators	3.0
Merchant Mills	Refer to Factory
Mill Tables	
Roughing Breakdown Mills	3.0
Hot Bed or Transfer, non-reversing	1.5
Runout, reversing	3.0
Runout, non-reversing, non-plugging	2.0
Reel Drives	1.75
Rod Mills	Refer to Factory
Screwdown	2.0
Seamless Tube Mills	
Piercer	3.0
Thrust Block	2.0
Tube Conveyor Rolls	2.0
Reeler	2.0
Kick Out	2.0
Shear, Croppers	Refer to Factory
Sideguards	3.0
Skelp Mills	Refer to Factory
Slitters, Steel Mill only	1.75
Soaking Pit Cover Drives —	
Lift	1.0
Travel	2.0
Straighteners	2.0
Unscramblers (Billet Bundle Busters)	2.0
Wire Drawing Machinery	1.75
OIL INDUSTRY	
Chiller	1.25
Oilwell Pumping (not over 150% peak torque)	2.0
Paraffin Filter Press	1.5
Rotary Kiln	2.0
PAPER MILLS	
Barker Auxiliary, Hydraulic	2.0
Barker, Mechanical	2.0
Barking Drum	
L.S. shaft of reducer with final drive - Helical or Herringbone Gear	2.0
Machined Spur Gear	2.5
Cast Tooth Spur Gear	3.0
Beater & Pulper	1.75
Bleachers, Coaters	1.0
Calender & Super Calender	1.75
Chipper	2.5
Converting Machine	1.25
Couch	1.75
Cutter, Felt Whipper	2.0
Cylinder	1.75
Dryer	1.75
Felt Stretcher	1.25
Fourdrinier	1.75
Jordan	2.0
Log Haul	2.0
Line Shaft	1.5
Press	1.75
Pulp Grinder	1.75
Reel, Rewinder, Winder	1.5
Stock Chest, Washer, Thickener	1.5
Stock Pumps, Centrifugal	
Constant Speed	1.0
Frequent Speed Changes Under Load	1.25
Suction Roll	1.75
Vacuum Pumps	1.25
RUBBER INDUSTRY	
Calender	2.0
Cracker, Plasticator	2.5
Extruder	1.75
Intensive or Banbury Mixer	2.5
Mixing Mill, Refiner or Sheeter	
One or two in line	2.5
Three or four in line	2.0
Five or more in line	1.75
Tire Building Machine	2.5
Tire & Tube Press Opener (Peak Torque)	1.0
Tuber, Strainer, Pelletizer	1.75
Warming Mill	
One or two Mills in line	2.0
Three or more Mills in line	1.75
Washer	2.5
SEWAGE DISPOSAL EQUIPMENT	
Bar Screen, Chemical Feeders, Collectors, Dewatering Screen, Grit Collector	1.0
SUGAR INDUSTRY	
Cane Carrier & Leveler	1.75
Cane Knife & Crusher	2.0
Mill Stands, Turbine Driver with all Helical or Herringbone gears	1.5
Electric Drive or Steam Engine Drive with Helical, Herringbone, or Spur Gears with any Prime Mover	1.75
TEXTILE INDUSTRY	
Batcher	1.25
Calender, Card Machine	1.5
Cloth Finishing Machine	1.5
Dry Can, Loom	1.5
Dyeing Machinery	1.25
Knitting Machine	Refer to Factory
Mangle, Napper, Soaper	1.25
Spinner, Tenter Frame, Winder	1.5

Close-Coupled Type R10



Dimensions (in)

Cplg Size ①	Torque Rating (lb-in)	Allow Speed RPM	Min Bore	Max Bore ②	Cplg Wt (lb) ③		A		AA		B	BE ⑤	C	D	F	H	J	S	Z	GAP ⑤	Cover Fasteners ⑥	
					Nylon Cover	Steel Cover ④	Nylon Cover	Steel Cover ④	Nylon Cover	Steel Cover ④											Size	Allen Wrench
5R	550	4500	0.500	1.625	2.96	3.27	3.01	3.01	3.17	3.17	2.83	0.78	1.02	2.36	2.52	0.59	0.91	0.63	0.35	0.078	M4	M2.5
10R	1,150	4500	0.625	1.875	5.48	5.98	3.56	3.56	3.72	3.72	3.62	0.94	1.34	2.84	2.99	0.75	1.10	0.88	0.43	0.078	M4	M2.5
20R	2,800	4500	0.750	2.375	12.4	13.4	4.96	4.88	5.20	5.12	4.80	1.26	1.77	3.62	4.02	0.98	1.46	1.00	0.59	0.078	M6	M4
30R	4,600	4500	1.000	2.875	20.7	22.1	5.77	5.63	6.01	5.87	5.98	1.42	2.28	4.13	4.65	1.14	1.65	1.25	0.67	0.078	M6	M4
40R	9,100	3600	1.125	3.375	37.6	39.8	7.17	6.97	7.48	7.28	7.13	1.85	2.64	5.12	5.91	1.34	2.15	1.63	0.83	0.197	M8	M5
50R	22,200	3000	1.250	4.125	78.8	82.9	9.09	8.82	9.41	9.13	8.46	2.39	3.03	7.01	7.48	1.81	2.74	1.75	1.10	0.197	M8	M5
60R	35,500	2500	2.000	5.250	–	146	–	10.51	–	10.94	10.84	2.97	3.94	8.25	8.98	2.37	2.64	–	1.39	0.197	M10	M6
70R	70,900	2100	2.750	6.125	–	244	–	12.20	–	12.64	12.76	3.31	4.72	9.88	10.63	2.74	2.95	–	1.56	0.197	M10	M6
80R	133,000	1800	3.375	7.250	–	365	–	14.57	–	15.00	14.84	3.82	5.51	10.63	12.91	3.28	3.35	–	1.79	0.236	M10	M6

① Wrapflex is a metric product. Metric to inch conversions may not be direct. Dimensions are for reference only and are subject to change without notice unless certified.

② AGMA Class 1 clearance fit bores are standard for Sizes 5R thru 50R, with two setscrews (one over keyway and one at 90°). Interference fit bores and no setscrews are standard for Sizes 60R thru 80R. Long hubs and interference fits are available and recommended when at or near maximum bore and: a) Number of start/stop cycles exceeds 10 per hour; or b) Application service factor = 2.0 or higher.

③ Coupling assembly weight is based on "no bore" hubs. For coupling assembly weight and bored hubs, subtract the following value for each hub: $(0.20)(\text{Bore})^2(\text{C})$ lb. Bore in "inches".

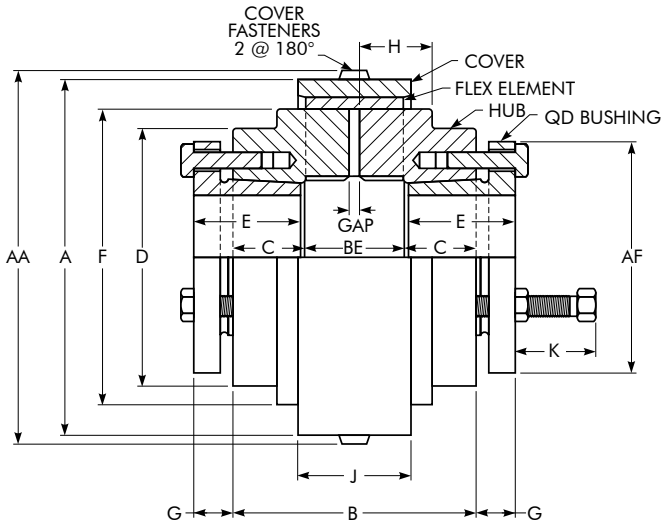
④ Nylon cover is standard on Sizes 5R thru 50R, with an epoxy-coated steel cover as an option. Epoxy-coated steel cover is standard on Sizes 60R thru 80R, with no option for nylon cover.

⑤ "BE" = Standard "Distance Between Shaft Ends" with hubs mounted flush to the shaft ends. "GAP" = Minimum allowable "Distance Between Shaft Ends". Any shaft end spacing between the "GAP" and "BE" dimensions is acceptable. However, if utilizing a shaft end spacing less than the "BE" dimension, the key should not extend beyond the hub face in order to prevent potential interference with the flex element.

⑥ Cover fasteners are stainless steel, socket button head cap screws, per ISO 7380-A2. Two cap screws per coupling assembly.

NOTE: Dimensions subject to change. Certified dimensions of ordered material furnished on request.

QD Bushings Type R10



Dimensions (in)

Coupling Size	Bushing Size	Torque Rating ① (lb-in)	HP per 100 RPM	Max RPM	Max Bore ①	Min Bore ①	Coupling Weight without Bushing		GAP	BE
							Nylon Cover (lb)	Steel Cover (lb)		
5R	JA	550	0.87	4500	1.250	0.500	2.13	2.43	0.078	0.78
10R	JA	1,150	1.82	4500	1.250	0.500	3.49	3.99	0.078	0.94
20R	SD	2,800	4.44	4500	1.938	0.500	6.73	7.78	0.078	1.26
30R	SD	4,600	7.30	4500	1.938	0.500	10.2	11.6	0.078	1.42
40R	SF	9,100	14.4	3600	2.938	0.500	17.0	19.2	0.197	1.84
50R	E	22,200	35.2	3000	3.500	0.875	38.6	42.7	0.197	2.39
60R	J	35,500	56.3	2500	4.500	1.438	NA	86.3	0.197	2.96
70R	J	70,900	112	2100	4.500	1.438	NA	142	0.197	3.31
80R	M ②	133,000	211	1800	5.500	1.938	NA	254	0.236	3.82

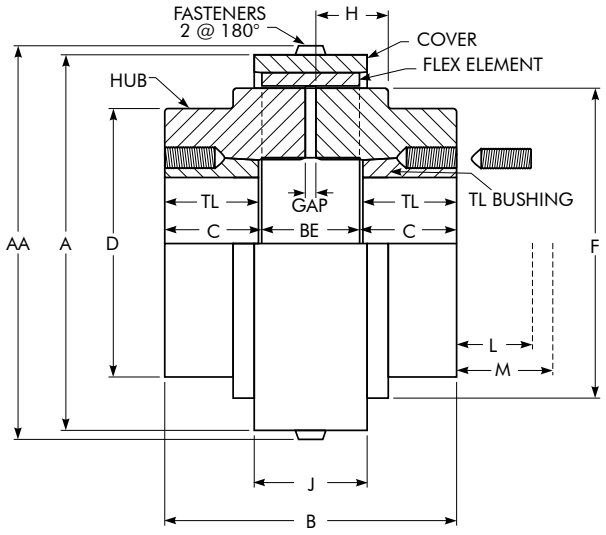
Coupling Size	Cover Fasteners ③		Bushing Fasteners ③ Inch Hardware	AA – Nylon Cover	AA – Steel Cover	A – Nylon Cover	A – Steel Cover	AF ①	B
	Size	Hex Tool							
5R	M4	M2.5	#10-24 x 1.00	3.17	3.17	3.01	3.01	2.00	2.83
10R	M4	M2.5	#10-24 x 1.00	3.72	3.72	3.56	3.56	2.00	2.99
20R	M6	M4	1/4-20 x 1.00	5.20	5.12	4.96	4.88	3.19	3.78
30R	M6	M4	1/4-20 x 1.00	6.01	5.87	5.77	5.63	3.19	3.94
40R	M8	M5	3/8-16 x 1.25	7.48	7.28	7.17	6.97	4.63	4.52
50R	M8	M5	1/2-13 x 1.75	9.41	9.13	9.09	8.82	6.00	5.70
60R	M10	M6	5/8-11 x 2.50	–	10.94	–	10.51	7.25	9.34
70R	M10	M6	5/8-11 x 2.50	–	12.64	–	12.20	7.25	9.69
80R	M10	M6	3/4-10 x 3.00	–	15.00	–	14.57	9.13	14.22

Coupling Size	C	D	E ①	F	G ①	H	J – Nylon Cover	J – Steel Cover	K – Clearance
5R	1.02	2.36	1.00	2.520	0.44	0.59	0.91	0.91	1.16
10R	1.02	2.84	1.00	2.992	0.44	0.75	1.10	1.10	1.16
20R	1.26	3.62	1.81	4.016	0.56	0.98	1.46	1.46	1.19
30R	1.26	4.13	1.81	4.646	0.56	1.14	1.65	1.64	1.19
40R	1.34	5.12	2.00	5.906	0.84	1.34	2.15	2.09	1.50
50R	1.65	7.01	2.63	7.480	1.13	1.81	2.74	2.65	2.13
60R	3.19	8.25	4.50	8.976	1.50	2.37	–	2.64	2.94
70R	3.19	9.88	4.50	10.630	1.50	2.74	–	2.95	2.94
80R	5.20	10.63	6.75	12.913	1.66	3.28	–	3.35	3.50

① Typical – refer to bushing manufacturer for exceptions and service factor limitations.
② 80R requires a special "M" bushing, manufactured for "reverse" mounting. Consult bushing manufacturer.
③ Cover fasteners are ISO 7380, stainless steel, socket button head cap screws. Bushing fasteners are SAE Grade 5 (inch) or ISO 8.8 (metric), hex head cap screws.

NOTE: Dimensions subject to change. Certified dimensions of ordered material furnished on request.

Taper-Lock Bushings Type R10



Dimensions (in)

Coupling Size	Bushing Size	Torque Rating ① (lb-in)	HP per 100 RPM	Max RPM	Max Bore ①	Min Bore ①	Coupling Weight w/o Bushing Nylon Cover (lb)	Coupling Weight w/o Bushing Steel Cover (lb)	GAP
5R	1108	550	0.87	4500	1.125	0.500	1.78	2.08	0.078
10R	1210	1,150	1.82	4500	1.250	0.500	3.44	3.93	0.078
20R	1610	2,800	4.44	4500	1.688	0.500	6.86	7.91	0.078
30R	2012	4,600	7.30	4500	2.125	0.500	10.7	12.1	0.078
40R	2517	9,100	14.4	3600	2.688	0.500	19.4	21.7	0.197
50R	3020	22,200	35.2	3000	3.250	0.875	43.7	47.8	0.197
60R	4040	35,500	56.3	2500	4.438	1.438	–	92.0	0.197
70R	4545	70,900	112	2100	4.938	1.938	–	160	0.197
80R	5050	126,000	200	1800	5.313	2.438	–	238	0.236

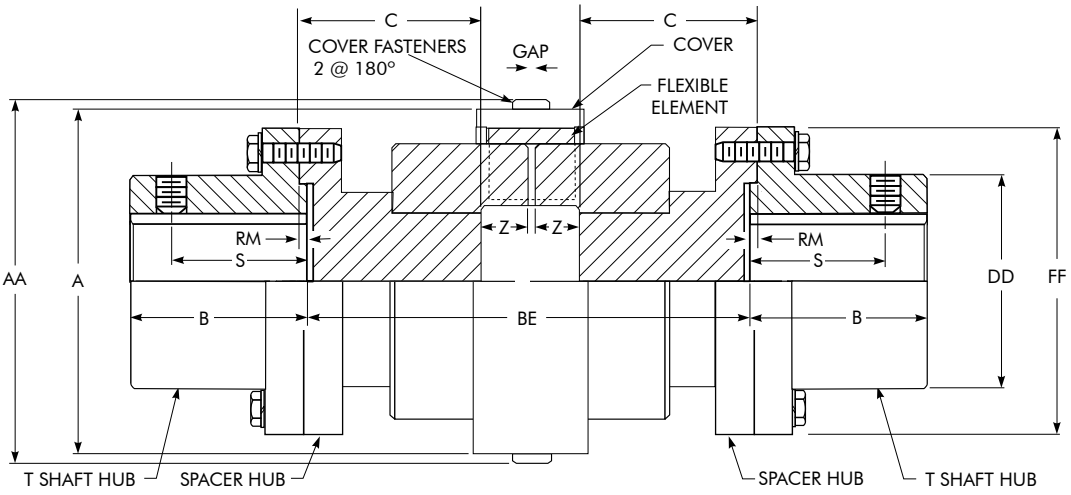
Coupling Size	BE	Cover Fasteners ② Size	Cover Fasteners ② Hex Tool	A – Nylon Cover	A – Steel Cover	AA – Nylon Cover	AA – Steel Cover	B	C
5R	0.78	M4	M2.5	3.01	3.01	3.17	3.17	2.56	0.89
10R	0.94	M4	M2.5	3.56	3.56	3.72	3.72	3.54	1.30
20R	1.26	M6	M4	4.96	4.88	5.20	5.12	3.86	1.30
30R	1.42	M6	M4	5.77	5.63	6.01	5.87	4.72	1.65
40R	1.84	M8	M5	7.17	6.97	7.48	7.28	5.46	1.81
50R	2.39	M8	M5	9.09	8.82	9.41	9.13	6.72	2.17
60R	2.96	M10	M6	–	10.51	–	10.94	10.84	3.94
70R	3.31	M10	M6	–	12.20	–	12.64	12.37	4.53
80R	3.82	M10	M6	–	14.57	–	15.00	13.90	5.04

Coupling Size	D	F	H	J – Nylon Cover	J – Steel Cover	L ③ Standard Hex Key	L ③ Short ⑤ Hex Key	M ④ Standard Hex Key	M ④ Short ⑤ Hex Key	TL
5R	2.36	2.520	0.59	0.91	0.91	1.13	0.63	1.25	0.75	0.875
10R	2.84	2.992	0.75	1.10	1.10	1.38	0.81	1.63	1.06	1.000
20R	3.62	4.016	0.98	1.46	1.46	1.38	0.81	1.63	1.06	1.000
30R	4.13	4.646	1.14	1.65	1.64	1.56	0.94	2.00	1.38	1.250
40R	5.12	5.906	1.34	2.15	2.09	1.63	1.00	2.25	1.63	1.750
50R	7.01	7.480	1.81	2.74	2.65	1.81	1.19	2.69	2.06	2.000
60R	8.25	8.976	2.37	–	2.64	2.38	1.63	4.13	3.38	4.000
70R	9.88	10.630	2.74	–	2.95	2.63	1.94	4.75	4.06	4.500
80R	10.63	12.913	3.28	–	3.35	2.81	2.31	5.25	4.81	5.000

① Typical – refer to bushing manufacturer for exceptions and service factor limitations.
② Cover fasteners are ISO 7380, stainless steel, socket button head cap screws.
③ Space required to tighten bushing. Also, space required to loosen screws to permit removal of hub by puller.
④ Space required to remove bushing using jack screws – no puller required.
⑤ Standard hex key cut to minimum useable length.

NOTE: Dimensions subject to change. Certified dimensions of ordered material furnished on request.

Full Spacer Type R31



Dimensions (in)

Cplg Size ①	NOTE: Distance Between Shaft Ends (BE) = 2(C) + 2(Z) + GAP – 2(RM) Spacer Dimensions																						
	Torque Rating (lb-in)	Allow Speed RPM	Max Bore ⑤	Cplg Wt No Bore – lb		BE		A		AA		B	DD	FF	RM	S	Z	GAP	Cover Fasteners ③		Flange Fasteners ④		T Shaft Hub
				At Min BE (lb)	Per Added BE (lb/in)	Min	Max	Nylon Cover	Steel Cover ②	Nylon Cover	Steel Cover ②								Size	Allen Wrench Tool	Size	No. Per Flange	
5R	550	4500	1.375	8.0	0.79	3.19	9.25	3.01	3.01	3.17	3.17	1.38	2.06	3.39	0.05	1.080	0.35	0.078	M4	M2.5	M6	4	1020T
10R	1,150	4500	1.625	11.0	0.86	3.50	10.00	3.56	3.56	3.72	3.72	1.63	2.34	3.70	0.05	1.240	0.43	0.078	M4	M2.5	M6	8	1030T
20R	2,800	4500	2.125	21.0	1.49	3.50	10.00	4.96	4.88	5.20	5.12	2.13	3.09	4.45	0.05	1.080	0.59	0.078	M6	M4	M6	8	1040T
30R	4,600	4500	2.375	31.0	1.88	4.38	10.00	5.77	5.63	6.01	5.87	2.38	3.44	4.96	0.05	1.600	0.67	0.078	M6	M4	M8	8	1050T
40R	9,100	3600	3.125	57.0	2.23	5.00	12.25	7.17	6.97	7.48	7.28	3.13	4.31	6.02	0.05	1.840	0.83	0.197	M8	M5	M10	12	1070T
50R	22,200	3000	3.500	100.0	3.31	6.50	12.25	9.09	8.82	9.41	9.13	3.50	4.81	7.01	0.05	1.960	1.10	0.197	M8	M5	M12	12	1080T
60R	35,500	2500	4.000	160.0	4.57	7.87	12.25	–	10.51	–	10.94	4.00	5.63	8.27	0.05	–	1.39	0.197	M10	M6	M16	12	1090T
70R	70,900	2100	4.750	225.0	6.59	8.80	14.70	–	12.20	–	12.64	3.56	6.75	9.88	0.06	–	1.56	0.197	M10	M6	M20	12	1100T
70R	70,900	2100	5.500	265.0	6.59	8.80	14.70	–	12.20	–	12.64	4.10	7.75	10.88	0.06	–	1.56	0.197	M10	M6	M20	12	1110T
80R	133,000	1800	6.250	415.0	8.10	9.85	16.69	–	14.57	–	15.00	4.70	8.88	12.56	0.06	–	1.79	0.236	M10	M6	M24	12	1120T
80R	133,000	1800	7.000	505.0	13.60	10.07	16.69	–	14.57	–	15.00	5.30	9.38	13.63	0.06	–	1.79	0.236	M10	M6	M27	12	1130T

① Wrapflex is a metric product. Metric to inch conversions may not be direct. Dimensions are for reference only and are subject to change without notice unless certified.
② 5R-50R nylon cover is standard and epoxy coated steel cover is optional. 60R-80R epoxy coated steel cover is standard (nylon cover not available).
③ Cover fasteners are ISO 7380, stainless steel, socket button head cap screws. Two cover fasteners per coupling.
④ Flange fasteners are ISO Grade 10.9 hex head cap screws for 5R-50R and ISO Grade 8.8 hex head cap screws for 60R.
⑤ Maximum Inch Bore listed is for a standard square key. Larger bores, with a rectangular key, are available. Sizes 5R-50R are standard clearance fit with setscrew over keyway. Size 60R is standard interference fit with keyway, but no setscrew. For interference fit with setscrew over keyway, refer to 427-105.

Taper-Lock Bushings for T Shaft Hubs

Cplg Size	T Shaft Hub	Assembly Torque Rating (lb-in)	HP per 100 RPM	Allow Speed	Bore Range	Bushing Size
5R	1020T	550	0.87	4500	0.500-1.125	1108
10R	1030T	1,150	1.82	4500	0.500-1.125	1108
20R	1040T	2,800	4.44	4500	0.500-1.375	1310
30R	1050T	4,300	6.82	4500	0.500-1.625	1615
40R	1070T	9,100	14.4	3600	0.750-2.500	2525
50R	1080T	11,300	17.9	3000	0.750-2.500	2525
60R	1090T	24,000	38.1	2500	0.938-3.000	3030
70R	1100T	24,000	38.1	2100	0.938-3.000	3030
70R	1110T	44,000	71.1	2100	1.19-3.500	3535
80R	1120T	77,300	122	1800	1.44-4.000	4040
80R	1130T	110,000	174	1800	1.94-4.500	4545

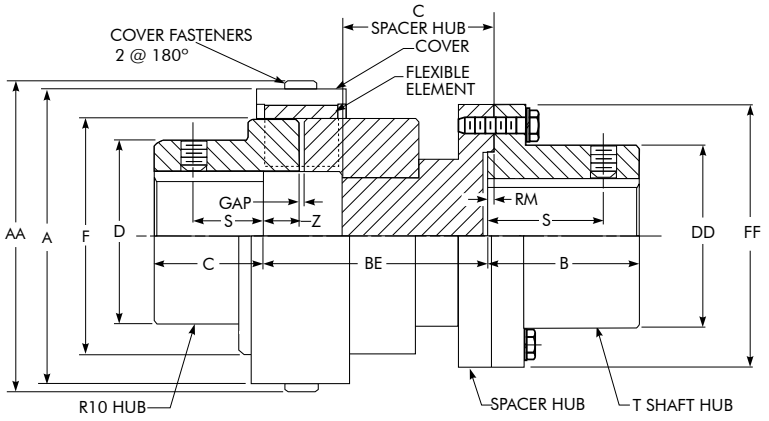
Type R31 Standard Spacer Lengths — Inches

Cplg Size	BE Lengths (Distance Between Shaft Ends)					
	3.50	4.38	5.00	7.25	9.75	10.00
5R	X	X	X	–	–	–
10R	X	X	X	X	–	–
20R	X	X	X	X	–	–
30R	–	X	X	X	–	–
40R	–	–	X	X	X	–
50R	–	–	–	X	X	X
60R	–	–	–	–	X	–

NOTE: Other BE lengths available. Refer to the Factory.

NOTE: Dimensions subject to change. Certified dimensions of ordered material furnished on request.

Half Spacer Type R35



Dimensions (in)

Cplg Size ①	NOTE: Distance Between Shaft Ends (BE) = (C)Spacer Hub + 2(Z) + GAP – RM Spacer Dimensions																								
	Torque Rating (lb-in)	Allow Speed RPM	Max Bore ③		Cplg Wt No Bore (lb)		BE		A		AA		B	C R10 Hub	D	DD	F	FF	RM	S		Z	GAP	T Shaft Hub
			T Shaft Hub	R10 Hub	At Min BE (lb)	Per Added BE (lb/in)	Min	Max	Nylon Cover	Steel Cover ②	Nylon Cover	Steel Cover ②								Shaft Hub ④	R10 Hub ④			
5R	550	4500	1.375	1.625	5.61	0.79	1.99	5.00	3.01	3.01	3.17	3.17	1.38	1.02	2.36	2.06	2.52	3.39	0.05	1.08	0.63	0.35	0.078	1020T
10R	1,150	4500	1.625	1.875	8.73	0.86	2.35	5.51	3.56	3.56	3.72	3.72	1.63	1.34	2.84	2.34	2.99	3.70	0.05	1.24	0.88	0.43	0.078	1030T
20R	2,800	4500	2.125	2.375	18.6	1.49	3.01	5.51	4.96	4.88	5.20	5.12	2.13	1.77	3.62	3.09	4.02	4.45	0.05	1.08	1.00	0.59	0.078	1040T
30R	4,600	4500	2.375	2.875	28.4	1.88	2.33	5.75	5.77	5.63	6.01	5.87	2.38	2.28	4.13	3.44	4.65	4.96	0.05	1.60	1.25	0.67	0.078	1050T
40R	9,100	3600	3.125	3.375	49.4	2.23	3.49	7.25	7.17	6.97	7.48	7.28	3.13	2.64	5.12	4.31	5.91	6.02	0.05	1.84	1.63	0.83	0.197	1070T
50R	22,200	3000	3.500	4.125	90.0	3.31	4.45	7.25	9.09	8.82	9.41	9.13	3.50	3.03	7.01	4.81	7.48	7.01	0.05	1.96	1.75	1.10	0.197	1080T
60R	35,550	2500	4.000	5.250	152	4.57	5.42	8.00	–	10.51	–	10.94	4.00	3.94	8.25	5.63	8.98	8.27	0.05	–	–	1.39	0.197	1090T
70R	70,900	2100	4.750	6.125	234	6.55	6.06	9.01	–	12.20	–	12.64	3.56	4.72	9.88	6.75	10.63	9.88	0.06	–	–	1.56	0.197	1100T
70R	70,900	2100	5.510	6.125	254	6.55	6.06	9.01	–	12.20	–	12.64	4.10	4.72	9.88	7.75	10.63	10.88	0.06	–	–	1.56	0.197	1110T
80R	133,000	1800	6.250	7.250	390	8.04	6.80	10.22	–	14.57	–	15.00	4.70	5.51	10.63	8.88	12.91	12.56	0.06	–	–	1.79	0.236	1120T
80R	133,000	1800	7.000	7.250	425	13.44	6.91	10.22	–	14.57	–	15.00	5.30	5.51	10.63	9.37	12.91	13.62	0.06	–	–	1.79	0.236	1130T

① **IMPORTANT: Upon removal of spacer hub, working clearance available for equipment removal = "BE" – "Z".**
Wrapflex is a metric product. Metric to inch conversions may not be direct. Dimensions are for reference and are subject to change without notice unless certified.

② 5R-50R nylon cover is standard and epoxy coated steel cover is optional. 60R-80R epoxy coated steel cover is standard (nylon cover not available).

③ For R10 hubs see **page 7** for "Max Bore Protruded Shaft" along with the footnote. Maximum Inch Bore listed is for a standard square key. For T shaft hubs only, larger inch bores with a rectangular key are available. Sizes 5R-50R are standard clearance fit with setscrew(s) over keyway. Sizes 60R - 80R are standard interference fit with keyway, but no setscrew. For interference fit with setscrew over keyway, refer to 427-105. For R10 hubs at the Max Bore condition, limit the number of start/stop cycles to 10 per hour unless long hubs are used.

④ Standard for T shaft hub is one setscrew over keyway; standard for R10 hub is two setscrews (one over keyway and one at 90° from keyway), Sizes 5-50R.

R35 Standard Spacer Lengths

Coupling Size	BE	Z	Usable Clearance Gap
5R	2.143	0.35	1.793
	2.362	0.35	2.012
	2.581	0.35	2.231
	2.893	0.35	2.543
	3.500	0.35	3.150
10R	2.004	0.43	1.574
	2.441	0.43	2.011
	2.660	0.43	2.230
	2.973	0.43	2.543
	3.228	0.43	2.798
	3.500	0.43	3.070
	3.937	0.43	3.507
	4.098	0.43	3.668
20R	1.775	0.59	1.185
	2.070	0.59	1.480
	2.510	0.59	1.920
	2.986	0.59	2.396
	3.130	0.59	2.540
	3.386	0.59	2.796
	3.500	0.59	2.910
	3.937	0.59	3.347
	4.255	0.59	3.665

Coupling Size	BE	Z	Usable Clearance Gap
30R	2.332	0.67	1.662
	2.952	0.67	2.282
	3.464	0.67	2.794
	4.333	0.67	3.663
	5.000	0.67	4.330
40R	3.425	0.83	2.595
	3.681	0.83	2.851
	4.468	0.83	3.638
	4.550	0.83	3.720
	5.000	0.83	4.170
	5.800	0.83	4.970
50R	4.745	1.10	3.645
	4.826	1.10	3.726
	6.076	1.10	4.976
	6.201	1.10	5.101
60R	6.359	1.39	4.969

NOTE: Other BE lengths available. Refer to the Factory.

Taper-Lock bushing for R10 hub, see page 9.
QD bushing for R10 hub, see page 8.
Taper-Lock bushing for T shaft hub, see page 10.

NOTE: Dimensions subject to change. Certified dimensions of ordered material furnished on request.

Bore Specifications and Keyways — All Rexnord Couplings

Recommended Hub Bores for Clearance & Interference Fit on Keyed Shafting (in)

Shaft Dia.	Clearance Fit		Interference Fit	
	Hub Bore	Clearance	Hub Bore	Interference
+.0000	+.0010	.0000	+.0005	.0000
-.0005	-.0000	.0015	-.0000	.0010
0.5000	0.5000		0.4990	
0.5625	0.5625		0.5615	
0.625	0.625		0.6240	
0.6875	0.6875		0.6865	
0.7500	0.7500		0.7490	
0.8125	0.8125		0.8115	
0.8750	0.8750		0.8740	
0.9375	0.9375		0.9365	
1.0000	1.0000		0.9990	
1.0625	1.0625		1.0615	
1.1250	1.1250		1.1240	
1.1875	1.1875		1.1865	
1.2500	1.2500		1.2490	
1.3125	1.3125		1.3115	
1.3750	1.3750		1.3740	
1.4375	1.4375		1.4365	
1.5000	1.5000		1.4990	
+.0000	+.0010	.0000	+.0010	.0000
-.0010	-.0000	.0020	-.0000	.0020
1.5625	1.5625		1.5605	
1.6250	1.6250		1.6230	
1.6875	1.6875		1.6855	
1.7500	1.7500		1.7480	
1.8125	1.8125		1.8105	
1.8750	1.8750		1.8730	
1.9375	1.9375		1.9355	
2.0000	2.0000		1.9980	
+.0000	+.0015	.0000	+.0010	.0000
-.0010	-.0000	.0025	-.0000	.0020
2.0625	2.0625		2.0605	
2.1250	2.1250		2.1230	
2.1875	2.1875		2.1855	
2.2500	2.2500		2.2480	
2.3125	2.3125		2.3105	
2.3750	2.3750		2.3730	
2.4375	2.4375		2.4355	
2.5000	2.5000		2.4980	
2.5625	2.5625		2.5605	
2.6250	2.6250		2.6230	
2.6875	2.6875		2.6855	
2.7500	2.7500		2.7480	
2.8125	2.8125		2.8105	
2.8750	2.8750		2.8730	
2.9375	2.9375		2.9355	
3.0000	3.0000		2.9980	

Shaft Dia.	Clearance Fit		Interference Fit	
	Hub Bore	Clearance	Hub Bore	Interference
+.0000	+.0015	.0000	+.0015	.0000
-.0010	-.0000	.0025	-.0000	.0030
3.0625	3.0625		3.0595	
3.1250	3.1250		3.1220	
3.1875	3.1875		3.1845	
3.2500	3.2500		3.2470	
3.3125	3.3125		3.3095	
3.3750	3.3750		3.3720	
3.4375	3.4375		3.4350	
3.5000	3.5000		3.4970	
3.5625	3.5625		3.5595	
3.6250	3.6250		3.6220	
3.6875	3.6875		3.6845	
3.7500	3.7500		3.7470	
3.8125	3.8125		3.8095	
3.8750	3.8750		3.8720	
3.9375	3.9375		3.9345	
4.0000	4.0000		3.9970	
+.0000	+.0015	.0000	+.0015	.0010
-.0010	-.0000	.0025	-.0000	.0035
4.0625	4.0625		4.0590	
4.1250	4.1250		4.1215	
4.1875	4.1875		4.1840	
4.2500	4.2500		4.2465	
4.3125	4.3125		4.3090	
4.3750	4.3750		4.3715	
4.5000	4.5000		4.4965	
4.5625	4.5625		4.5590	
4.6250	4.6250		4.6215	
4.6875	4.6875		4.6840	
4.7500	4.7500		4.7465	
4.8125	4.8125		4.8090	
4.8750	4.8750		4.8715	
4.9375	4.9375		4.9340	
5.0000	5.0000		4.9965	
5.0625	5.0625		5.0585	.0015
5.1250	5.1250		5.1210	.0040
5.1875	5.1875		5.1835	
5.2500	5.2500		5.2460	
5.3125	5.3125		5.3085	
5.3750	5.3750		5.3710	
5.4375	5.4375		5.4335	
5.5000	5.5000		5.4960	
5.5625	5.5625		5.5585	
5.6250	5.6250		5.6210	
5.6875	5.6875		5.6835	
5.7500	5.7500		5.7460	
5.8125	5.8125		5.8085	
5.8750	5.8750		5.8710	
5.9375	5.9375		5.9335	
6.0000	6.0000		5.9960	
6.2500	6.2500		6.2460	
6.5000	6.5000		6.4960	

Shaft Dia.	Interference Fit	
	Hub Bore	Interference
+.0000	+.0015	.0015
-.0010	-.0000	.0040
6.7500	6.7460	
7.0000	6.9960	
+.0000	+.0015	.0020
-.0010	-.0000	.0050
7.250	7.2450	
7.500	7.4950	
7.750	7.7450	
8.000	7.9950	
8.250	8.2445	.0025
8.500	8.4945	.0055
8.750	8.7445	
9.000	8.9945	
9.250	9.2440	.0030
9.500	9.4940	.0060
9.750	9.7440	
10.000	9.9940	
10.250	10.2435	.0035
10.500	10.4935	.0065
10.750	10.7435	
11.000	10.9935	
11.250	11.2430	.0040
11.500	11.4930	.0070
11.750	11.7430	
12.000	11.9930	
12.500	12.4925	.0045
13.000	12.9925	.0075
+.0000	+.0020	.0050
-.0015	-.0000	.0085
13.500	13.4915	
14.000	13.9915	
14.500	14.4910	.0055
15.000	14.9910	.0090
+.0000	+.0025	.0060
-.0015	-.0000	.0100
15.500	15.4900	
16.000	15.9900	
16.500	16.4895	.0065
17.000	16.9895	.0105
17.500	17.4890	.0070
18.000	17.9890	.0110
18.500	18.4890	
19.000	18.9890	
19.500	19.4880	.0080
20.000	19.9880	.0120

NOTE: Consult Rexnord for all keyless bore fits.

Recommended Keyways for Hubs with One Keyway (in)

Nominal Bore		Keyway Size ①	Width Tolerance ②
Over	Thru	Width x Depth	
0.4375	0.5625	0.125 x 0.062	+.0020 -.0000
0.5625	0.875	0.1875 x 0.094	+.0020 -.0000
0.875	1.250	0.250 x 0.125	+.0020 -.0000
1.250	1.375	0.3125 x 0.156	+.0020 -.0000
1.375	1.750	0.375 x 0.188	+.0025 -.0000
1.750	2.250	0.500 x 0.250	+.0025 -.0000
2.250	2.750	0.625 x 0.312	+.0030 -.0000
2.750	3.250	0.750 x 0.375	+.0030 -.0000
3.250	3.750	0.875 x 0.438	+.0030 -.0000

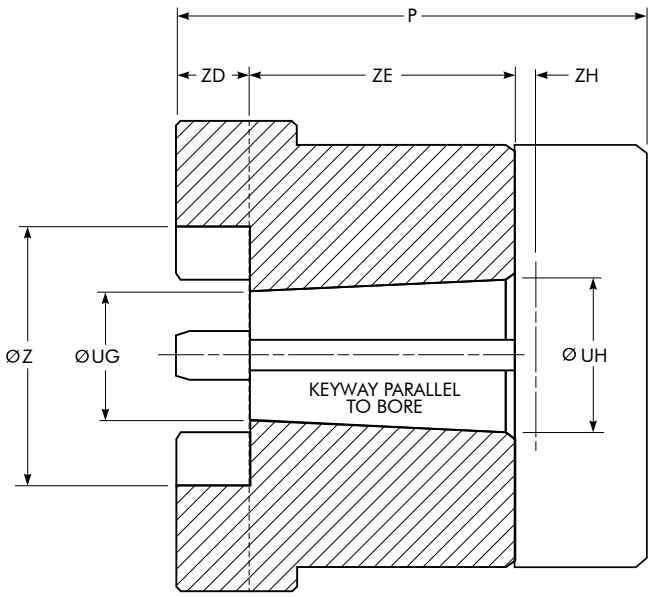
Nominal Bore		Keyway Size ①	Width Tolerance ②
Over	Thru	Width x Depth	
3.750	4.500	1.000 x 0.500	+.0030 -.0000
4.500	5.500	1.250 x 0.625	+.0035 -.0000
5.500	6.500	1.500 x 0.750	+.0035 -.0000
6.500	7.500	1.750 x 0.750	+.0040 -.0000
7.500	9.000	2.000 x 0.750	+.0040 -.0000
9.000	11.000	2.500 x 0.875	+.0045 -.0000
11.000	13.000	3.000 x 1.000	+.0045 -.0000
13.000	15.000	3.500 x 1.250	+.0050 -.0000
15.000	18.000	4.000 x 1.500	+.0050 -.0000

① One square key for bore diameters thru 6.500"; one rectangular key for bore diameters over 6.500".

② Depth tolerance: +.010" to +.020".

NOTE: Dimensions subject to change. Certified dimensions of ordered material furnished on request.

Mill Motor Selection



Standard AISE AC & DC Mill Motor Coupling Selections (in)

Motor Frame Sizes			Coupling Size	Torque Rating (lb-in)	Ø UG	Ø UH	Ø Z	Keyway	ZD	ZE	ZH +.xxx - .000
602	802 A,B,C	AC 1, 2, 4	40R ①	9,100	1.438	1.750	3.181	0.500 x 0.250	0.83	3.00	0.024
			50R	22,200			4.173	0.500 x 0.250	1.10		
603, 604	803, 804	–	50R	22,200	1.635	2.000	4.173	0.500 x 0.250	1.10	3.50	0.029
			60R	35,500			5.315	0.500 x 0.250	1.39		
606	806	AC 8, 12	50R ①	22,200	2.083	2.500	4.173	0.500 x 0.250	1.10	4.00	0.029
			60R	35,550			5.315	0.500 x 0.250	1.39		
			70R	70,900			6.299	0.500 x 0.250	1.56		
608	808	–	60R	35,550	2.531	3.000	5.315	0.750 x 0.250	1.39	4.50	0.029
			70R	70,900			6.299	0.750 x 0.250	1.56		
			80R	133,000			7.480	0.750 x 0.250	1.79		
610	810	AC 18	70R	70,900	2.781	3.250	6.299	0.750 x 0.250	1.56	4.50	0.034
			80R	133,000			7.480	0.750 x 0.250	1.79		
612	812	AC 25, 30	70R	70,900	3.104	3.625	6.299	0.750 x 0.250	1.56	5.00	0.034
			80R	133,000			7.480	0.750 x 0.250	1.79		
614	814	AC 40, 50	80R	133,000	3.729	4.250	7.480	1.000 x 0.375	1.79	5.00	0.034

Taper & Counter Bore Limitations (in)

Coupling Size	P Max	Ø UG Min	Ø UH Max	Ø Z Max	ZD Max	ZE Min	Keyway ②
5R	2.40	0.500	1.500	1.535	0.362	0.827	0.375 x 0.188
10R	3.11	0.500	1.750	1.811	0.441	1.000	0.375 x 0.188
20R	4.13	0.750	2.250	2.311	0.598	1.063	0.500 x 0.250
30R	5.24	1.000	2.500	2.559	0.677	1.339	0.625 x 0.313
40R	6.10	1.125	3.125	3.181	0.835	1.339	0.750 x 0.375
50R	7.17	1.125	4.125	4.173	1.110	1.811	1.000 x 0.500
60R	7.29	1.250	5.250	5.315	1.394	2.126	1.250 x 0.625
70R	8.65	1.500	6.125	6.299	1.571	2.244	1.500 x 0.750
80R	10.06	1.500	7.250	7.480	1.795	2.618	1.750 x 0.875

① Must use "standard" socket on mill motor nut. "Impact" socket will not fit.
② Keyway shown is for maximum bore with square key.

Type R10 Mill Motor Hubs

Mill Motor Frame Size			R10 Flex Hubs								
			5R	10R	20R	30R	40R	50R	60R	70R	80R
602	802 A, B, C	AC 1, 2 & 4	–	–	–	–	X	X	–	–	–
603 604	803 804		–	–	–	–	Consult Rexnord	X	X	–	–
606	806	AC 8 & 12	–	–	–	–	–	X	X	X	–
608	808		–	–	–	–	–	–	X	X	X
610	810	AC 18	–	–	–	–	–	–	Consult Rexnord	X	X
612	812	AC 25 & 50	–	–	–	–	–	–	–	X	X
614	814	AC 40 & 50	–	–	–	–	–	–	–	X	X

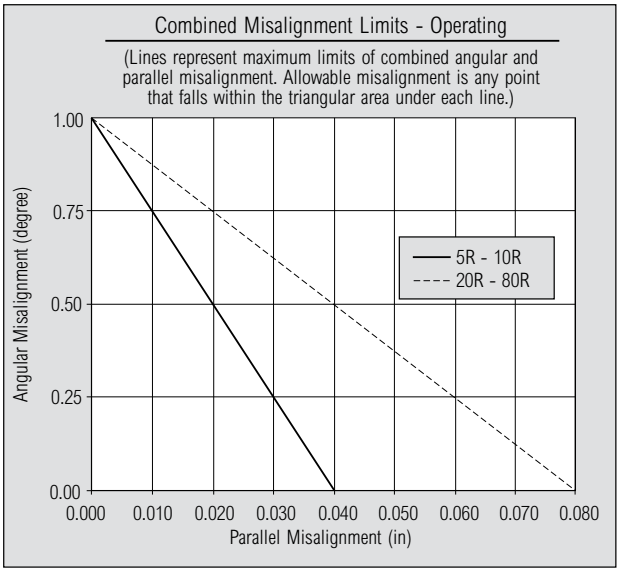
NOTE: Dimensions subject to change. Certified dimensions of ordered material furnished on request.

Misalignment Capacity, Mass & WR²

Installation & Operating Misalignment Capacity

Coupling Size	Installation Limits		Operating Limits	
	Parallel Offset (in)	Angular (degree)	Parallel Offset (in)	Angular (degree)
5R	0.020	0.25	0.040	1.00
10R	0.020	0.25	0.040	1.00
20R	0.040	0.25	0.080	1.00
30R	0.040	0.25	0.080	1.00
40R	0.040	0.25	0.080	1.00
50R	0.040	0.25	0.080	1.00
60R	0.040	0.25	0.080	1.00
70R	0.040	0.25	0.080	1.00
80R	0.040	0.25	0.080	1.00

70D Black Insert		
Used With	Torque	Temp (F)
Nylon Cover	+ 25%	225
Steel Cover	+ 35%	250



Mass & WR²

R10 Mass						
Coupling Size	Element (lb)	Nylon Cover (lb)	Steel Cover (lb)	R10 Hub (No Bore) (lb)	Total w/Nylon Cover (lb)	Total w/Steel Cover (lb)
5R	0.070	0.068	0.38	1.41	2.96	3.27
10R	0.13	0.11	0.61	2.62	5.48	5.98
20R	0.41	0.28	1.29	5.84	12.4	13.4
30R	0.63	0.37	1.82	9.83	20.7	22.1
40R	1.30	0.86	3.13	17.7	37.6	39.8
50R	2.70	1.70	5.83	37.2	78.8	82.9
60R	4.08	–	7.29	67.1	–	146
70R	6.17	–	10.2	114	–	244
80R	10.2	–	14.6	170	–	365

R10 WR²						
Coupling Size	Element (lb-in²)	Nylon Cover (lb-in²)	Steel Cover (lb-in²)	R10 Hub (No Bore) (lb-in²)	Total w/Nylon Cover (lb-in²)	Total w/Steel Cover (lb-in²)
5R	0.090	0.14	0.76	1.05	2.33	2.95
10R	0.23	0.32	1.73	2.80	6.15	7.56
20R	1.35	1.57	7.02	10.5	23.9	29.4
30R	2.75	2.80	13.2	23.2	52.0	62.4
40R	8.84	10.1	35.3	65.6	150	175
50R	30.4	31.8	106	245	552	626
60R	67.8	–	188	621	–	1,498
70R	141	–	358	1,500	–	3,499
80R	334	–	740	2,950	–	6,974

R31/R35 WR² Values ①									
Coupling Size	T31 Shaft Hub	R31 Assembly ②				R35 Assembly ③			
		Min BE (in)	WR² at Min BE (lb-in²)		WR² (lb-in²) per Inch	Min BE (in)	WR² at Min BE (lb-in²)		WR² (lb-in²) per Inch
			Nylon Cover	Steel Cover			Nylon Cover	Steel Cover	
5R	1020	3.19	7.53	8.15	0.351	1.99	4.93	5.55	0.351
10R	1030	3.50	13.6	15.0	0.413	2.35	9.61	11.0	0.413
20R	1040	3.50	39.1	44.8	1.253	3.01	33.0	38.4	1.253
30R	1050	4.38	72.4	82.3	1.980	3.45	65.9	75.8	1.980
40R	1070	5.00	217	243	4.164	3.49	184	209	4.164
50R	1080	6.50	579	654	10.78	4.45	565	640	10.78
60R	1090	7.87	–	1500	20.35	5.42	–	1500	20.35
70R	1100	8.80	–	2970	40.58	6.06	–	3230	40.58
70R	1110	8.80	–	3620	40.58	6.06	–	3550	40.58
80R	1120	9.78	–	7670	61.97	6.80	–	7210	61.97
80R	1130	10.00	–	9610	144.8	6.91	–	8190	144.8

① WR² values are based on hubs with no bore.
② For R31 Mass, refer to **page 10**.
③ For R35 Mass, refer to **page 11**.

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Your AUTHORIZED DISTRIBUTOR offers all the backup you require. A worldwide network of authorized distributors provides the finest product support in the blower industry.

1. Trained technical representatives to assist you in selecting the correct replacement parts.

2. Complete inventory of new machines and new, genuine factory parts.

3. A full line of factory tested AEON® PD blower lubricants, specifically formulated for optimum performance in all blowers.

4. Authorized distributor service technicians are factory-trained and skilled in blower maintenance and repair. They are ready to respond and assist you by providing fast, expert maintenance and repair service.

INSTRUCTIONS FOR DETERMINING BLOWER CONFIGURATION

1. Face the blower drive shaft.
2. In a **VERTICAL** configuration, air flow is horizontal.
3. In a **HORIZONTAL** configuration, air flow is vertical.
4. In a vertical configuration, a **BOTTOM HAND** exists when the drive shaft is below the horizontal center line of the blower. A **TOP HAND** exits when the drive shaft is above the horizontal center line of the blower.
5. In a horizontal configuration, a **RIGHT HAND** exists when the drive shaft is to the right of the vertical center line of the blower. A **LEFT HAND** exists when the drive shaft is to the left of the vertical center line of the blower.

INSTRUCTIONS FOR ORDERING REPAIR PARTS

For pricing, and ordering information contact your nearest AUTHORIZED FACTORY DISTRIBUTOR. When ordering parts, specify Blower **MODEL** and **SERIAL NUMBER** (see nameplate on unit).

Rely upon the knowledge and experience of your AUTHORIZED DISTRIBUTOR and let them assist you in making the proper parts selection for your blower.

To Contact Gardner Denver or locate your local distributor:
Visit: www.contactgd.com/mobile

Or

Call: (217)222-5400

GARDNER DENVER LUBRICANT ORDER INFORMATION

Re-order Part Numbers for Factory Recommended Lubricants.

Gear and Drive End

AEON PD Synthetic Lubricant, AEON PD-XP—Extreme Duty Synthetic Lubricant or AEON PD-FG—Food Grade Synthetic Lubricant

AEON PD Synthetic Lubricant

Description	Part Number
1 Quart	28G23
Case/12Quarts	28G24
1 Gallon Container	28G40
Case/6 Gallons	28G41
5 Gallon Pail	28G25
55 Gallon Drum	28G28

AEON PD-XD – Extreme Duty Synthetic Lubricant

Description	Part Number
1 Quart	28G46
Case/12Quarts	28G47
1 Gallon Container	28G42
Case/6 Gallons	28G43
5 Gallon Pail	28G44
55 Gallon Drum	28G45

AEON PD-FG – Food Grade Synthetic Lubricant

Description	Part Number
1 Quart	28H97
Case/12Quarts	28H98
1 Gallon Container	28H333
Case/6 Gallons	28H334
5 Gallon Pail	28H99
55 Gallon Drum	28H100

Drive End

AEON PD Grease

Description	Part Number
Case/10 Tubes (14oz/Tube	28H283

Call your local Gardner Denver Distributor to place your order for Gardner Denver lubricants. Your Authorized Gardner Denver Distributor is:

FOREWORD

Sutorbilt® blowers are the result of advanced engineering and skilled manufacturing. To be assured of receiving maximum service from this machine, the owner must exercise care in its operation and maintenance. This manual is written to give the operator and maintenance department essential information for day-to-day operation, maintenance and adjustment. Careful adherence to these instructions will result in economical operation and minimum downtime.

⚠ DANGER
Danger is used to indicate the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ WARNING
Warning is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ CAUTION
Caution is used to indicate the presence of a hazard which will or can cause minor personal injury or property damage if the warning is ignored.

NOTICE
Notice is used to notify people of installation, operation or maintenance information which is important but not hazard-related.

SAFETY PRECAUTIONS

Safety is everybody's business and is based on your use of good common sense. All situations or circumstances cannot always be predicted and covered by established rules. Therefore, use your past experience, watch out for safety hazards and be cautious. Some general safety precautions are given below:

⚠ DANGER

Failure to observe these notices could result in injury to or death of personnel.

- **Keep fingers and clothing away from revolving fan, drive coupling, etc.**
- **Do not use the air discharge from this unit for breathing – not suitable for human consumption.**
- **Do not loosen or remove the oil filler plug, drain plugs, covers or break any connections, etc., in the blower air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electrical shock can and may be fatal.**
- **Blower unit must be grounded in accordance with the National Electrical Code. A ground jumper equal to the size of the equipment ground conductor must be used to connect the blower motor base to the unit base.**
- **Open main disconnect switch, tag and lockout before working on the control.**
- **Disconnect the blower from its power source, tag and lockout before working on the unit – this machine may be automatically controlled and may start at any time.**

⚠ WARNING

Failure to observe these notices could result in damage to equipment.

- **Stop the unit if any repairs or adjustments on or around the blower are required.**
- **Disconnect the blower from its power source, tag and lockout before working on the unit – this machine maybe automatically controlled and may start at any time.**
- **Do not exceed the rated maximum speed shown on the nameplate.**
- **Do not operate unit if safety devices are not operating properly. Check periodically. Never bypass safety devices.**

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LIST OF ILLUSTRATIONS

SUTORBILT LEGEND SERIES BLOWERS
MATRIX/MENU

NOTICE TO CUSTOMER – To find the construction options for Your blower unit, FILL IN THE BALANCE OF LETTERS OR NUMBERS FROM YOUR UNIT NAMEPLATE

	G	A				R	
COLUMN NUMBER:	1	2	3	4	5	6	7

FOLLOW THE LINE DOWN AND OVER FROM EACH SPACE THUS FILLED IN TO FIND THE APPROPRICATE CONSTRUCTION OPTION WITH WHICH YOUR MACHINE IS EQUIPPED.

COLUMN 1 – BASIC DESIGNATOR

COLUMN 2 – PRODUCT FAMILY

COLUMN 3 – GEAR DIAMETER

B	3”	E	5”
C	4”		

COLUMN 4 – CASE LENGTH

- L - Low Pressure
- M - Medium Pressure
- H - High Pressure

COLUMN 5 – CONFIGURATION

- A Vertical-Top Hand -Central Timed
- B Vertical-Bottom Hand – Central Timed
- C Horizontal – Left Hand – Central Timed
- D Horizontal – Right Hand – Central Timed

COLUMN 6 – DESIGN VERSION

COLUMN 7 – ADDITIONAL DESCRIPTION

	SEALS	CLEARANCES	LUBRICATION
A.	Lip	Standard	Grease-Splash
B.	Mechanical	Standard	Grease-Splash
C.	Lip	High Temperature	Grease-Splash
D.	Lip	Standard	Dual-Splash
E.	Mechanical	Standard	Dual-Splash
F.	Lip	High Temperature	Dual-Splash
G.	Mechanical	High Temperature	Dual-Splash

INTRODUCTION
YOUR KEY TO TROUBLE FREE SERVICE

Thank you for investing in Gardner Denver quality. The Gardner Denver reputation for rugged dependability has been earned by over 50 years of service in demanding, industrial operations where downtime cannot be tolerated and efficient blower performance is expected.

Your Gardner Denver Sutorbilt blower is a precision engineered blower that has been carefully manufactured and thoroughly tested at the state-of the art Gardner Denver Blower Factory in Sedalia, Missouri.

As with other precision machinery, there are several relatively simple installation, operation and maintenance procedures that you must observe to assure optimum blower performance. There is no guesswork in the manufacture of your highly advanced Sutorbilt blower and there must be none in preparing the blower to get the job done in the field.

The purpose of this manual is to help you properly install, operate and maintain your Sutorbilt blower. It is essential that you review all sections of this manual in preparation for installing your blower. Follow the instructions for installing your blower. Follow the instructions carefully and you will be rewarded with trouble-free Gardner Denver Sutorbilt service year in and year out.

SECTION 1
EQUIPMENT CHECK

Before uncrating, check the packing slip carefully to be sure all the parts have been received. All accessories are listed as separate items on the packing slip, and small important accessories such as relief valves can be overlooked or lost. After every item on the packing slip has been checked off, uncrate carefully.

NOTICE
Register a claim with the carrier for lost or damaged equipment.

⚠WARNING
Customers are cautioned to provide adequate protection, warning and safety equipment necessary to protect personnel against hazards involved in installation and operation of this equipment in the system or facility.

STORAGE

Your Gardner Denver Blower was packaged at the factory with adequate protection to permit normal storage for up to six (6) months.

If the unit is to be stored under adverse conditions or for extended periods of time, the following additional measures should be taken to prevent damage.

1. Store the blower in a clean, dry, heated (if possible) area.
2. Make certain inlet and discharge air ports are tightly covered to prevent foreign material from entering the air box.
3. All exposed, non-painted surfaces should be protected against rust and corrosion.
4. Provide adequate protection to avoid accidental mechanical damage.
5. In high humidity or corrosive environments, additional measures may be required to prevent rusting of the blower internal surfaces.
6. To prevent rusting of gears, bearings, etc., the oil reservoirs may be filled with normal operating oil.

⚠CAUTION
Before running the blower, drain the oil and replace to the proper operating level with clean, fresh lubricant.

7. Rotate the blower shaft (10 to 25 turns) weekly during storage. Inspect the blower shaft (near the shaft seal area) monthly and spray with rust inhibitor if needed.
8. For long term storage (over six (6) months), contact Gardner Denver Compressor Division Customer Service for recommendations.

REMOVING PROTECTIVE MATERIALS

The shaft extension is protected with rust inhibitor which can be removed with any standard solvent.

⚠CAUTION
Follow the safety directions of the solvent manufacturer.

Blower inlet and outlet are temporarily capped to keep out dirt and other contaminants during shipment. These covers must be removed before start-up.

The internal surfaces of all Sutorbilt units are mist sprayed with a rust preventative to protect the machine during shipment. Remove this film upon initial startup, using any commercial safety solvent. Position the blower so that the inlet and discharge connections are in the vertical position (vertical airflow). On vertically mounted units, it will be necessary to lay the unit on its side supporting the ends of the unit so as not to restrict the port on the bottom side. Place a shallow pan on the under side of the unit. With the blower disconnected from power, spray the solvent in the top port, rotating the impellers by spinning the shaft manually. Continue this procedure until the unit is visibly clean.

⚠WARNING
Rotating components will cause severe injury in case of personal contact. Keep hands and loose clothing away from blower inlet and discharge ports.

SECTION 2
INSTALLATION

LOCATION

Install the blower in a well lit, clean dry place with plenty of room for inspection and maintenance.

FOUNDATIONS

For permanent installation we recommend concrete foundations be provided, and the equipment should be grouted to the concrete. It is necessary that a suitable base be used, such as a steel combination base under blower and motor, or a separate sole plate under each. Before grouting, equipment must be leveled, free of all strains, and anchored so no movement will occur during setting of grout. After grout has completely hardened, a recheck is necessary to compensate for shrinkage, etc. If required, add shims under blower feet after final tightening of foundation anchor bolts to remove strain from the blower housing.

Where jack screws or wedges are used during grouting, they must be backed off and wedges removed before final tightening of anchor bolts. Refer to grouting instructions.

Where a concrete foundation is not feasible, care must be taken to insure that equipment is firmly anchored to adequate structural members, restricting movement and vibration.

MOUNTING CONFIGURATIONS

The blower flex-mount design enables horizontal and vertical mounting configurations with top or bottom hand, right or left hand shaft positioning. The units are center timed allowing rotation in either direction (refer to Figure 2-1).

REPOSITIONING THE MOUNTING FEET.

1. Position the mounting feet to the desired location and snug the capscrew.
2. Place the blower on its feet on a flat surface.
3. Loosen mounting feet capscrews and level unit up. The bench or blower base flatness should be within .002 of an inch.

NOTICE
If the unit is not flat within .002 of an inch, it will be necessary to shim the blower feet at installation.

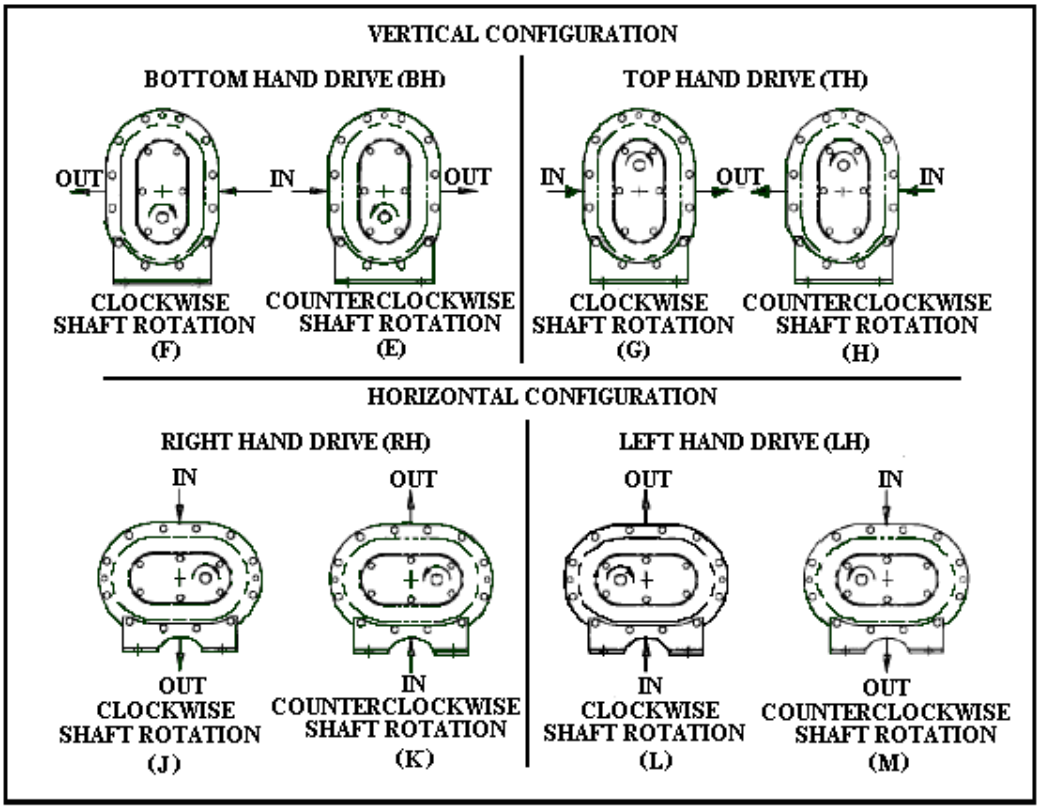


FIGURE 2-1 – BLOWER MOUNTING CONFIGURATIONS

4. Secure the mounting feet capscrews to the torque value in Figure 7-9, page 38.

NOTICE
When changing mounting configuration, it may be necessary to reposition breather/oil fill (B), oil level gauge (H) and drain plug (A). Refer to Figure 3-1, page 17, for correct location.

DRIVE INSTALLATION

When selecting a V-belt drive, check to be sure the shaft overhung load limitation is not exceeded. Refer to FIGURE 2-2, page 15, for overhung load calculations and limitations.

Belt drives must be carefully aligned. Motor and blower pulleys must be parallel to each other and in the same plane within 1/32 inch. Belt tension should be carefully adjusted to the belt manufacturer's recommendation using a belt tension gauge. Check tension frequently during the first day of operation.

⚠WARNING
Over tightening belts leads to heavy bearing loads and premature failure.

On the direct connected units, alignment and lubrication of couplings to specifications of the coupling manufacturer is very important. When mounted drives are supplied from the factory proper alignment has been established before shipment. However, during shipping, handling and installation, it is likely that the alignment has been disturbed and final adjustment must be made before startup.

⚠WARNING

Exceeding overhung load limitations leads to unwarrantable premature bearing failure and shaft breakage.

The location of the sheave on the blower shaft greatly affects the stress in the shaft. The optimum blower sheave positioning is as close as possible to the blower drive cover, not to exceed dimension "C" in Drive Shaft Illustration, FIGURE 2-2, page 15

The calculated shaft moment must not exceed the maximum allowable moment listed in Maximum Allowable Moment Chart, FIGURE 2-2 page 15. If the calculated shaft moment exceed the maximum allowable moment:

- Increase Sheave Diameters to Reduce Belt Pull
- Use Jackshaft Drive
- Use Direct Coupled or Gearbox Drive

To calculate shaft moment for a given V-Belt Drive Arrangement:

1. Use the formula for Calculation of Belt Pull, FIGURE 2-2, page 15, to calculate belt pull. Refer to Arc of Contact Factor Chart, Figure 2-2, page 15.
2. Insert the calculated belt pull into the formula for Calculation of Shaft Moment, FIGURE 2-2, page 15 to arrive at the calculated shaft moment.

PIPING

Inlet and discharge connections on all blowers are large enough to handle maximum volume with minimum friction loss. Reducing the pipe diameter on either inlet or discharge will only create additional line loss and increase the overall pressure differential. Excessive weight of piping and fittings will cause internal misalignment and premature wear. Never allow the blower to carry the weight of the pipe. If possible, a spool or sleeve-type expansion joint should be installed between the unit and the piping. Where a flexible connection is not practical, the weight of the rigid connection must be separately supported.

All system piping must be cleaned internally before connecting to the blower.

⚠WARNING

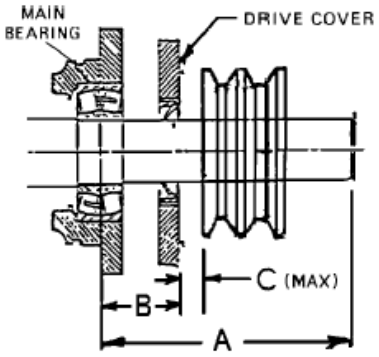
Sutorbilt blowers are shipped dry from the factory. Do not attempt to operate the blower before following proper lubrication instructions. Permanent damage to the gears, bearings and seals will occur.

Gear Diameter (Inches)	GREASE SPLASH Dimensions (Inches)			Maximum Allowable Moment (LB-IN)
	A	B	C (Max)	
3	2.88	.85	.38	385
4	3.49	1.10	.38	490
5	3.90	1.40	.38	1245

MAXIMUM ALLOWABLE MOMENT

Gear Diameter (Inches)	DUAL SPLASH LUBE Dimensions (Inches)			Maximum Allowable Moment (LB-IN)
	A	B	C (Max)	
3	3.07	1.18	.25	385
4	3.62	1.27	.25	650
5	3.85	1.39	.25	1370

MAXIMUM ALLOWABLE MOMENT



Z	Ac	Z	Ac	Z	Ac	Z	Ac	Z	Ac	Z	Ac
0.000	1.000	0.250	0.966	0.500	0.926	0.750	0.879	1.000	0.823	1.250	0.751
0.025	0.997	0.275	0.962	0.525	0.922	0.775	0.874	1.025	0.816	1.275	0.742
0.050	0.994	0.300	0.958	0.550	0.917	0.800	0.869	1.050	0.810	1.300	0.734
0.075	0.990	0.325	0.954	0.575	0.913	0.825	0.864	1.075	0.803	1.325	0.725
0.100	0.987	0.350	0.951	0.600	0.908	0.850	0.858	1.100	0.796	1.350	0.716
0.125	0.983	0.375	0.947	0.625	0.904	0.875	0.852	1.125	0.789	1.375	0.706
0.150	0.980	0.400	0.943	0.650	0.899	0.900	0.847	1.150	0.782	1.400	0.697
0.175	0.977	0.425	0.939	0.675	0.894	0.925	0.841	1.175	0.774	1.425	0.687
0.200	0.973	0.450	0.935	0.700	0.889	0.950	0.835	1.200	0.767		
0.225	0.969	0.475	0.930	0.725	0.884	0.975	0.829	1.225	0.759		

ARC OF CONTACT FACTORS

$$\text{Belt Pull} = \left[\frac{2.5 - Ac}{Ac}\right] \times \left[\frac{125954 \times Hp \times S.F.}{D \times RPM}\right]$$

Key:
- Ac = Arc of Contact Factor (Refer to Arc of Contact Factor Chart above)
- Hp = Blower Horsepower for Operating Conditions
- S.F. = Actual Drive Service Factor
- D = Blower Sheave Pitch Diameter in Inches
- RPM = Blower Sheave Speed
- Z = $\left[\frac{\text{Large Sheave Pitch Diameter (in)} - \text{Small Sheave Pitch Diameter (in)}}{\text{Sheave Center Distance (in)}}\right]$

CALCULATION OF BELT PULL

$$\text{Shaft Moment (LB-IN)} = \text{Belt Pull} \times \left[B + C + \left(\frac{\text{Sheave Width}}{2}\right)\right]$$

CALCULATION OF SHAFT MOMENT

FIGURE 2-2 – BELT DRIVE OVERHUNG LOAD CALCULATIONS

AIR FILTERS AND FILTER SILENCERS

⚠WARNING

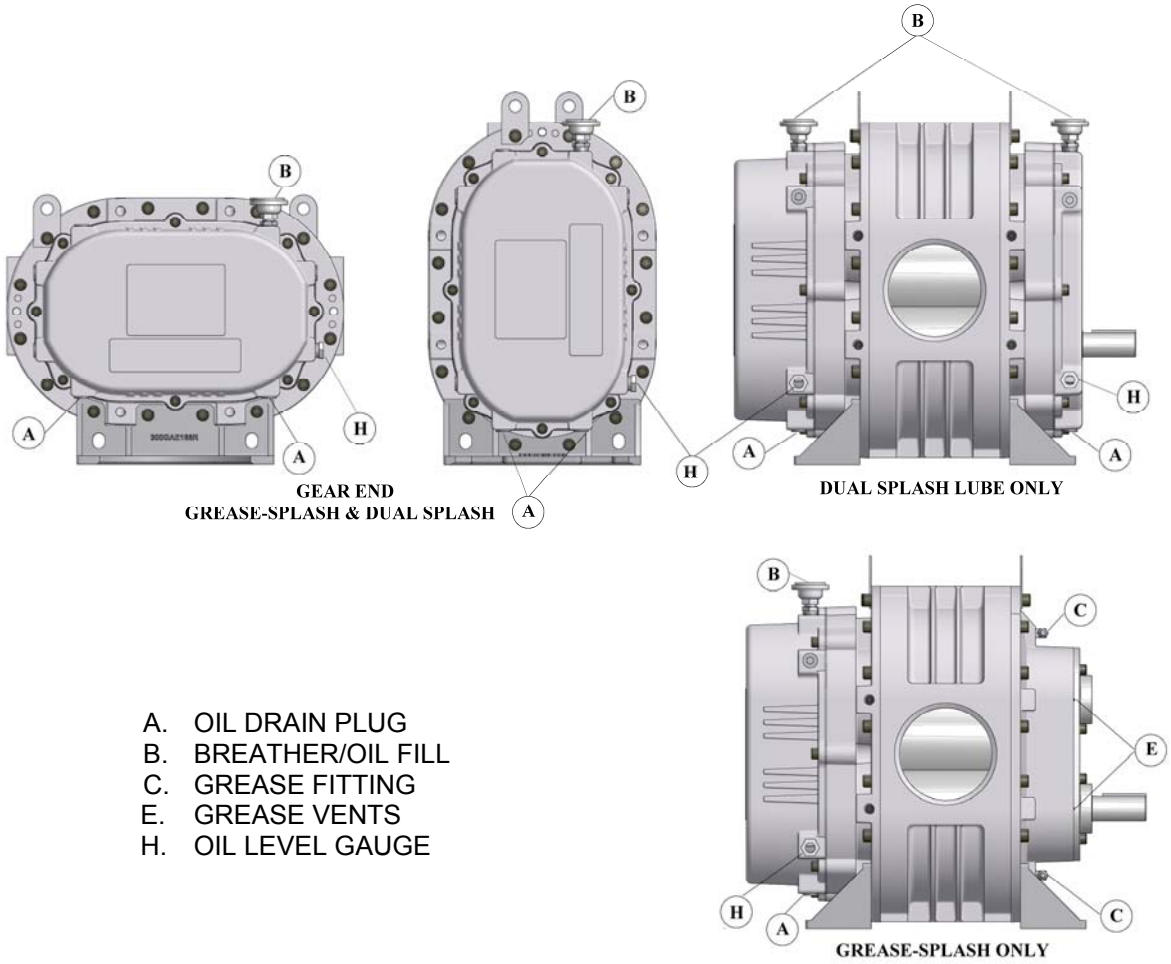
Servicing the air filters is one of the most important maintenance operations to be performed to insure long blower life.

Servicing frequency of filter elements is not time predictable. A differential pressure indicator, with a continuous gauge reading, should be installed across the inlet filter. It will tell how much of the service life of the filter element has been used. It will also eliminate both premature filter servicing and premature blower failure due to a plugged filter when the filter pressure drop is used to establish maintenance points. In all cases refer to the filter manufacturer's service instructions. Due to the many types of filters, it is not practical to give specific instructions covering all models.

NOTICE

No matter what type of filter is used, always make sure all seats, gaskets, clamps and hose connections on the filter and inlet line are absolutely air tight. Each time the filter is serviced, inspect interior of the blower for dirt.

SECTION 3
LUBRICATION



A. OIL DRAIN PLUG
B. BREATHER/OIL FILL
C. GREASE FITTING
E. GREASE VENTS
H. OIL LEVEL GAUGE

FIGURE 3-1 - LUBRICATION

DRIVE END LUBRICATION (For Grease – Splash Lube Blowers)

Drive end bearings are grease lubricated at the factory with Lithium Complex based grease. **For relubrication, use Gardner Denver AEON PD Grease, Part Number 28H283.** AEON PD Grease is a high temperature, high performance grease that is formulated with antiwear additives to provide superior service under the severe operating conditions of positive displacement blowers. It contains rust inhibitors which provide excellent protection against rust and corrosion.
If you choose not to use AEON PD Grease, select compatible base grease. The grease should be NLGI Grade 2 EP, contain rust inhibitors, and be suitable for blower discharge temperatures up to 350° F (177° C). Completely clean or purge the factory--filled grease from the blower. **Do not mix different types of grease as they may not be compatible. Substitutions may cause early bearing failure.**

Re-grease bearings every 500 hours of operation. Lubricate each bearing through the grease fittings located at C in FIGURE 3-1 (2 places). When re-greasing, the old grease will be forced out of the vents (E in FIGURE 3-1). To prevent damage to seals, these vents must be open at all times.

⚠WARNING
Do not over--grease bearings as this could cause premature bearing failure.

DRIVE END LUBRICATION (For Dual Splash Lube Blowers)

At the drive end, the bearings are lubricated by the slinger, which must be on the lowest rotor when in a vertical configuration.

Approximate oil sump capacities are listed in Figure 3-2.

NOTICE
Machines are shipped without oil in the sump. Do not operate before adding lubricant.

Lubrication Instructions

Filling procedure
Refer to Figure 3-1, page 17. Remove the breather (B) from the drive cover. Add oil to the drive sump until oil reaches the center of the oil level gauge (H). Secure breather (B) in the drive cover.

Add fresh oil as required to maintain proper level. The oil level should be at the middle of the sight glass when the machine is not operating. Refer to Figure 3-2, for approximate oil capacities.

Legend "R" Series, Grease-Splash Lube Blower Oil Capacities

		Approximate Sump capacity in pints or ounces					
		Vertical Configuration			Horizontal Configuration		
Series	**Gear Diameter (in)**	**Gear End**	**Drive End**	**Total**	**Gear End**	**Drive End**	**Total**
3	3.5	0.6 PT (9 oz.)	grease	0.6 PT (9 oz.)	1.1 PT (18 oz.)	grease	1.1 PT (18 oz.)
4	4	0.9 PT (14 oz.)	grease	0.9 PT (14 oz.)	1.5 PT (24 oz.)	grease	1.5 PT (24 oz.)
5	5	1.1 PT (18 oz.)	grease	1.1 PT (18 oz.)	2.5 PT (40 oz.)	grease	2.5 PT (40 oz.)

Note: Quantities are for purchase estimates only.

Legend "R" Series, Dual Splash Lube Blower Oil Capacities

		Approximate Sump capacity in pints or ounces					
		Vertical Configuration			Horizontal Configuration		
Series	**Gear Diameter (in)**	**Gear End**	**Drive End**	**Total**	**Gear End**	**Drive End**	**Total**
3	3.5	0.6 PT (9 oz.)	0.3 PT (5 oz.)	0.9 PT (14 oz.)	1.1 PT (18 oz.)	0.6 PT (9 oz.)	1.7 PT (27 oz.)
4	4	0.9 PT (14 oz.)	0.4 PT (6 oz.)	1.3 PT (20 oz.)	1.5 PT (24 oz.)	0.7 PT (11 oz.)	2.2 PT (35 oz.)
5	5	1.1 PT (18 oz.)	0.6 PT (9 oz.)	1.7 PT (27 oz.)	2.5 PT (40 oz.)	1.2 PT (19.1 oz)	3.7 PT (59.1 oz.)

Note: Quantities are for purchase estimates only.

FIGURE 3-2 – APPROXIMATE OIL CAPACITIES

GEAR END LUBRICATION (For Grease – Splash Lube and Dual Splash Lube Blowers)
At the gear end, the timing gear teeth are lubricated by being partially submerged in oil. The gear teeth serve as oil slingers for gear end bearings.

Approximate oil sump capacities are listed in Figure 3-2.

⚠WARNING

Do not overfill as this will tend to cause excessive heating of the gears and may damage the unit.

NOTICE

Machines are shipped without oil in the sump. Do not operate before adding lubricant.

LUBRICATION INSTRUCTIONS

Filling procedure Refer to FIGURE 3-1, page 17. Remove the breather (B) from the gear cover. Add oil to the gear case until oil reaches the center of the oil level gauge (H). Secure breather (B) in the gear cover.

Add fresh oil as required to maintain proper level. The oil level should be at the middle of the sight glass when the machine is not operating. Refer to Figure 3-2, page 18, for approximate oil capacities.

RECOMMENDED LUBRICANT

AEON PD Synthetic Blower Lubricant is recommended. Refer to FIGURE 3-3, for AEON PD, AEON PD-FG (Food Grade) and AEON PD-XD (Extreme Duty) part numbers. Order AEON PD from your Gardner Denver Distributor or call Gardner Denver directly.

Convenient Package Sizes	AEON PD Part No.	AEON PD-FG Part No.	AEON PD-XD Part No.
1 quart	28G23	28H97	28G46
Case 12 quarts	28G24	28H98	28G47
1 gallon	28G40	28H333	28G42
Case 6 gallons	28G41	28H334	28G43
5 gallon pail	28G25	28H99	28G44
55 gallon drum	28G28	28H100	28G45

FIGURE 3-3 – AEON PD SYNTHETIC LUBRICANT

AEON PD is formulated especially for positive displacement blower service to provide maximum blower protection at any temperature. One fill of AEON PD will last a minimum of 4 times longer than a premium mineral oil. Refer to FIGURE 3-4.

		Ambient Temperatures			
		Less than 10° F	10°F to 32°F	32°F to 90°F	Greater than 90°F
Blower Discharge Temperature	Less than 32°F	AEON PD AEON PD-FG	AEON PD AEON PD-FG		
	32° F to 100° F	AEON PD AEON PD-FG	AEON PD AEON PD-FG	AEON PD AEON PD-FG	
	100° F to 225°F	AEON PD AEON PD-FG	AEON PD AEON PD-FG	AEON PD AEON PD-FG	AEON PD AEON PD-FG
	225° F to 300° F	AEON PD AEON PD-FG	AEON PD AEON PD-FG	AEON PD AEON PD-FG	AEON PD XD
	Greater than 300°F			AEON PD XD	AEON PD XD

FIGURE 3-4 – SYNTHETIC LUBRICANT CHART

AEON PD Synthetic Lubricant should be drained after 6000 hours of operation. Re-fill with fresh AEON PD oil. If mineral oil is used, perform the above oil change maintenance every 1500 hours. Recommended service intervals are for normal blower operating conditions. Severe operating conditions may warrant more frequent oil changes. Laboratory analysis of lubricant should be used to help determine the optimum oil change interval.

For best performance and equipment protection, use AEON PD Synthetic Lubricant, which has been specifically formulated for positive displacement blowers. If you choose not to use AEON PD Synthetic Blower Lubricant, select an oil with rust and oxidation inhibitors, anti-foam additives, and the viscosities listed in FIGURE 3-5. Do not use an oil that contains EP additives.

NOTICE
Flush the oil whenever a change is made from one type of oil to another.

Drain the current lubricant as thoroughly as possible. Refill with the new lubricant. Fill to normal level of the blower, which is at the middle of the sight glass when the machine is not operating. Run the blower for one hour. Shut off the blower and drain the lubricant completely. Refill the blower again with the new lubricant.

Blower Discharge Temperature	Ambient Temperature			
	Less than 10° F*	10° F to 32° F**	32° F to 90° F	Greater than 90° F
Less than 32° F (0° C)	ISO 100	ISO 100		
32° F to 100° F (0° C to 38° C)	ISO 100	ISO 100	ISO 150	
100° F to 225° F (38° C to 105° C)	ISO 100	ISO 100	ISO 150	ISO 220
225° F to 300° F (105° C to 149° C)	ISO 150	ISO 150	ISO 220	ISO 220
Greater than 300° F (149° C)			***	***

***** For ambient temperatures less than 10° F, but not less than –20° F, the use of oil sump heaters, heated enclosures or synthetic lubricant is required.

****** For ambient temperatures 10° F to 32° F, the use of oil sump heaters, heated enclosures or synthetic lubricant is recommended.

******* The lubricant viscosity must be 70 SUS minimum at the lubricant operating temperature.

The pour point of the lubricant should be at least 5° to 10° F below the minimum expected ambient temperature.

For continuous operation, where the lubricant temperature exceeds 200° F, synthetic lubricant is recommended.

FIGURE 3-5 – LUBRICATION RECOMMENDATION

SECTION 4
OPERATION

Future operating problems can be avoided if proper precautions are observed when the equipment is first put into service.

Before starting under power, the blower should be turned over by hand to make certain there is no binding or internal contact.

Each size blower has limits on pressure differential, running speed and discharge temperature which must not be exceeded. These limits are shown in "Maximum Operating Limitations", FIGURE 4-1, below.

⚠WARNING

Operating beyond the specified operating limitations will result in damage to the unit.

It is important that the pressures and temperatures are measured directly at the ports of the blower to avoid error that may be caused by intervening pipe runs, fittings, etc.

Relief valves must be used to protect against excessive pressure or vacuum conditions. These valves should be tested at initial startup to be sure they are adjusted to relieve at or below the maximum pressure differential rating of the blower.

NOTICE

Relief valves should be placed as close as possible to the blower inlet or discharge.

In some instances, pressure may be relieved at a lower point than the blower maximum in order to protect the motor or the equipment served by the blower.

Discharge temperature switches are recommended to protect against excessive inlet restriction or inlet temperatures. Check valves in the discharge line on pressure blowers and in the inlet line on vacuum blowers are recommended to protect the blower from motoring backwards when shut down under load.

LIMITATIONS

For information regarding limitations, refer to FIGURE 4-1, below.

MAXIMUM / MINIMUM OPERATING LIMITATIONS

SIZE	MAX. RPM	MIN. RPM VERT.	MIN RPM HORIZ.	MAX. PRESSURE PSI	MAX VAC IN HG	MAX. TEMPERATURE RISE ° F	MAX. DISCHARGE TEMPERATURE ° F
3LR	3600	1528	1091	7	14	160	260
3MR	3600	1528	1091	12	15	180	280
3HR	3600	1528	1091	15	16	220	320
4LR	3600	1337	955	7	14	160	260
4MR	3600	1337	955	10	16	185	285
4HR	3600	1337	955	15	16	210	310
5LR	2850	1070	764	7	14	160	260
5MR	2850	1070	764	13	16	180	280
5HR	2850	1070	764	15	16	200	300

DO NOT EXCEED THESE LIMITS

NOTICE

Blower speed, line losses, elevation, and increased inlet temperatures will affect the maximum operating limitations. The minimum RPM for the blowers is based on lubrication only. The blowers may only be operated down to the minimum RPM, when the temperature rise and discharge temperature are below the maximum limitations as shown.

FIGURE 4-1 – MAXIMUM / MINIMUM OPERATING LIMITATIONS

BLOWER STARTUP CHECKLIST

This startup procedure should be followed during the initial installation and after any shutdown periods or after the blower has been worked on or moved to new location. It is suggested that the steps be followed in sequence and checked off (√) in the boxes provided.

- ☐ 1. Check the unit and all piping for foreign material and clean if required.
- ☐ 2. Check the flatness of the feet and the alignment of the drive. Feet that are bolted down in a bind can cause housing distortion and internal rubbing. Misaligned V-drives can cause the rotors to rub against the headplates and cause a reduction in the volumetric efficiency of the unit. Misaligned couplings can ruin bearings.
- ☐ 3. If the blower is V-belt driven, check the belt tension and alignment. Over-tensioned belts create heavy bearing/shaft loads which lead to premature failure.
- ☐ 4. Be sure adequate drive guards are in place to protect the operator from severe personal injury and incidental contact.
- ☐ 5. Check the unit for proper lubrication. Proper oil level cannot be over-emphasized. Too little oil will ruin bearings and gears. Too much oil will cause overheating and can ruin gears and cause other damage. Insure that grease lubricated bearings are properly lubricated.
- ☐ 6. With motor electrical power locked out and disconnected, turn the drive shaft by hand to be certain the impellers do not bind.
- ☐ 7. “Jog” the unit with the motor a few times to check that rotation is in the proper direction, and to be certain it turns freely and smoothly.
- ☐ 8. The internal surfaces of all Sutorbilt units are mist sprayed with a rust preventive to protect the machine during the shipping and installation period. This film should be removed upon initial startup.
- ☐ 9. Start the unit and operate 15 minutes at no load. During this time, check for hot spots and other indications of interference.
- ☐ 10. Apply the load and observe the operation of the unit for one hour. Check frequently during the first day of operation.
- ☐ 11. If malfunctions occur, do not continue to operate. Problems such as knocking rotors can cause serious damage if the unit is operated without correction.

SAFETY PRECAUTIONS

1. Do not operate blower with open inlet or outlet port.
2. Do not exceed specified vacuum or pressure limitations.
3. Do not operate above or below recommended blower speed range.
4. Blower is not to be used where non-sparking equipment is specified.
5. Do not operate without belt guard or coupling shield.

⚠WARNING
Do not exceed sheave or coupling manufacturer's rim speed limit.

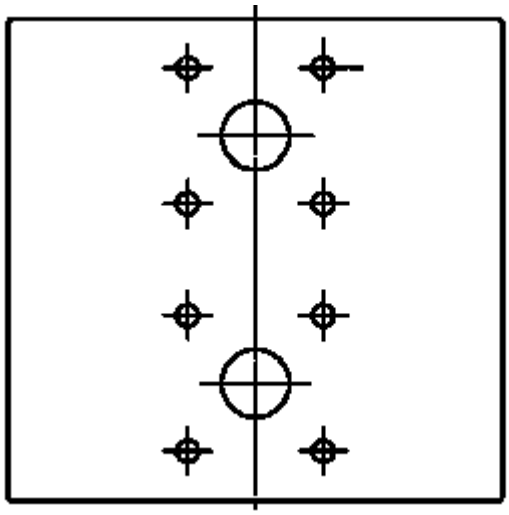
6. The blower and blower discharge piping may be extremely hot and cause skin burns on contact.

TROUBLE SHOOTING

No matter how well the equipment is designed and manufactured, there may be times when servicing will be required due to normal wear, the need for adjustment, or various external causes. Whenever equipment needs attention, the operator or repairman should be able to locate the cause and correct the trouble quickly. The Trouble Shooting Chart below is provided to assist the mechanic in those respects.

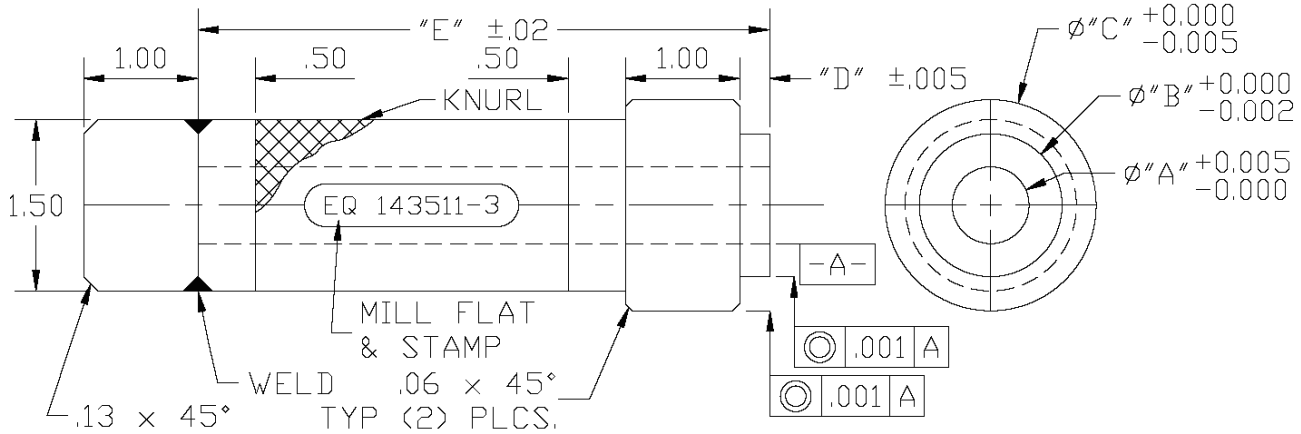
PROBLEM	POSSIBLE CAUSES	SOLUTION
Knocking	1. Unit out of time. 2. Distortion due to improper mounting or pipe strains. 3. Excessive pressure differential. 4. Worn gears. 5. Worn bearings.	1. Re-time impellers 2. Check mounting alignment and relieve pipe strains. 3. Reduce to manufacturer's recommended pressure. Examine relief valve, re-set if necessary. 4. Replace timing gears. 5. Replace bearings..
Excessive blower temperature.	1. Too much oil in gear case. 2. Too low operating speed. 3. Dirty air Filter. 4. Clogged filter or muffler. 5. Excessive pressure differential. 6. Worn impeller clearances. 7. Internal contact.	1. Reduce oil level. 2. Increase blower speed. 3. Clean or replace air filter 4. Remove cause of obstruction. 5. Reduce pressure differential across the blower. 6. Replace impeller. 7. Correct clearances.
Impeller end or tip drag.	1. Insufficient assembled clearances. 2. Case or frame distortion. 3. Excessive operating pressure. 4. Excessive operating temperature.	1. Correct clearances. 2. Check mounting and pipe strain. 3. Remove cause. 4. Remove cause
Lack of volume.	1. Slipping belts. 2. Worn clearances. 3. Dirty air filter	1. Tighten belts. 2. Re-establish proper clearances. 3. Clean or replace air filter.
Excessive bearing or gear wear.	1. Improper lubrication.	1. Correct lubrication level. Replace dirty oil.
Loss of oil.	1. Headplate, gear case or drive cover vents plugged. 2. Worn Seal.	1. Clean vents. 2. Replace seals.

ORDER SPECIAL TOOLS BY PART NUMBER. SEE PAGE 2 FOR ORDERING INSTRUCTIONS.



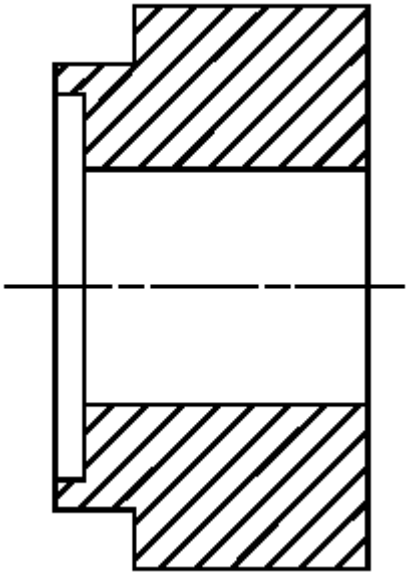
Unit Size	Part Number
3”	201GAA340
4”	202GAA340
5”	203GAA340

FIGURE 5-1 – PULLER PLATE



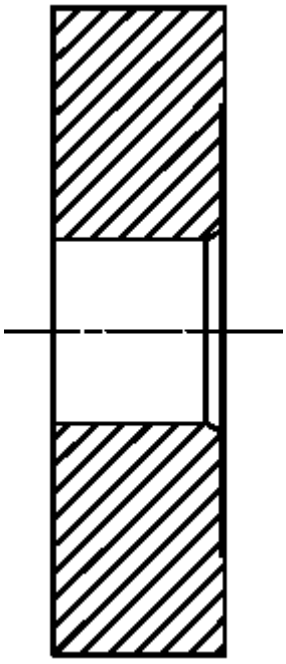
PART NO.	SIZE	"A"	"B"	"C"	"D"	"E"
EQ 143511-3	3"	.790	1.435	2.044	.335	5.50
EQ 143511-4	4"	1.000	1.624	2.436	.395	6.25
EQ 143511-5	5"	1.184	2.247	2.829	.695	7.00

FIGURE 5-2 – SEAL DRIVE



Unit Size	Part Number
3”	205GAA074
4”	206GAA074
5”	207GAA074

FIGURE 5-3 – MECHANICAL SEAL INSTALLATION TOOL



Unit Size	Part Number
3”	201GAA074
4”	202GAA074
5”	203GAA074

FIGURE 5-4 – BEARING PRESS TOOL – MECHANICAL SEAL UNITS

SECTION 6
DISASSEMBLY INSTRUCTIONS

NOTICE
Numbers in parentheses ( ) refer to key numbers in assembly drawings on pages 39 and 43.

1. Drain oil from gear case by removing drain plug (2).
2. Remove the socket head bolts (5) from the gear cover (3).
3. Remove the gear cover from the gear headplate.

NOTICE
The cover and gear headplate gasket tends to bond tightly to both surfaces. After socket head bolt removal, it is sometimes necessary to take a ball peen hammer and a blunt chisel and drive off the cover.

IMPORTANT:

MARK ALL PARTS WITH A CENTER PUNCH SO THEY CAN BE REASSEMBLED IN THE SAME POSITION (IMPELLERS, HEADPLATES, AND GEARS).

4. If the timing gears appear undamaged, the gear backlash must be checked to see if the gears can be salvaged.
   A. Mount a magnetic base dial indicator on the gear headplate (see FIGURE 6-1).
   B. Lock one impeller stationary by wedging a feeler gauge between the impeller and the headplate.
   C. The tip of the indicator should be placed at the center of the contact surface on a tooth of the gear on the free shaft.
   D. Rock the impeller back and forth by hand and read the total rotational movement to the nearest .0005 inches. Do this at four gear mesh positions 90 degrees apart.
   E. Permissible gear backlash is shown below.

GEAR DIA.	GEAR BACKLASH
3”	.0015 - .0025
4”	.0015 - .0025
5”	.002 - .003

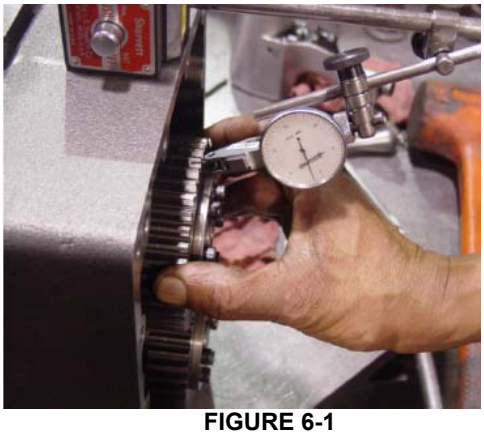


FIGURE 6-1

FIGURE 6-2

FIGURE 6-3

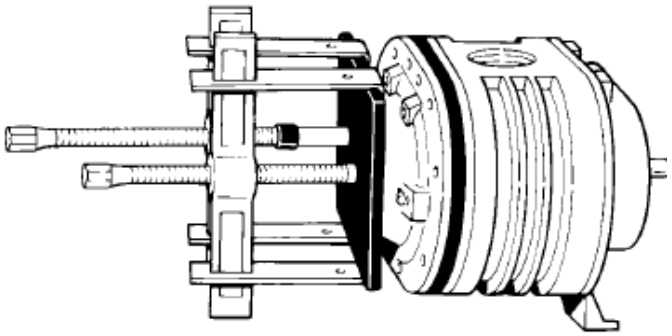


FIGURE 6-4

NOTICE
If backlash is above the specified limit, the gears are not necessarily unusable. Excessive play could be caused by worn bearings.

5. If timing gears appear to be reusable, match marktiming gear toothmesh by making small punch marks on the ends of meshing gear teeth with a pin punch and hammer (see FIGURE 6-2, page 27). The impeller tip to valley (throat) and the case to headplates should also be matchmarked to facilitate blower reassembly.
6. Remove all cap screws from both gear locking assemblies (see FIGURE 6-3). Thread 3 of these cap screws into the threaded holes in the outer ring of each locking assembly. Tighten the screws evenly to remove the locking assembly from each gear. Remove the gears (9) from both rotor shafts.

NOTICE
Blowers with mechanical seals have two wavy washers (28) located between the bearings and the cover on the drive end.

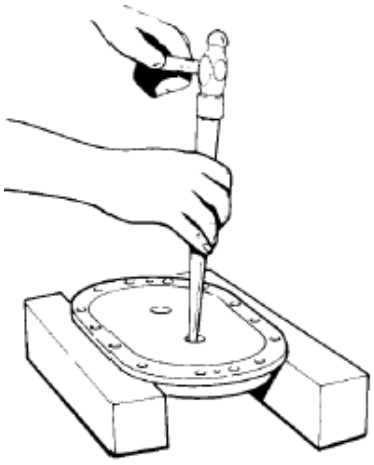


FIGURE 6-5

7. Remove the socket head cap screws (30) from the drive end bearing cover (29) and remove the cover. Support the external surface of the drive end cover near the oil seal with blocks of wood. Drive the oil seal from the cover using a hammer and punch. Discard the seal as it will not be reused. Replace oil seals each time the drive end cover is removed.

   For Dual Splash Version
   Remove the socket cap screws (84) from each slinger and remove slingers.

   For Dual Splash Version with Mechanical Seal
   Remove the socked cap screws (84) from each slinger and remover slingers. Remove flat head cap screws (86) from wavy spring retainer plates and remove retainer plate and wavy spring.

8. Remove mounting foot (17) from the drive headplate (24) by removing the capscrews (16).
9. Remove the capscrews (21) which secure the drive headplate (24) to the impeller case (22).
10. Using the puller plate shown on page 25, bolt to the drive headplate using the tapped holes on used to secure the drive cover.
11. Install a gear puller to each shaft and attach puller arms to the plate. Turn each puller only half a revolution at a time keeping the advance of the shafts as uniform as possible (see Figure 6-4). After the headplate has been removed, detach the puller plate.
12. Remove the two drive end bearings (35 and 80 for dual splash lube) or (14 and 35 for grease) from the drive headplate (24) using a ball peen hammer and punch (see Figure 6-5, page 28).

⚠ CAUTION
Exercise care not to damage the headplate bearing bores when removing bearings.

13. The oil seals can now be driven out of the drive headplate with hammer and punch (see Figure 6-5, page 28). Discard the seals as they will not be reused. Replace oil seals each time the headplate is removed.

   For Mechanical Seal Version
   Remove mechanical seal from the drive headplate.

NOTICE
Seals and bearings should be replaced during overhaul as a matter of service policy.

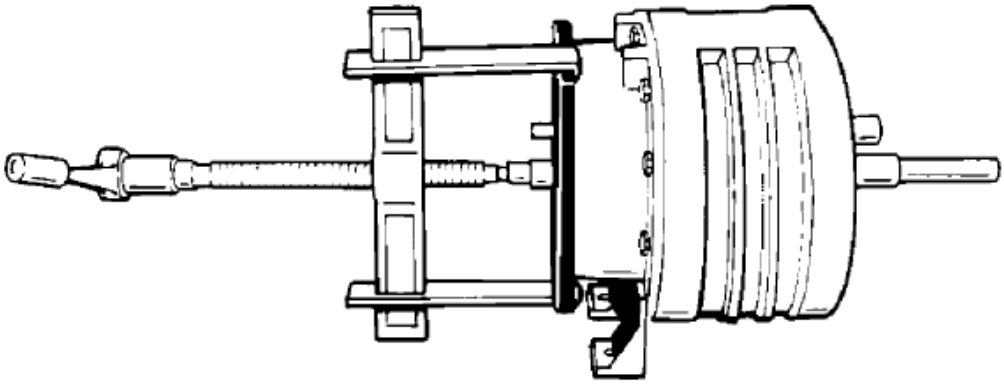


FIGURE 6-6

14. Remove the four bearing retaining screws (10), and washers (12) from the gear headplate.

    For Mechanical Seal Version
    Remove bearing retainer plate by removing 8 screws.

15. Attach puller plate to the gear headplate using the tapped holes on the bearing housing.

16. Install a gear puller to one of the shafts and attach puller arms to the plate (see Figure 6-6).

17. Remove mounting foot (17) from the gear headplate by removing 4 capscrews (16).

18. Push the impeller shaft through the gear headplate and remove the impeller assembly(23) (see Figure 6-6). Remove the other impeller assembly following the same procedure.

19. Remove the cap screws (21) securing the gear headplate to the impeller case. Located near each dowel pin on the headplate is a threaded hole. Insert a 5/16-18 UNC capscrew into each of the threaded holes. Tighten the screws evenly until the headplate separates from the impeller case.

20. Remove the two gear and bearings (14) from the gear headplate (18) as done in step 12.

21. Remove the oil seals (15) from gear headplate (19) as done in step 13.

SECTION 7
ASSEMBLY INSTRUCTIONS

NOTICE
Numbers in parentheses ( ) refer to key numbers in assembly drawings on pages 39 and 43.

1. Make sure all metallic parts are clean and free of any nicks or burrs.
2. Lubricate the outside diameter of the lip seal (15) with a light oil or grease. Install seals in both the drive headplate (24) and gear headplate (18). Use the seal driver (Figure 5-2). The seal lip should always face towards the bearing or lubricant. New seals should be installed each time the headplate is removed.

NOTICE
Make sure seals are fully seated. Use extreme care when installing.

MECHANICAL SEALS ONLY

A. Lightly coat the headplate bores with assembly lubricant.

B. Refer to Figure 7-1. Install mechanical seal (A) into the headplate bore (C) using a press and the correct driver shown on page 26. Drive the seal securely on to its seat.

⚠ CAUTION
Use extreme care when installing seals in the headplate bores. Do not attempt to install the mechanical seals without the use of a press. Blows from a hammer or mallet can damage the fragile seal surface. Too much force can crush the seal casing. Make certain the seal is properly seated and undamaged before proceeding.

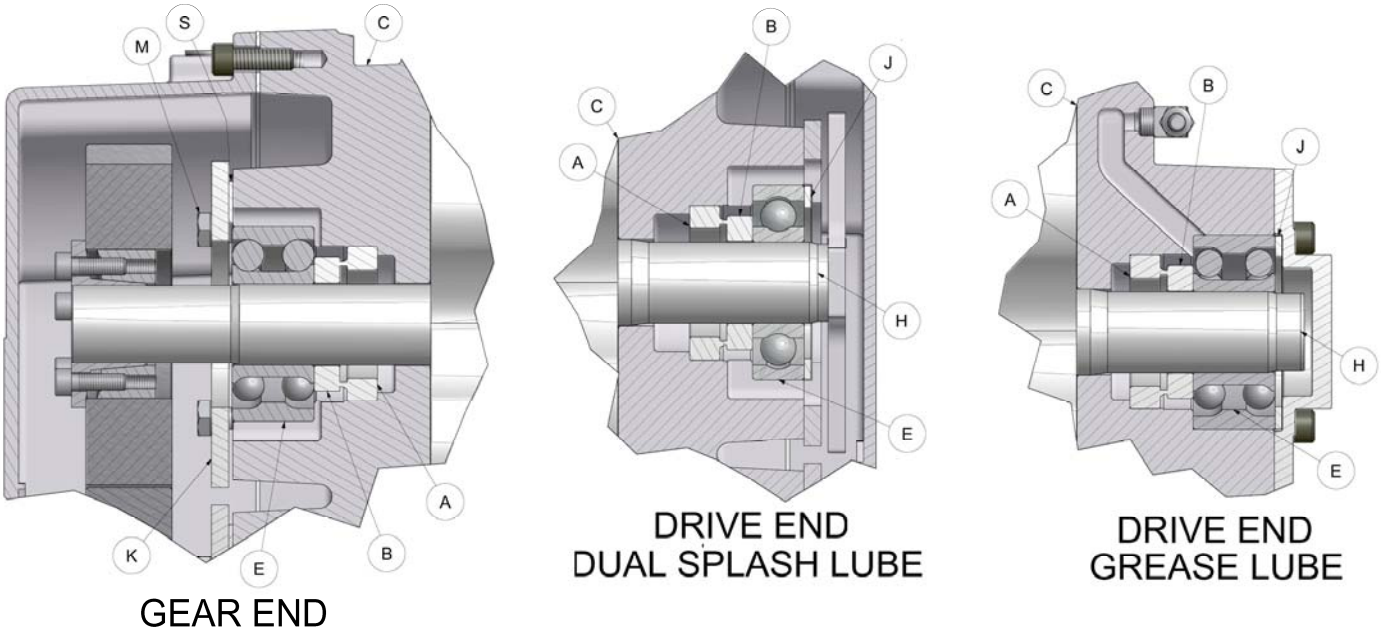


FIGURE 7-1

FIGURE 7-2

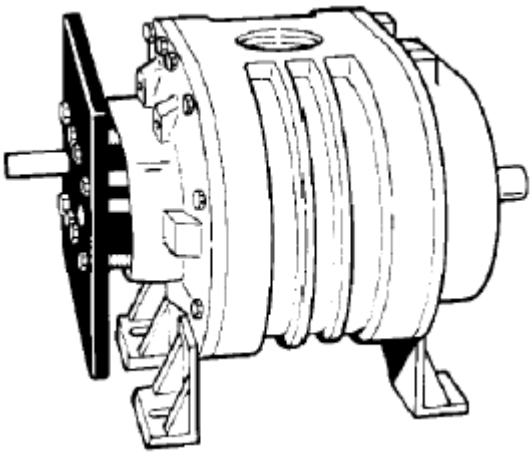


FIGURE 7-3

3. Assemble gear headplate (18) and mounting foot (17) to the impeller case with cap screws (21) and where the mounting foot is secured to the headplate use capscrews (16). The two positioning dowel pins (19) will ensure proper alignment of the headplate and impeller case. Also secure lifting lugs using capscrews (21) (see exploded assembly drawing on page 39. Refer to Figure 7-9, page 38, for torque specifications.

⚠ CAUTION
Seals are delicate; use extreme care when installing impeller shafts in the headplate bores. A piece of light shim stock wrapped around the shaft keyway will prevent cutting the seal lip.

4. Apply a light oil or grease on the shaft seal areas and the bearing areas. Insert impellers into the gear headplate using the same headplate bores as used in the original assembly.
5. Position blower so that impellers are vertical, with the drive end on top. It will be necessary to use blocks in order for the unit to set level. Measure the total end clearance using a depth micrometer (see Figure 7-2).

NOTICE
If more than .007" shim is required, put .007" on the drive end and the remaining on the gear end.

If total clearance is not within the limits specified in Figure 7-4, page 33, it may be necessary to shim the case to obtain the proper total end clearance. The shim should be placed between the drive headplate and impeller case.

6. Assemble drive headplate (24) to impeller case as in step 3 with the gear headplate. If shims were required, place shims between drive headplate and impeller case.

MECHANICAL SEALS ONLY

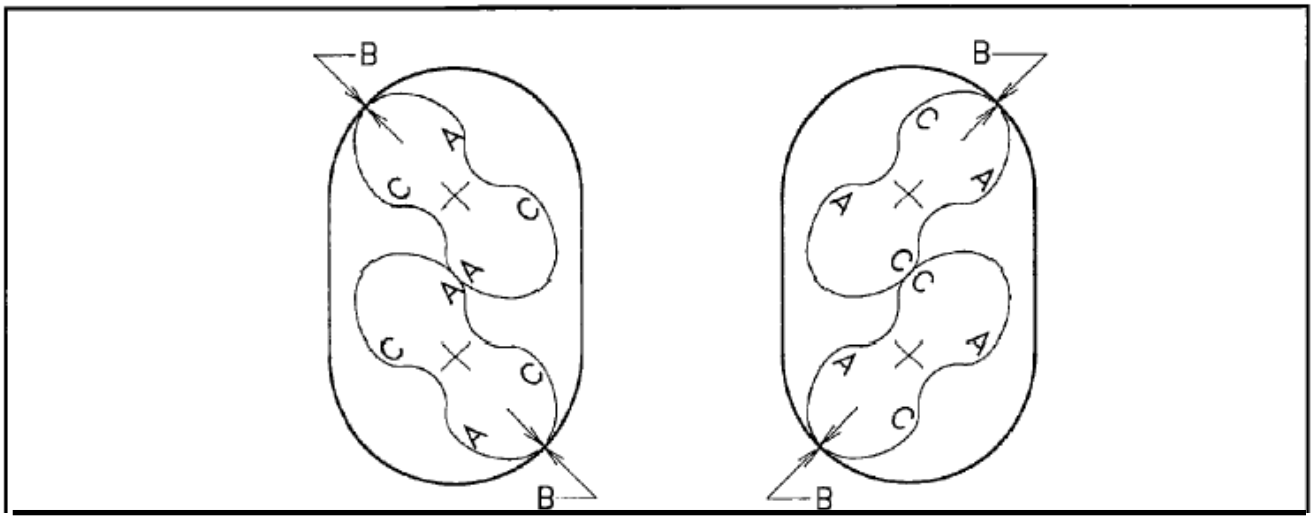
A. Refer to Figure 7-1, page 31. Lightly coat the impeller shaft (H) and the inside diameter of the mating ring (B) with assembly lubricant.

B. Install the mating ring (B) on the shaft only far enough to get the bearing (E) started on the shaft.

⚠ CAUTION
Do not drive the mating ring down to the mechanical seal, as this can damage the seal.

C. Lightly lubricate the bearing inner race (E) with a light oil or grease.

D. Using a press, install the bearing on the shaft with the bearing driver shown on page 24.



INTERNAL CLEARANCES FOR STANDARD UNITS ONLY

	3H	3M	3L	4H	4M	4L	5H	5M	5L
TOTAL END CLEARANCE	0.007-0.011			0.007-0.011			0.007-0.011		
IMPELLER TO GEAR HEADPLATE	0.003-0.005			0.003-0.005			0.003-0.005		
IMPELLER TIMING (A-A) (C-C)	0.005-0.007	.006-.008		0.006-0.008	.007-.010		.007-.010	.008-.010	
TIP TO CASE CLEARANCE (B-B)	0.002 min.			0.002 min.			0.002 min.		

FIGURE 7-4

The bearing driver will position the mating ring (B) to the correct depth with respect to the mechanical seal (A).

7. Apply a light oil to the drive headplate bearing bore, bearing inside diameter, and shaft seat. Install the drive end bearings (14and 35 for grease) or (80 and 35 for dual splash lube) as far as possible without force.
8. Attach the puller plate shown on page 25, to the drive headplate using the tapped holes used on the drive headplate (see FIGURE 7-3, page 32). Tighten the bolts so that the advance of the bearings stay as uniform as possible. Bearings should be pressed until flush with the drive headplate.
9. Lubricate the gear end bearing fits with a light oil as described previously. Install gear end bearings (14) as far as possible without force. Use the plate, used to install the drive end bearings, to press the bearings on the shafts as described in Step 8. Press bearings into the gear headplate until completely seated in the bearing bore.

NOTICE
Bearings will not be flush with gear headplate bores when completely seated.

10. Impellers should now be checked for free axial movement by hitting the ends of the impeller shafts with the palm of your hand.
11. Push the impellers against the gear headplate and recheck the total end clearance between the drive headplate and the impellers (see FIGURE 7-4).
    A. If total end clearance is insufficient, loosen impeller case to headplate bolts on either headplate, and move the headplate away from the case far enough to insert a paper shim in the amount equal to the insufficient clearance. Retighten case bolts and again check the total end clearance. Refer to FIGURE 7-4 for correct clearance.
    B. Excessive end clearances normally will require new impeller assemblies, but in some circumstances the impeller case can be removed and reduced in width by machining off the amount of excess clearance.
    C. Apply Loctite 246 on the 4 bearing retaining screws. Install 4 bearing screws and washers into the gear end headplate. Tighten screws evenly to the torque value given in FIGURE 7-9.

For Mechanical Seal Version

Install 8 bearing retaining screws and washers into the gear bearing retainer plates. Tighten screws evenly.

12.

A. Dual Splash Version

Install slingers on both shafts. Hold .31" +/_.01" gap between face of the bearing and back of the slingers. Rotate slingers approximately 90 degree apart, apply Loctite 246 on the socket cup screw and tight. Recommended torque is 3-3.5 FT-LBS. (See FIGURE 7-5).

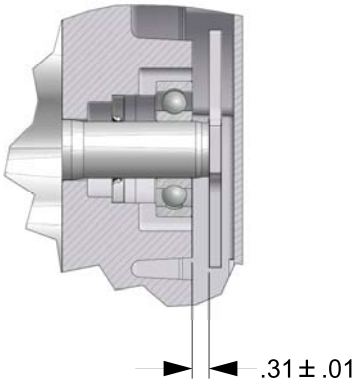


Figure 7-5

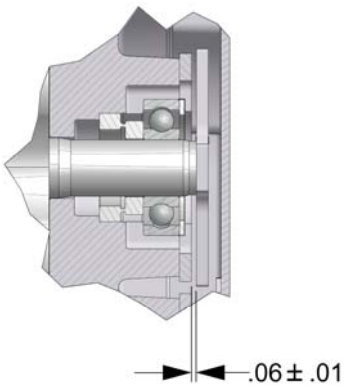


Figure 7-6

B. For Dual Splash Version with Mechanical Seal

Install slingers on both shafts. Hold .06"+_.01" gap between wavy spring retainer plates and back of the slingers. Rotate slingers approximately 90 degree apart, apply Loctite 246 on the socket cup screw and tight. Recommended torque is 3-3.5 FT-LBS. (See FIGURE 7-6).

13. **SETTING IMPELLER END CLEARANCES**

Refer to FIGURE 7-7, page 34. The outer races of the gear end bearings are clamped against the headplate (F) by the bearing retaining screws or by bearing retainer plate (mechanical seal version) (B).

This is referred to as the "fixed end". The interference fit between the shaft and the bearing inner race (H) keeps the shaft from moving axially. Adjustment is by movement of the shaft through the gear end bearing inner race (H).

A. Check the total end clearance by adding the clearance between the impellers and the drive headplate to the clearance between the impellers and the gear headplate.

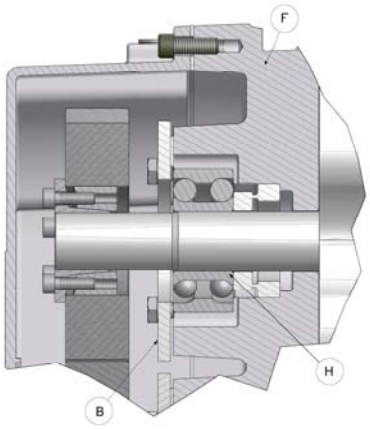


Figure 7-7

NOTICE
Check the clearance over the entire width of the impeller and consider the tightest spot.

B. Divide the end clearance by 3 and distribute approximately 1/3 on the gear end and the remaining 2/3 on the drive end.
C. To move the impeller assembly toward the drive end, lightly tap the shaft at the gear end with a soft face mallet.

D. To move the impeller assembly toward the gear end, lightly tap the shaft at the drive end with a soft face mallet.

E. To set the fixed end, insert the feeler gauge in the amount specified in FIGURE 7-4, page 33, between the headplate and the impeller at the gear end.

F. Tap lightly until the feeler gauge is snug. Adjust both impellers using the same procedure. Rotate the impellers checking for clearance through a complete revolution.

SETTING IMPELLER END CLEARANCE WITH MECHANICAL SEALS

Refer to FIGURE 7-1, page 31. The gear end bearings are held in position by the force created by the wavy spring (J) on the drive end and the bearing retainer (K) on the gear end. This is referred to as the fixed end. The interference fit between the shaft (H) and the bearing inner race (E) keeps the shaft from moving axially.

End clearance adjustment is by movement of the bearing retainer (K). Tightening the bearing retainer screws (M) moves the bearing to load the wavy spring (J), and the impeller is forced toward the drive end. Relaxing the screws allows the wavy spring to return the impeller toward the gear end.

A. Assemble drive cover to drive headplate. Refer to Step 15 with the exception of the use of wavy springs (J) installed between the drive end bearings and the wavy spring retainer plates.

B. Back out retainer screws (M) until both impellers are tight against the gear headplate.

C. With feeler gauge, measure the clearance between each impeller and the drive headplate. This value is the total end clearance.

D. Measure the clearance between the gear headplate and bearing retainer (K) at point (S).

E. Subtract 1/3 of the total end clearance from the clearance measured at point (S). This value is the amount of shim (13) that should be placed between the retainer and the headplate at point (S).

F. Tighten the bearing retainer screws (M) to the torque value given in FIGURE 7-9, page 38. With the retainer screws secure, approximately 1/3 of the total end clearance should be on the gear end and the remaining 2/3 on the drive end.

1. INSTALLING THE TIMING GEARS

If reusing the timing gears, the gears should be returned to their original positions.

A. Obtain 2 gear locking assemblies. Clean the inside and outside diameters of both locking assemblies. Clean the inside diameter of 2 gears. Clean the outside diameter of the both rotor shafts. Lightly oil the surfaces that have been cleaned. Note: DO NOT USE MOLYBDENUM DISULFIDE, MOLYKOTOE, OR ANY OTHER SIMILAR LUBRICANTS.

B. Slide a locking assembly into a gear. Install the gear and locking ring assembly onto the idler rotor shaft. Push the locking assembly firmly until flush with the end of the idler rotor shaft and hand tighten the 7 cap screws. Align and adjust the connections.

C. Use a torque wrench to tighten the screws to 75 in. lbs. in a diametrically opposite sequence. Ensure that none of the screws will turn when 75 in. lbs. is applied to them a second time.

D. Tighten the screws further to 150 in. lbs. in a diametrically opposite sequence. Ensure that none of the screws will turn when 150 in. lbs. is applied to them a second time.

E. Slide the second locking assembly into a gear. Install the gear and locking ring assembly onto the drive rotor shaft. Note the circular mark on each gear indicates the position of the largest runout. These marks must be 180 degrees apart when the gears are installed.

F. Push the locking assembly firmly until flush with the end of drive rotor shaft and hand tighten all cap screws but leave them loose enough that the gear can be rotated on the shaft.

G. The first step in setting the interlobe clearance is to measure the total clearance between two meshing lobes. This is accomplished by determining the maximum feeler gauge thickness that will fit between the rotor lobes near the pitch diameter. The clearance should be measured along the entire length of the meshing lobes. This measurement should be taken for each of the 2 interlobe meshes. The location of the smallest total interlobe clearance should be marked on the rotor lobes. Refer to diagram in FIGURE 7-4, page 33. Use feeler gauges to check clearances between impeller lobes at positions A—A and C—C. Add the clearances, and divide the total clearance evenly between A—A and C—C.

H. Rotate the rotors until the two lobes that have the smallest total interlobe clearance (as determined in step G) are visible through the discharge port. Lock the idler rotor from turning by wedging a shop rag between the tip of a lobe and the air cylinder. Insert feeler gauges with a thickness equal to the half clearance (determined in step G) between the drive rotor and the idler rotor lobe. Pull the drive rotor tight against the feeler gauges (drive rotor, feeler gauges, and idler rotor must be tight against each other). While holding the drive rotor tight against the feeler gages rotate (in the direction that the rotor turns) the gear on the drive rotor until a tooth on it contacts a tooth on the gear on the idler rotor. Hand tighten the 7 capscrews in the drive gear locking assembly. Align and adjust the connection.

I. Use a torque wrench to tighten the screws to 75 in. lbs in a diametrically opposite sequence. Ensure that none of the screws will turn when 75 in. lbs is applied to them a second time.

J. Tighten the screws further to 150 in. lbs in a diametrically opposite sequence. Ensure that none of the screws will turn when 150 in. lbs is applied to them a second time.

K. Check gear backlash four places at 90 degree intervals as described in the disassembly procedure (Item 4).

⚠ CAUTION

These impeller-to-impeller and impeller-to-case clearances are extremely critical. Even though the blower may turn freely by hand when cold, under operating conditions, the parts expand, and the rotors are subject to slight defection.

If the clearances are not sufficient, the impellers may contact each other or the housing with destructive results. If the clearances are too great, the blower may not develop the pressure or airflow that is required to perform its function.

14. Impeller tip to case clearance should be checked at this time by inserting the correct thickness feeler gauge between the tip and the case and rotating the impeller (see FIGURE 7-4, page 34). Repeat the procedure on both impellers.

NOTICE

When checking the tip to case clearance, move the feeler gauge over the entire length of the impeller to ensure that the tips do not bind along their length.

FIGURE 7-8

NOTICE

Replacement gears have minimum backlash marks on the outside diameter of the gear face. These marks should be located 180 degrees from each other (see FIGURE 7-8).

NOTICE

The gear used for adjustment should be flush with its mate on completion of the timing.

NOTICE

If any of the four gear backlash readings are not within the specified limits, the gears must be replaced.

15. Replace drive shaft oil seal (31) in the drive end cover (29). The seal lip should always face towards the bearing or lubricant.

Grease Units

Pack bearing cavities with recommended grease and secure drive cover with socket head cap screws (30) to drive headplate.

Dual Splash Units

Install drive end gasket (7). Gently slide the drive end cover (29) over the drive shaft and tap cover down over dowel pins until flush. Install and tighten drive cover bolts (30).

Refer to FIGURE 7-9, for torque specifications.

⚠ CAUTION

Exercise care not to damage the seal lip as it passes over the shaft keyway.

16. Assemble the gear cover (3) and gasket (7) to the gear headplate (18) using socket head screw (5). Tighten the capscrews alternately and evenly. Refer to FIGURE 7-9 for torque specifications.

17. Place the blower on its feet on a flat surface. Loosen cap screws (16) and level the unit up. The bench or blower base flatness should be within .002 of an inch. Re-tighten cap screws (16) to the specification in FIGURE 7-9.

NOTICE

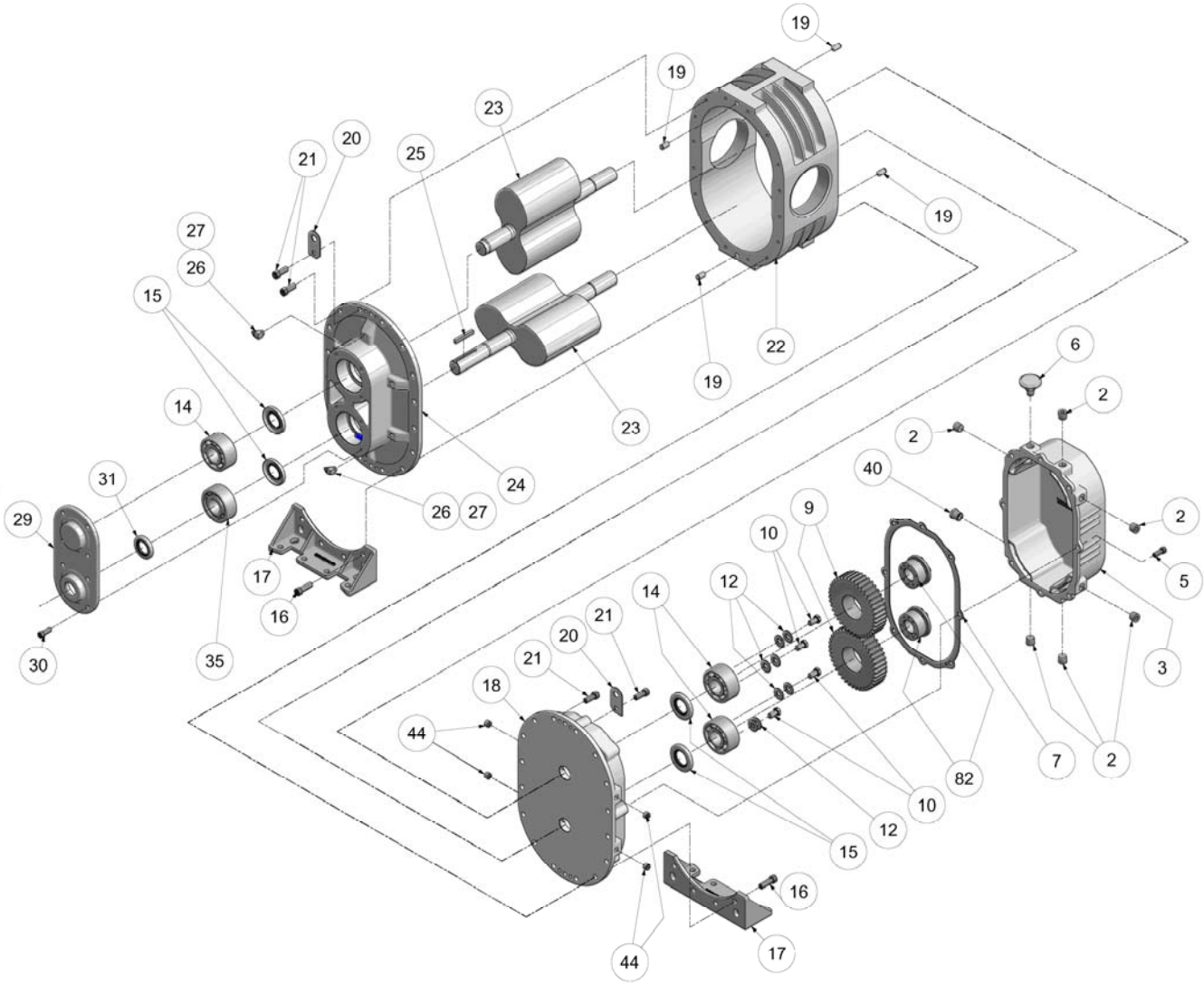
If the unit is not flat within .002 of an inch, it will be necessary to shim the blower feet at installation.

	GEAR DIAMETER		
FASTENERS	**3**	**4**	**5**
CAPSCREW (21)	23 – 30	42 – 45	42 – 45
CAPSCREW (16)	23 – 30	42 – 45	42 – 45
SOCKET HD CAPSCREW (5)	6 – 8	16 – 18	11 – 13
SOCKET HD CAPSCREW (30)	6 – 8	16 – 18	11 – 13
CAPSCREW (10)	6 – 8	38 – 42	38 – 42

NOTE: ( ) DENOTES ITEMS IN EXPLODED VIEW DRAWINGS ON PAGES 39 AND 43.

FIGURE 7-9 – TORQUE (FT-LBS)

SECTION 8
PARTS LIST

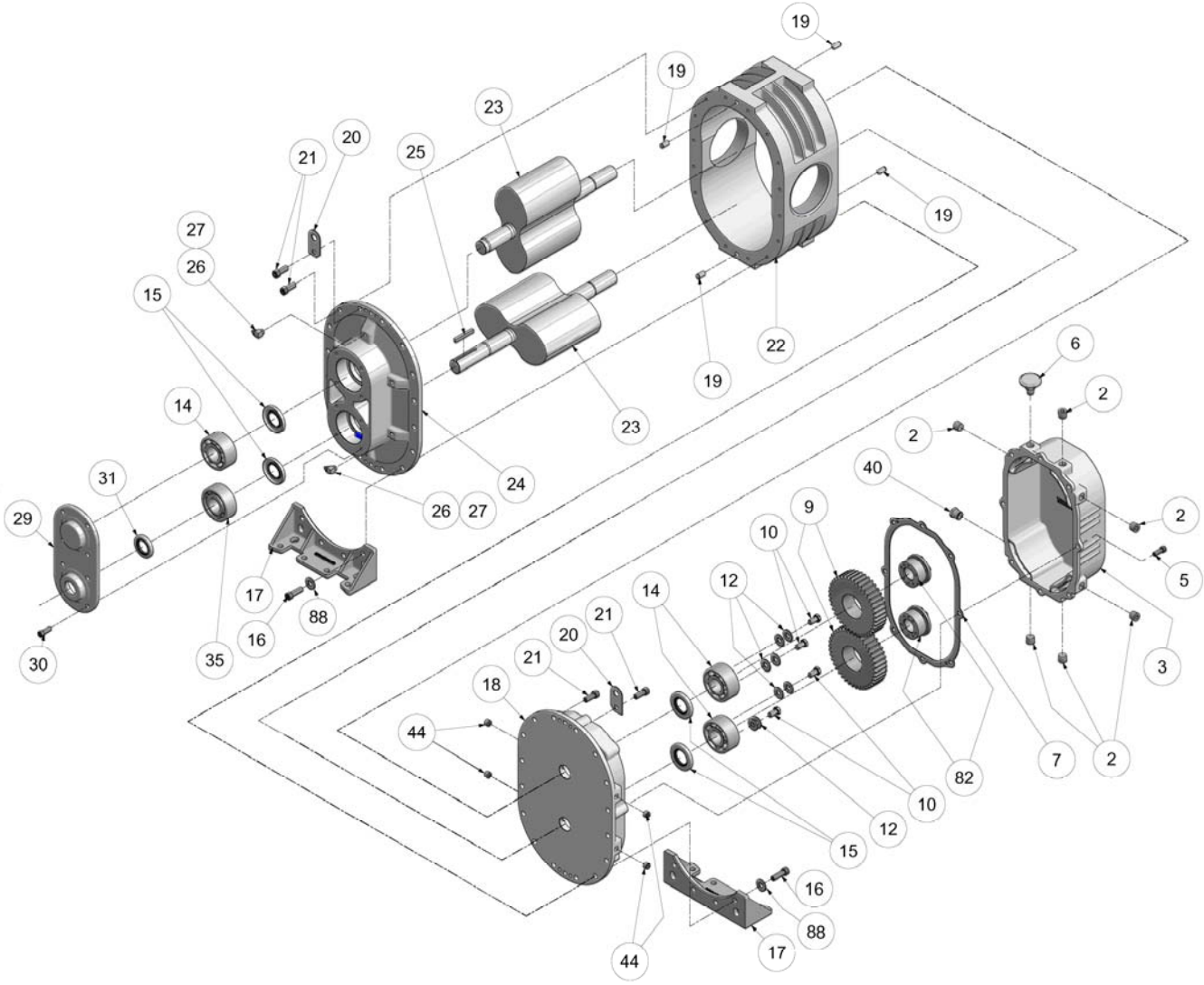


Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAB Lip Seal Grease Splash Lube

Ref. No.	Description	No. Req'd	Size – 3H GABH_R Δ Δ= (A or C)	Size – 3M GABM_R Δ Δ= (A or C)	Size -- 3L GABL_R Δ Δ= (A or C)
2	Plug	6	64AC2	64AC2	64AC2
3	Gear Case	1	303GAB602	303GAB602	303GAB602
5	Screw	8	75P7	75P7	75P7
6	Breather	1	5L358	5L358	5L358
* 7	Gasket	1	300GAB715	300GAB715	300GAB715
9	Gear Kit	1	300GAB6008	300GAB6008	300GAB6008
* 10	Screws	4	75A33P	75A33P	75A33P
12	Washer	4	95A2	95A2	95A2
* 14	Ball Bearing	3	12BA143	12BA143	12BA143
* 15	Oil Seal	4	900891030601	900891030601	900891030601
16	Screw	4	75P56	75P56	75P56
17	Foot – Vert. & Horiz.	2	303GAB166	303GAB166	303GAB166
18	Bearing Housing Gear End	1	302GAB006	302GAB006	302GAB006
19	Dowel Pin	4	62M48	62M48	62M48
20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
21	Screw	20	75P55	75P55	75P55
22	Impeller Case	1	900873034301	900873033801	900873034201
23	Rotor Group				
	3" Standard Clearances	1	307GAB4028	309GAB4028	308GAB4028
	3" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
24	Bearing Housing Drive End	1	900873033501	900873033501	900873033501
25	Key-Square	1	900639910304	900639910304	900639910304
26	Pipe Fitting	2	40E9	40E9	40E9
27	Cap	2	40P58	40P58	40P58
29	Drive Cover	1	9010873033701	9010873033701	9010873033701
30	Screw	6	75P22	75P22	75P22
* 31	Oil Seal	1	60DD725	60DD725	60DD725
* 35	Bearing – Roller	1	12BA153	12BA153	12BA153
40	Oil Level Gauge	1	40P82	40P82	40P82
44	Screw	4	76F1	76F1	76F1
** 45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
** 54	Shim Case .0025/.0035"	1	200GAB732	200GAB732	200GAB732
** 55	Shim Case .010"	1	201GAB732	201GAB732	201GAB732
** 56	Shim Case .0015/.002"	1	202GAB732	202GAB732	202GAB732
82	Locking Assembly	2	22G45	22G45	22G45
** 105	Overhaul Kit 3" R VERS Lip Seal, Grease Splash Lube	1	302GAB6010	302GAB6010	302GAB6010
** 900	Group-Indent & Instruction Legend Series 3" R VERS	1	303GAB4011	303GAB4011	303GAB4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION.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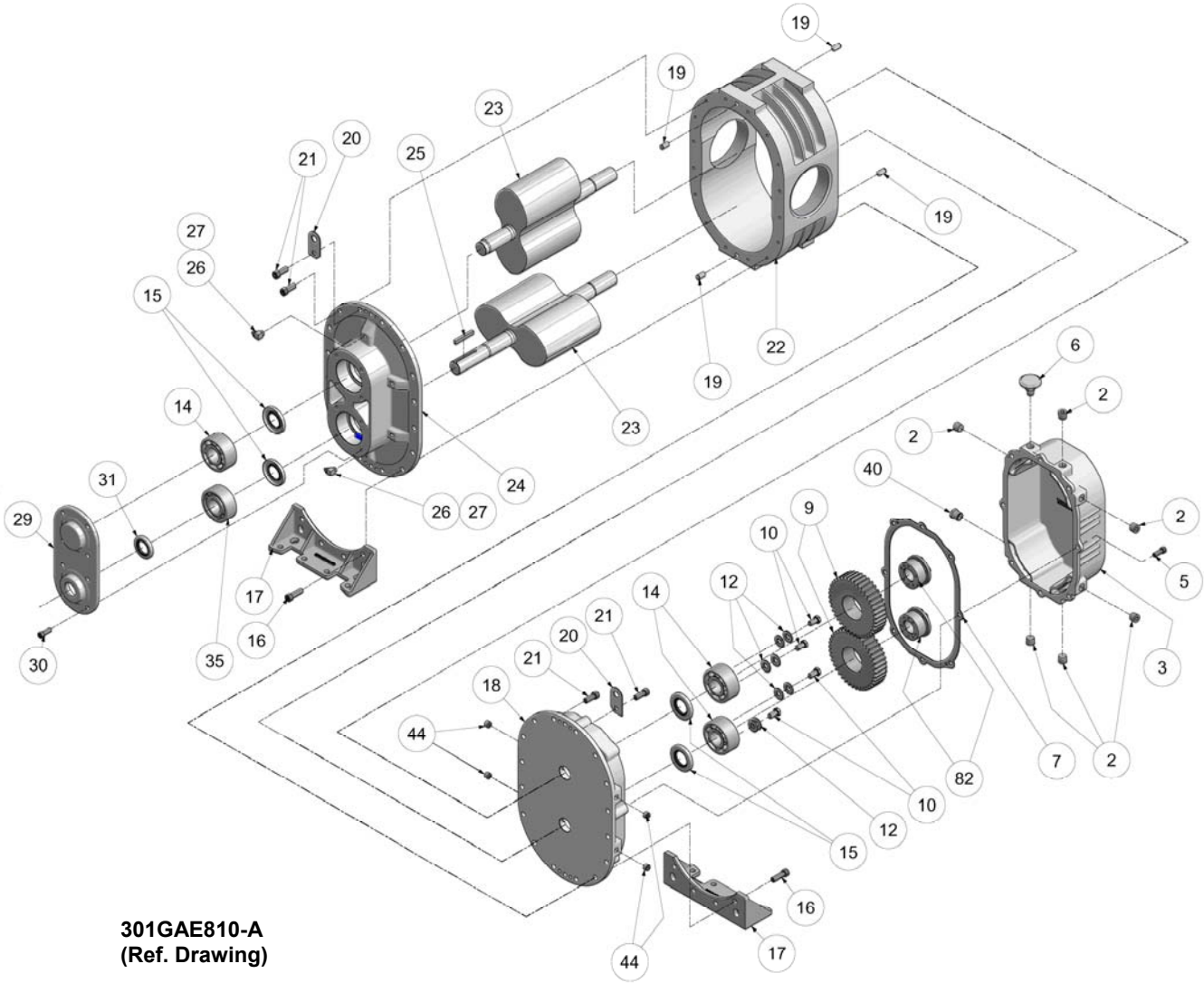
Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAC Lip Seal — Grease Splash Lube

Ref. No.	Description	No. Req'd	Size – 4H GACH_R Δ Δ= (A or C)	Size – 4M GACM_R Δ Δ= (A or C)	Size -- 4L GACL_R Δ Δ= (A or C)
2	Plug	6	64AC3	64AC3	64AC3
3	Gear Case	1	304GAC602	304GAC602	304GAC602
5	Screw	8	75P40	75P40	75P40
6	Breather	1	5L359	5L359	5L359
* 7	Gasket	1	301GAC715	301GAC715	301GAC715
9	Gear Kit	1	300GAC6008	300GAC6008	300GAC6008
* 10	Screws	4	655ED03P	655ED03P	655ED03P
12	Washer	8	95A3	95A3	95A3
* 14	Ball Bearing	3	12BA144	12BA144	12BA144
* 15	Oil Seal	4	60DD630	60DD630	60DD630
16	Screw	8	75P56	75P56	75P56
17	Foot – Vert. & Horiz.	2	300GAC166	300GAC166	300GAC166
18	Bearing Housing Gear End	1	302GAC006	302GAC006	302GAC006
19	Dowel Pin	4	62M48	62M48	62M48
20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
21	Screw	16	75P55	75P55	75P55
22	Impeller Case	1	900883042201	900883041801	900883042001
23	Rotor Group				
	4" Standard Clearances	1	307GAC4028	306GAC4028	305GAC4028
	4" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
24	Bearing Housing Drive End	1	300GAC006	300GAC006	300GAC006
25	Key-Square	1	900639910304	900639910304	900639910304
26	Pipe Fitting	2	40E9	40E9	40E9
27	Cap	2	40P58	40P58	40P58
29	Drive Cover	1	900883040301	900883040301	900883040301
30	Screw	8	75P189	75P189	75P189
* 31	Oil Seal	1	60DD716	60DD716	60DD716
* 35	Bearing – Roller	1	12BA154	12BA154	12BA154
40	Oil Level Gauge	1	40P34	40P34	40P34
44	Screw	4	76F1	76F1	76F1
** 45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
** 54	Shim Case .0025/.0035"	1	200GAC732	200GAC732	200GAC732
** 55	Shim Case .010"	1	201GAC732	201GAC732	201GAC732
** 56	Shim Case .0015/.002"	1	202GAC732	202GAC732	202GAC732
82	Locking Assembly	2	22G44	22G44	22G44
88	Washer	4	95A3	95A3	95A3
** 105	Overhaul Kit 4" R VERS Lip Seal, Grease Splash Lube	1	300GAC6010	300GAC6010	300GAC6010
** 900	Group-Indent & Instruction Legend Series 4" R VERS	1	201GAC4011	201GAC4011	201GAC4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION.



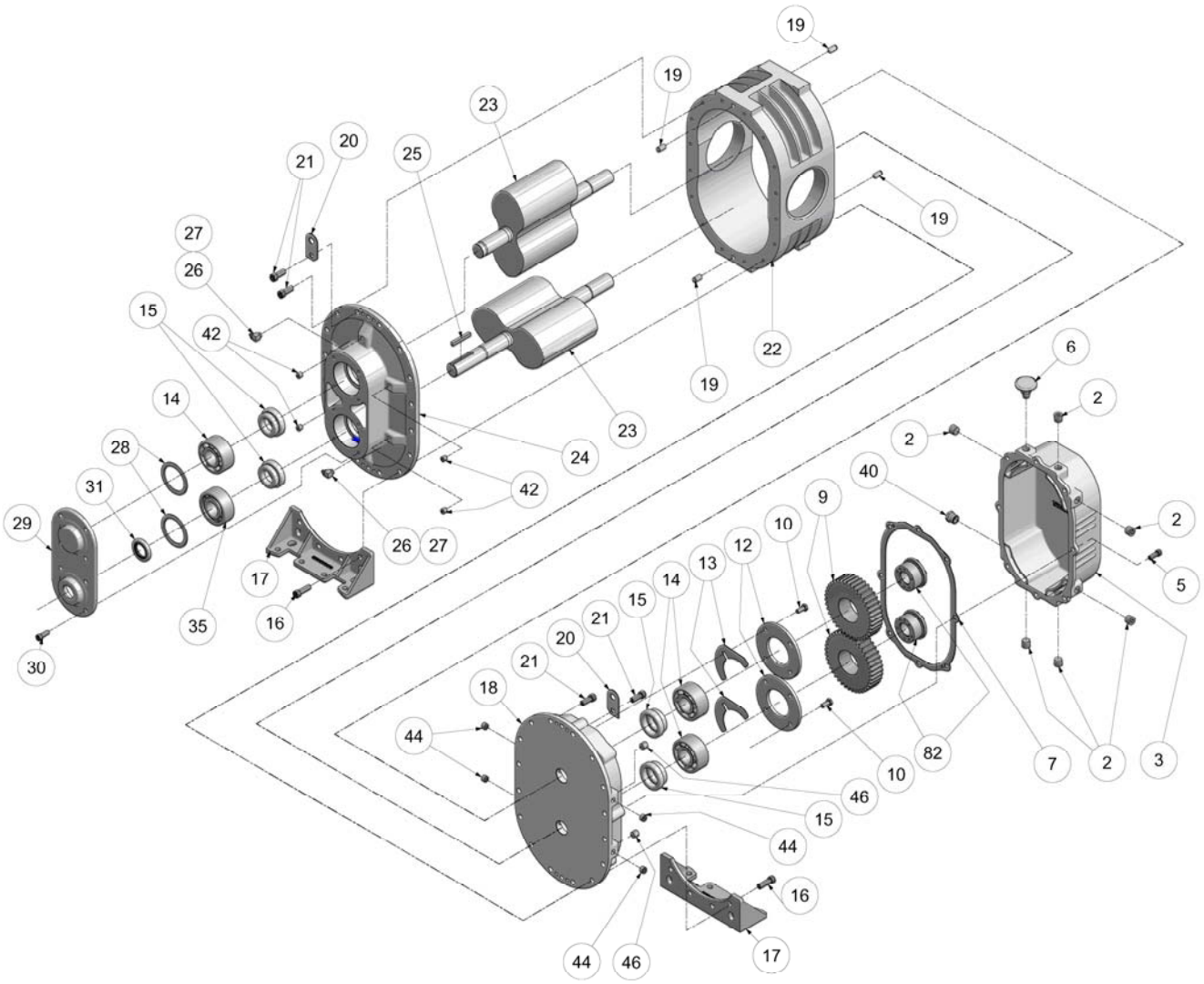
301GAE810-A
(Ref. Drawing)

Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAE Lip Seal Grease Splash Lube

	Ref. No.	Description	No. Req'd	Size – 5H GAEH_R Δ Δ= (A or C)	Size – 5M GAEM_R Δ Δ= (A or C)	Size -- 5L GAEL_R Δ Δ= (A or C)
	2	Plug	6	64AC3	64AC3	64AC3
	3	Gear Case	1	304GAE602	304GAE602	304GAE602
	5	Screw	8	75P40	75P40	75P40
	6	Breather	1	5L359	5L359	5L359
*	7	Gasket	1	300GAE715	300GAE715	300GAE715
	9	Gear Kit	1	300GAE6008	300GAE6008	300GAE6008
*	10	Screws	4	655ED03P	655ED03P	655ED03P
	12	Washer	8	95A3	95A3	95A3
*	14	Ball Bearing	3	8500397	8500397	8500397
*	15	Oil Seal	4	60DD714	60DD714	60DD714
	16	Screw	8	75P56	75P56	75P56
	17	Foot – Vert. & Horiz.	2	300GAE166	300GAE166	300GAE166
	18	Bearing Housing Gear End	1	301GAE006	301GAE006	301GAE006
	19	Dowel Pin	4	62M48	62M48	62M48
	20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
	21	Screw	24	75P55	75P55	75P55
	22	Impeller Case	1	900883051701	900883051801	900883051901
	23	Rotor Group				
		5" Standard Clearances	1	327GAE4028	326GAE4028	325GAE4028
		5" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
	24	Bearing Housing Drive End	1	206GAE006	206GAE006	206GAE006
	25	Key-Square	1	900639910305	900639910305	900639910305
	26	Pipe Fitting	2	40E9	40E9	40E9
	27	Cap	2	40P58	40P58	40P58
	29	Drive Cover	1	900883050401	900883050401	900883050401
	30	Screw	8	75P189	75P189	75P189
*	31	Oil Seal	1	60DD726	60DD726	60DD726
*	35	Bearing – Roller	1	12BA155	12BA155	12BA155
	40	Oil Level Gauge	1	40P34	40P34	40P34
	44	Screw	4	76F92	76F92	76F92
**	45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
**	54	Shim Case .0025/.0035"	1	200GAE732	200GAE732	200GAE732
**	55	Shim Case .010"	1	201GAE732	201GAE732	201GAE732
**	56	Shim Case .0015/.002"	1	202GAE732	202GAE732	202GAE732
	82	Locking Assembly	2	22G43	22G43	22G43
**	105	Overhaul Kit 5" R VERS Lip Seal, Grease Splash Lube	1	300GAE6010	300GAE6010	300GAE6010
**	900	Group-Indent & Instruction Legend Series 5" R VERS	1	205GAE4011	205GAE4011	205GAE4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION.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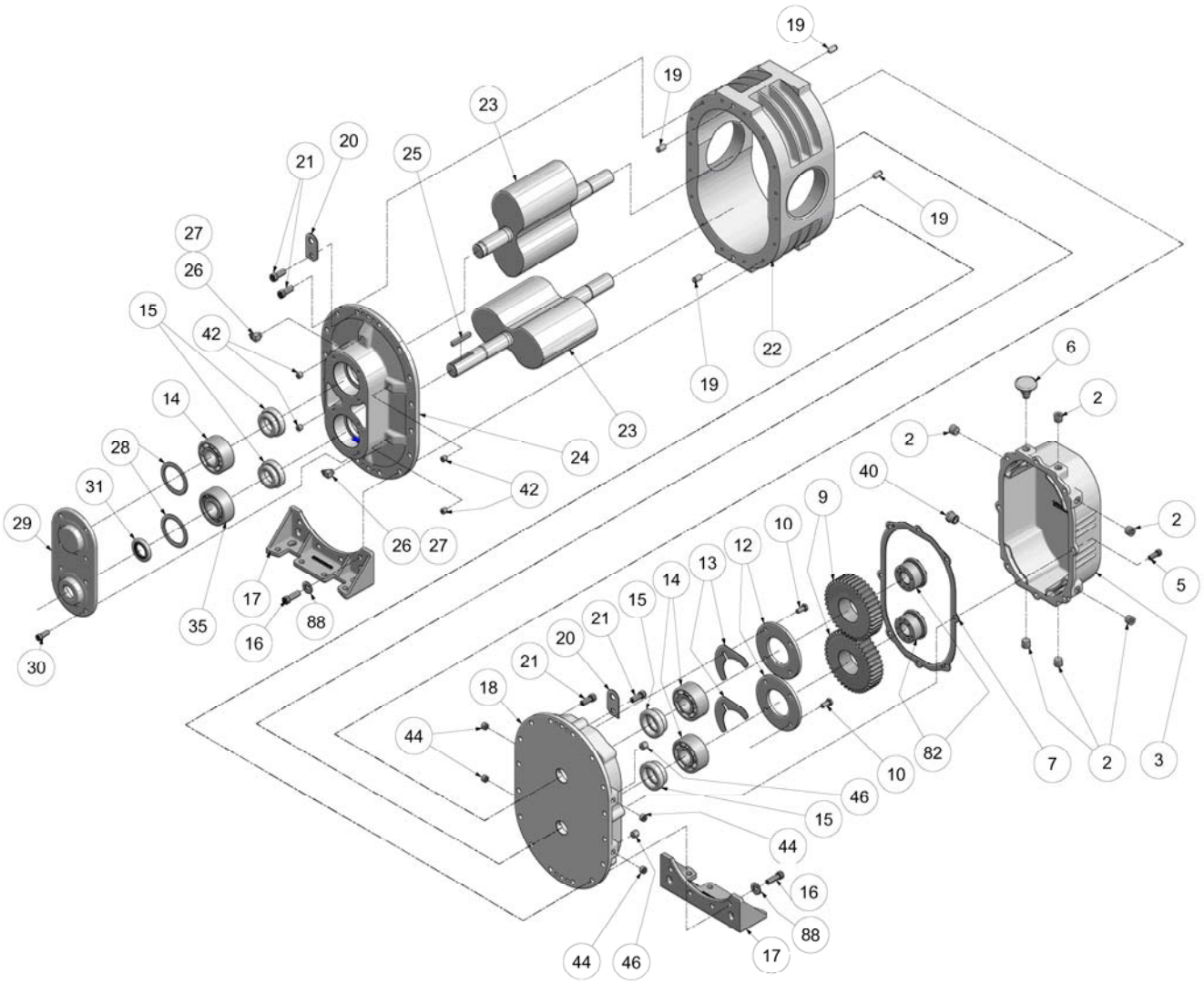
Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAB Mechanical Seal Grease Splash Lube

Ref. No.		Description	No. Req'd	Size – 3H GABH_RB	Size – 3M GABM_RB	Size -- 3L GABL_RB
	2	Plug	6	64AC2	64AC2	64AC2
	3	Gear Case	1	303GAB602	303GAB602	303GAB602
	5	Screw	8	75P7	75P7	75P7
	6	Breather	1	5L358	5L358	5L358
*	7	Gasket	1	300GAB715	300GAB715	300GAB715
	9	Gear Kit	1	300GAB6008	300GAB6008	300GAB6008
*	10	Screws	4	75A33P	75A33P	75A33P
	12	Bearing Retainer	2	300GAB205	300GAB205	300GAB205
*	13	Shim Set	1	900881032200	900881032200	900881032200
*	14	Ball Bearing	3	12BA143	12BA143	12BA143
*	15	Mechanical Seal	4	900871020003	900871020003	900871020003
	16	Screw	4	75P56	75P56	75P56
	17	Foot – Vert. & Horiz.	2	303GAB166	303GAB166	303GAB166
	18	Bearing Housing Gear End	1	304GAB006	304GAB006	304GAB006
	19	Dowel Pin	4	62M48	62M48	62M48
	20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
	21	Screw	20	75P55	75P55	75P55
	22	Impeller Case	1	900873034301	900873033801	900873034201
	23	Rotor Group				
		3" Standard Clearances	1	307GAB4028	309GAB4028	308GAB4028
		3" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
	24	Bearing Housing Drive End	1	900883030301	900883030301	900883030301
	25	Key-Square	1	900639910304	900639910304	900639910304
	26	Pipe Fitting	2	40E9	40E9	40E9
	27	Cap	2	40P58	40P58	40P58
*	28	Wavy Spring	2	900669170203	900669170203	900669170203
	29	Drive Cover	1	900873033701	900873033701	900873033701
	30	Screw	6	75P22	75P22	75P22
*	31	Oil Seal	1	60DD725	60DD725	60DD725
*	35	Bearing – Roller	1	12BA153	12BA153	12BA153
	40	Oil Level Gauge	1	40P82	40P82	40P82
	42	Plug	4	64AC1	64AC1	64AC1
	44	Screw	4	76F1	76F1	76F1
**	45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
	46	Plug	4	64AC1	64AC1	64AC1
**	54	Shim Case .0025/.0035"	1	200GAB732	200GAB732	200GAB732
**	55	Shim Case .010"	1	201GAB732	201GAB732	201GAB732
**	56	Shim Case .0015/.002"	1	202GAB732	202GAB732	202GAB732
	82	Locking Assembly	2	22G45	22G45	22G45
**	105	Overhaul Kit 3" R VERS Mechanical Seal, Grease Splash Lube	1	303GAB6010	303GAB6010	303GAB6010
**	900	Group-Indent & Instruction Legend Series 3" R VERS	1	303GAB4011	303GAB4011	303GAB4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION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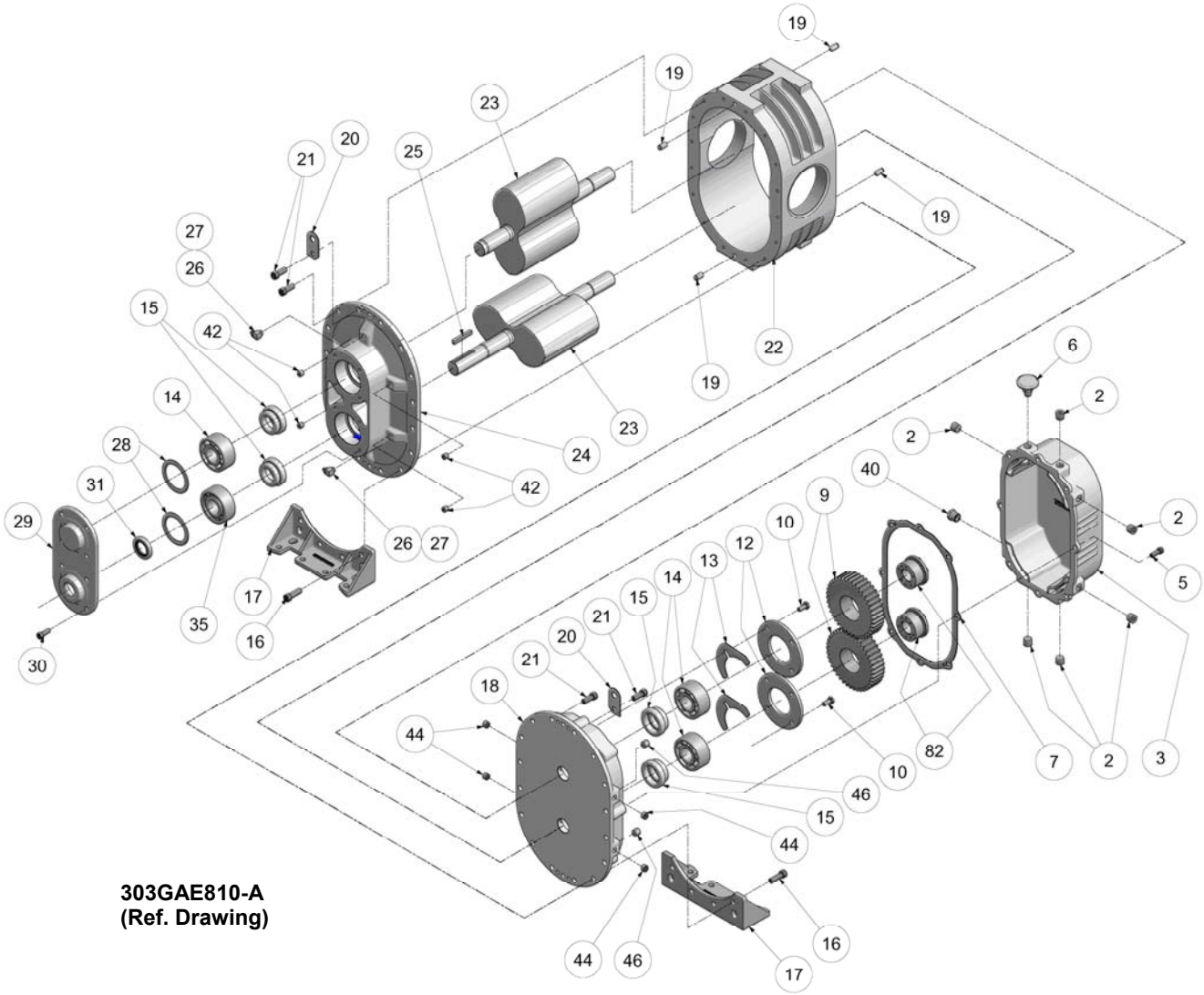
Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAC Mechanical Seal Grease Splash Lube

Ref. No.	Description	No. Req'd	Size – 4H GACH_RB	Size – 4M GACM_RB	Size -- 4L GACL_RB
2	Plug	6	64AC3	64AC3	64AC3
3	Gear Case	1	304GAC602	304GAC602	304GAC602
5	Screw	8	75P40	75P40	75P40
6	Breather	1	5L359	5L359	5L359
* 7	Gasket	1	301GAC715	301GAC715	301GAC715
9	Gear Kit	1	300GAC6008	300GAC6008	300GAC6008
* 10	Screws	8	75A33P	75A33P	75A33P
12	Bearing Retainer	2	900883040201	900883040201	900883040201
* 13	Shim Set	1	900881042900	900881042900	900881042900
* 14	Ball Bearing	3	12BA144	12BA144	12BA144
* 15	Mechanical Seal	4	900871020004	900871020004	900871020004
16	Screw	8	75P56	75P56	75P56
17	Foot – Vert. & Horiz.	2	300GAC166	300GAC166	300GAC166
18	Bearing Housing Gear End	1	304GAC006	304GAC006	304GAC006
19	Dowel Pin	4	62M48	62M48	62M48
20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
21	Screw	16	75P55	75P55	75P55
22	Impeller Case	1	900883042201	900883041801	900883042001
23	Rotor Group				
	4" Standard Clearances	1	307GAC4028	306GAC4028	305GAC4028
	4" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
24	Bearing Housing Drive End	1	900883041201	900883041201	900883041201
25	Key-Square	1	900639910304	900639910304	900639910304
26	Pipe Fitting	2	40E9	40E9	40E9
27	Cap	2	40P58	40P58	40P58
* 28	Wavy Spring	2	900669170304	900669170304	900669170304
29	Drive Cover	1	900883040301	900883040301	900883040301
30	Screw	8	75P189	75P189	75P189
* 31	Oil Seal	1	60DD716	60DD716	60DD716
* 35	Bearing – Roller	1	12BA154	12BA154	12BA154
40	Oil Level Gauge	1	40P34	40P34	40P34
42	Plug	4	64AC1	64AC1	64AC1
44	Screw	4	76F1	76F1	76F1
** 45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
46	Plug	4	64AC1	64AC1	64AC1
** 54	Shim Case .0025/.0035"	1	200GAC732	200GAC732	200GAC732
** 55	Shim Case .010"	1	201GAC732	201GAC732	201GAC732
** 56	Shim Case .0015/.002"	1	202GAC732	202GAC732	202GAC732
82	Locking Assembly	2	22G44	22G44	22G44
88	Washer	4	95A3	95A3	95A3
** 105	Overhaul Kit 4" R VERS Mechanical Seal, Grease Splash Lube	1	302GAC6010	302GAC6010	302GAC6010
** 900	Group-Indent & Instruction Legend Series 4" R VERS	1	201GAC4011	201GAC4011	201GAC4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION



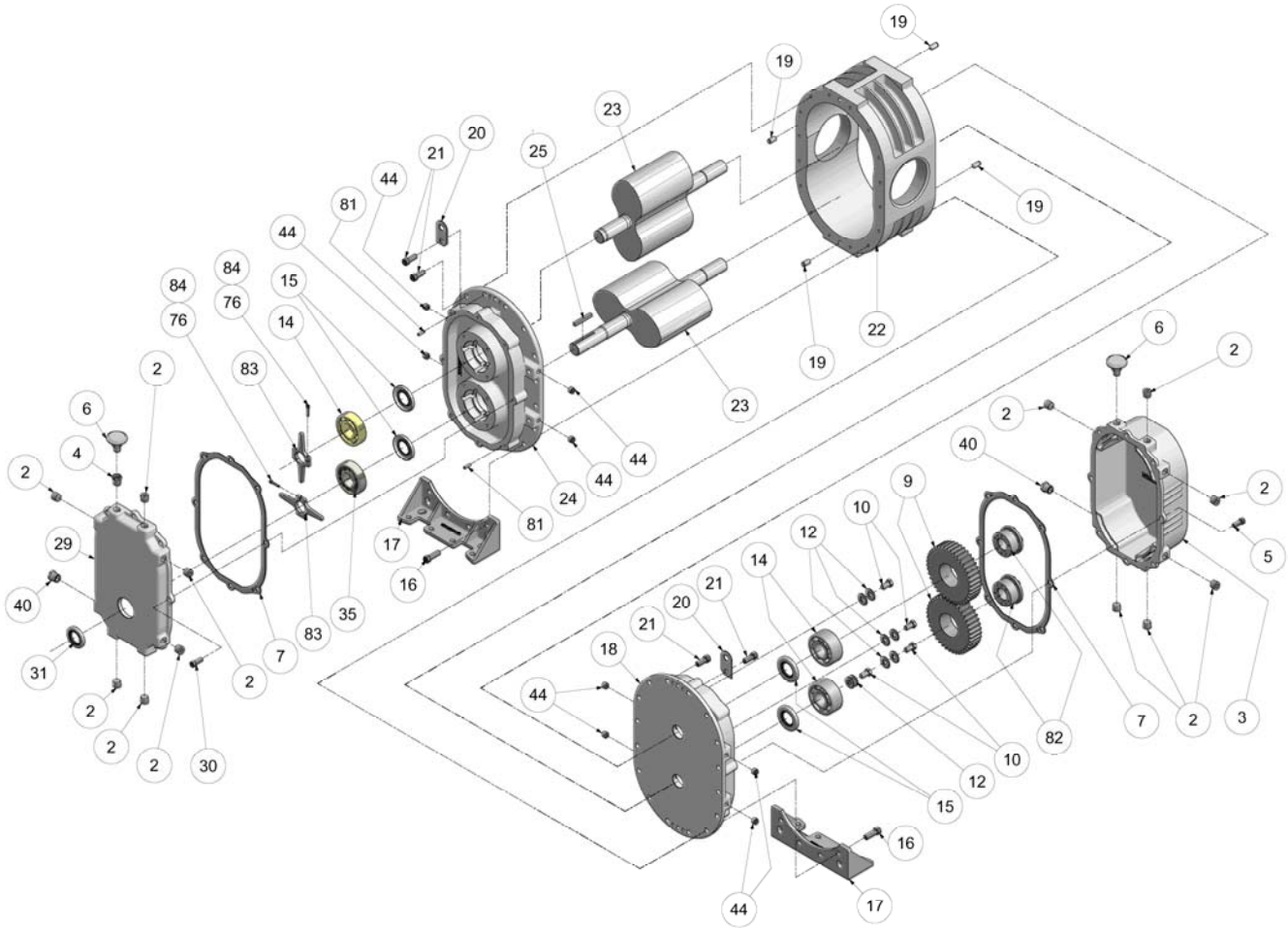
303GAE810-A
(Ref. Drawing)

Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAE Mechanical Seal Grease Splash Lube

Ref. No.		Description	No. Req'd	Size – 5H GAEH_RB	Size – 5M GAEM_RB	Size -- 5L GAEL_RB
	2	Plug	6	64AC3	64AC3	64AC3
	3	Gear Case	1	304GAE602	304GAE602	304GAE602
	5	Screw	8	75P40	75P40	75P40
	6	Breather	1	5L359	5L359	5L359
*	7	Gasket	1	300GAE715	300GAE715	300GAE715
	9	Gear Kit	1	300GAE6008	300GAE6008	300GAE6008
*	10	Screws	8	75A33P	75A33P	75A33P
	12	Bearing Retainer	2	900883050501	900883050501	900883050501
*	13	Shim Set	1	900881052900	900881052900	900881052900
*	14	Ball Bearing	3	8500397	8500397	8500397
*	15	Mechanical Seal	4	900871020005	900871020005	900871020005
	16	Screw	8	75P56	75P56	75P56
	17	Foot – Vert. & Horiz.	2	300GAE166	300GAE166	300GAE166
	18	Bearing Housing Gear End	1	303GAE006	303GAE006	303GAE006
	19	Dowel Pin	4	62M48	62M48	62M48
	20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
	21	Screw	24	75P55	75P55	75P55
	22	Impeller Case	1	900883051701	900883051801	900883051901
	23	Rotor Group				
		5" Standard Clearances	1	327GAE4028	326GAE4028	325GAE4028
		5" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
	24	Bearing Housing Drive End	1	207GAE006	207GAE006	207GAE006
	25	Key-Square	1	900639910305	900639910305	900639910305
	26	Pipe Fitting	2	40E9	40E9	40E9
	27	Cap	2	40P58	40P58	40P58
*	28	Wavy Spring	2	900669170405	900669170405	900669170405
	29	Drive Cover	1	900883050401	900883050401	900883050401
	30	Screw	8	75P189	75P189	75P189
*	31	Oil Seal	1	60DD726	60DD726	60DD726
*	35	Bearing – Roller	1	12BA155	12BA155	12BA155
	40	Oil Level Gauge	1	40P34	40P34	40P34
	42	Plug	4	64AC1	64AC1	64AC1
	44	Screw	4	76F92	76F92	76F92
**	45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
	46	Plug	4	64AC2	64AC2	64AC2
**	54	Shim Case .0025/.0035"	1	200GAE732	200GAE732	200GAE732
**	55	Shim Case .010"	1	201GAE732	201GAE732	201GAE732
**	56	Shim Case .0015/.002"	1	202GAE732	202GAE732	202GAE732
	82	Locking Assembly	2	22G43	22G43	22G43
**	105	Overhaul Kit 5" R VERS Mechanical Seal, Grease Splash	1	302GAE6010	302GAE6010	302GAE6010
**	900	Group-Indent & Instruction Legend Series 5" R VERS	1	205GAE4011	205GAE4011	205GAE4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION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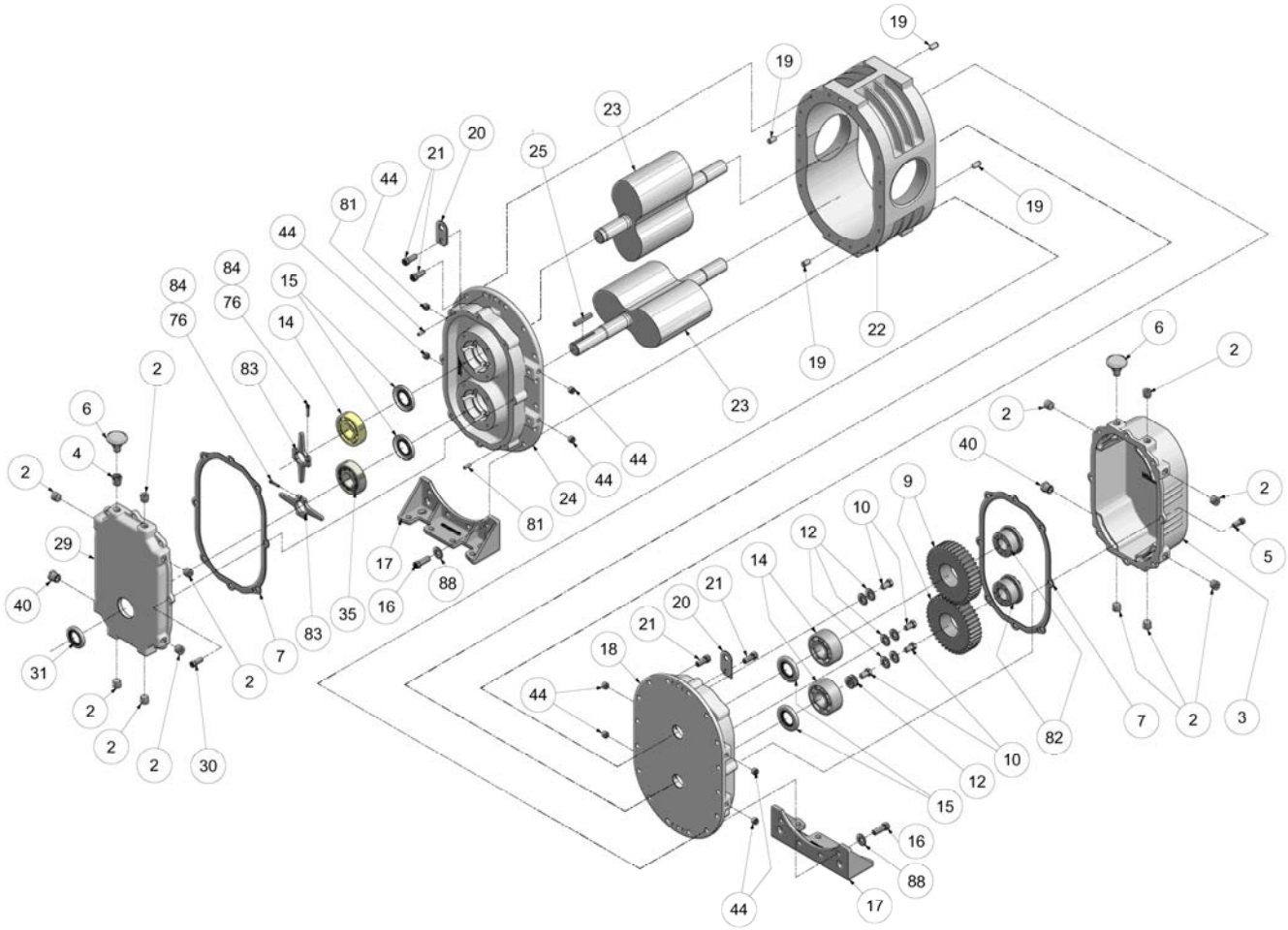
Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAB Lip Seal — Dual Splash Lube

	Ref. No.	Description	No. Req'd	Size – 3H GABH_R △ △= (D or F)	Size – 3M GABM_R △ △= (D or F)	Size -- 3L GABL_R △ △= (D or F)
	2	Plug	12	64AC2	64AC2	64AC2
	3	Gear Case	1	303GAB602	303GAB602	303GAB602
	5	Screw	8	75P7	75P7	75P7
	6	Breather	2	5L358	5L358	5L358
*	7	Gasket	2	300GAB715	300GAB715	300GAB715
	9	Gear Kit	1	300GAB6008	300GAB6008	300GAB6008
*	10	Screws	4	75A33P	75A33P	75A33P
	12	Washer	8	95A2	95A2	95A2
*	14	Ball Bearing	3	12BA143	12BA143	12BA143
*	15	Oil Seal	4	900891030601	900891030601	900891030601
	16	Screw	4	75P56	75P56	75P56
	17	Foot – Vert. & Horiz.	2	303GAB166	303GAB166	303GAB166
	18	Bearing Housing Gear End	1	302GAB006	302GAB006	302GAB006
	19	Dowel Pin	4	62M48	62M48	62M48
	20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
	21	Screw	20	75P55	75P55	75P55
	22	Impeller Case	1	900873034301	900873033801	900873034201
	23	Rotor Group				
		3" Standard Clearances	1	307GAB4028	309GAB4028	308GAB4028
		3" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
	24	Bearing Housing Drive End	1	303GAB006	303GAB006	303GAB006
	25	Key-Square	1	900639910304	900639910304	900639910304
	29	Drive Cover	1	302GAB477	302GAB477	302GAB477
	30	Screw	8	75P7	75P7	75P7
*	31	Oil Seal	1	60DD725	60DD725	60DD725
*	35	Bearing – Spherical	1	12BA153	12BA153	12BA153
	40	Oil Level Gauge	2	40P82	40P82	40P82
	44	Screw	8	76F1	76F1	76F1
**	45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
**	54	Shim Case .0025/.0035"	1	200GAB732	200GAB732	200GAB732
**	55	Shim Case .0010"	1	201GAB732	201GAB732	201GAB732
**	56	Shim Case .0015/.002"	1	202GAB732	202GAB732	202GAB732
	76	Compound, Loctite	50	25BC877	25BC877	25BC877
	81	Dowel Pin	2	62M13	62M13	62M13
	82	Locking Assembly	2	22G45	22G45	22G45
	83	Slinger	2	300GAB173	300GAB173	300GAB173
	84	Screw	2	75LM13	75LM13	75LM13
**	105	Overhaul Kit 3" R VERS Lip Seal, Dual Splash Lube	1	301GAB6010	301GAB6010	301GAB6010
**	900	Group-Indent & Instruction Legend Series 3" R VERS	1	303GAB4011	303GAB4011	303GAB4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION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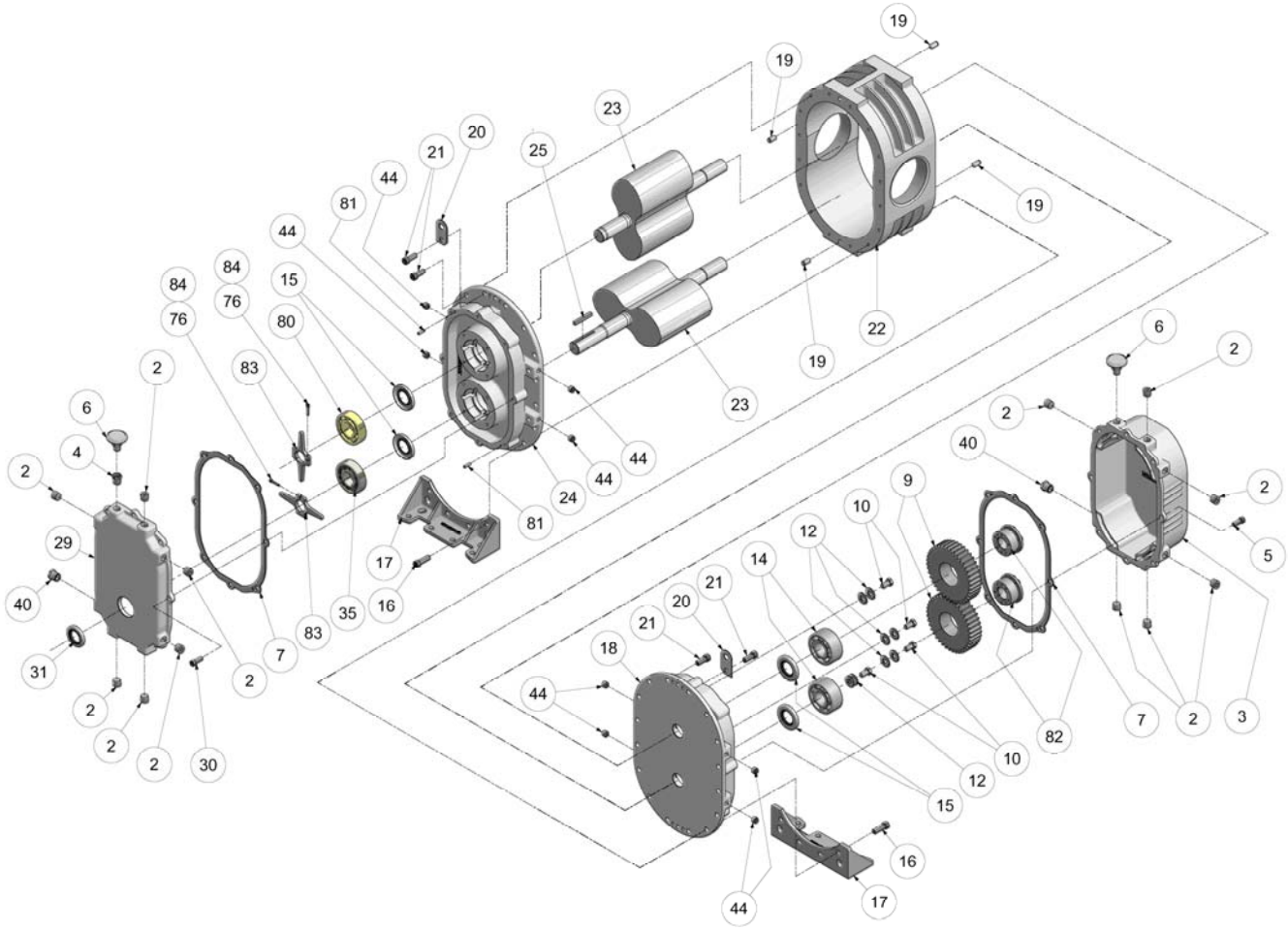
Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAC Lip Seal Dual Splash Lube

	Ref. No.	Description	No. Req'd	Size – 4H GACH_R Δ Δ= (D or F)	Size – 4M GACM_R Δ Δ= (D or F)	Size -- 4L GACL_R Δ Δ= (D or F)
	2	Plug	12	64AC3	64AC3	64AC3
	3	Gear Case	1	304GAC602	304GAC602	304GAC602
	5	Screw	8	75P40	75P40	75P40
	6	Breather	2	5L359	5L359	5L359
*	7	Gasket	2	301GAC715	301GAC715	301GAC715
	9	Gear Kit	1	300GAC6008	300GAC6008	300GAC6008
*	10	Screws	4	655ED03P	655ED03P	655ED03P
	12	Washer	8	95A3	95A3	95A3
*	14	Ball Bearing	3	12BA144	12BA144	12BA144
*	15	Oil Seal	4	60DD630	60DD630	60DD630
	16	Screw	8	75P56	75P56	75P56
	17	Foot – Vert. & Horiz.	2	300GAC166	300GAC166	300GAC166
	18	Bearing Housing Gear End	1	302GAC006	302GAC006	302GAC006
	19	Dowel Pin	4	62M48	62M48	62M48
	20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
	21	Screw	16	75P55	75P55	75P55
	22	Impeller Case	1	900883042201	900883041801	900883042001
	23	Rotor Group				
		4" Standard Clearances	1	307GAC4028	306GAC4028	305GAC4028
		4" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
	24	Bearing Housing Drive End	1	303GAC006	303GAC006	303GAC006
	25	Key-Square	1	900639910304	900639910304	900639910304
	29	Drive Cover	1	302GAC477	302GAC477	302GAC477
	30	Screw	8	75P40	75P40	75P40
*	31	Oil Seal	1	60DD716	60DD716	60DD716
*	35	Bearing – Spherical	1	12BA255	12BA255	12BA255
	40	Oil Level Gauge	2	40P34	40P34	40P34
	44	Screw	8	76F1	76F1	76F1
**	45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
**	54	Shim Case .0025/.0035"	1	200GAC732	200GAC732	200GAC732
**	56	Shim Case .0015/.002"	1	202GAC732	202GAC732	202GAC732
	76	Compound, Loctite	50	25BC877	25BC877	25BC877
	81	Dowel Pin	2	62M13	62M13	62M13
	82	Locking Assembly	2	22G44	22G44	22G44
	83	Slinger	2	300GAC173	300GAC173	300GAC173
	84	Screw	2	75LM14	75LM14	75LM14
	88	Washer	4	95A3	95A3	95A3
**	105	Overhaul Kit 4" R VERS Lip Seal, Dual Splash Lube	1	301GAC6010	301GAC6010	301GAC6010
**	900	Group-Indent & Instruction Legend Series 4" R VERS	1	201GAC4011	201GAC4011	201GAC4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION



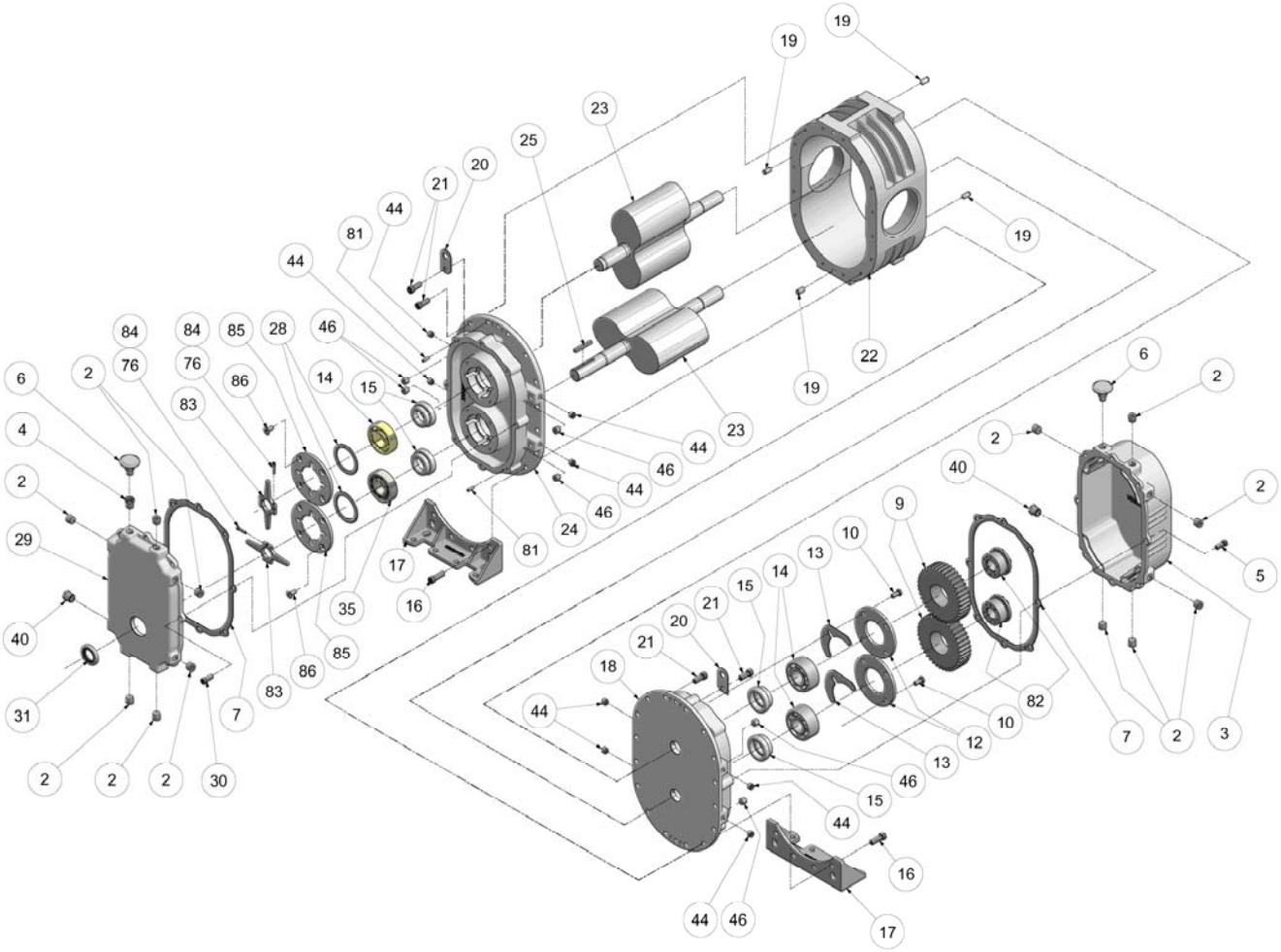
300GAE810-A
(Ref. Drawing)

Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAE Lip Seal — Dual Splash Lube

Ref. No.	Description	No. Req'd	Size – 5H GAEH_R △ △= (D or F)	Size – 5M GAEM_R △ △= (D or F)	Size -- 5L GAEL_R △ △= (D or F)
2	Plug	12	64AC3	64AC3	64AC3
3	Gear Case	1	304GAE602	304GAE602	304GAE602
5	Screw	8	75P40	75P40	75P40
6	Breather	2	5L359	5L359	5L359
* 7	Gasket	2	300GAE715	300GAE715	300GAE715
9	Gear Kit	1	300GAE6008	300GAE6008	300GAE6008
* 10	Screws	4	655ED03P	655ED03P	655ED03P
12	Washer	8	95A3	95A3	95A3
* 14	Ball Bearing	2	8500397	8500397	8500397
* 15	Oil Seal	4	60DD714	60DD714	60DD714
16	Screw	8	75P56	75P56	75P56
17	Foot – Vert. & Horiz.	2	300GAE166	300GAE166	300GAE166
18	Bearing Housing Gear End	1	301GAE006	301GAE006	301GAE006
19	Dowel Pin	4	62M48	62M48	62M48
20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
21	Screw	24	75P55	75P55	75P55
22	Impeller Case	1	900883051701	900883051801	900883051901
23	Rotor Group				
	5" Standard Clearances	1	327GAE4028	326GAE4028	325GAE4028
	5" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
25	Key-Square	1	900639910305	900639910305	900639910305
29	Drive Cover	1	300GAE477	300GAE477	300GAE477
30	Screw	8	75P40	75P40	75P40
* 31	Oil Seal	1	60DD726	60DD726	60DD726
* 35	Bearing – Spherical	1	12BA253	12BA253	12BA253
40	Oil Level Gauge	2	40P34	40P34	40P34
44	Screw	8	76F92	76F92	76F92
** 45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
** 54	Shim Case .0025/.0035"	1	200GAE732	200GAE732	200GAE732
** 55	Shim Case .010"	1	201GAE732	201GAE732	201GAE732
** 56	Shim Case .0015/.002"	1	202GAE732	202GAE732	202GAE732
76	Compound, Loctite	5	25BC877	25BC877	25BC877
* 80	Bearing – Conrad	1	12BA254	12BA254	12BA254
81	Dowel Pin	2	62M13	62M13	62M13
82	Locking Assembly	2	22G43	22G43	22G43
83	Slinger	2	300GAE173	300GAE173	300GAE173
84	Screw	2	75LM14	75LM14	75LM14
** 105	Overhaul Kit 5" R VERS Lip Seal, Dual Splash Lube	1	301GAE6010	301GAE6010	301GAE6010
** 900	Group-Indent & Instruction Legend Series 5" R VERS	1	205GAE4011	205GAE4011	205GAE4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION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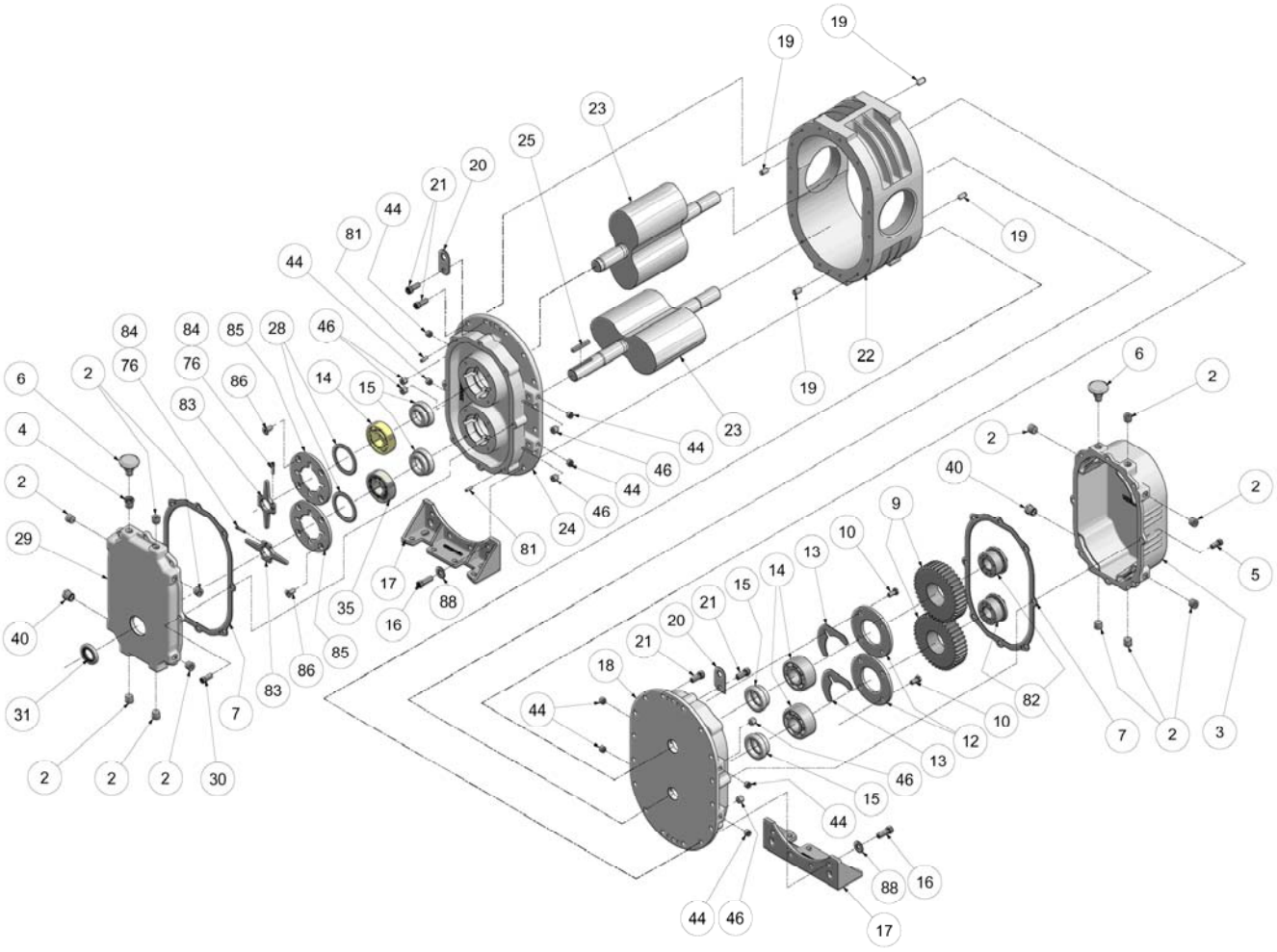
Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAB Mechanical Seal Dual Splash Lube

Ref. No.	Description	No. Req'd	Size – 3H GABH_R △ △= (E or G)	Size – 3M GABM_R △ △= (E or G)	Size -- 3L GABL_R △ △= (E or G)
2	Plug	12	64AC2	64AC2	64AC2
3	Gear Case	1	303GAB602	303GAB602	303GAB602
5	Screw	8	75P7	75P7	75P7
6	Breather	2	5L358	5L358	5L358
* 7	Gasket	2	300GAB715	300GAB715	300GAB715
9	Gear Kit	1	300GAB6008	300GAB6008	300GAB6008
* 10	Screws	4	75A33P	75A33P	75A33P
12	Bearing Retainer	2	300GAB205	300GAB205	300GAB205
* 13	Shim Set	1	900881032200	900881032200	900881032200
* 14	Ball Bearing	3	12BA143	12BA143	12BA143
* 15	Mechanical Seal	4	900871020003	900871020003	900871020003
16	Screw	4	75P56	75P56	75P56
17	Foot – Vert. & Horiz.	2	303GAB166	303GAB166	303GAB166
18	Bearing Housing Gear End	1	304GAB006	304GAB006	304GAB006
19	Dowel Pin	4	62M48	62M48	62M48
20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
21	Screw	20	75P55	75P55	75P55
22	Impeller Case	1	900873034301	900873033801	900873034201
23	Rotor Group				
	3" Standard Clearances	1	307GAB4028	309GAB4028	308GAB4028
	3" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
24	Bearing Housing Drive End	1	305GAB006	305GAB006	305GAB006
25	Key-Square	1	900639910304	900639910304	900639910304
* 28	Wavy Spring	2	900669170203	900669170203	900669170203
29	Drive Cover	1	302GAB477	302GAB477	302GAB477
30	Screw	6	75P7	75P7	75P7
* 31	Oil Seal	1	60DD725	60DD725	60DD725
* 35	Bearing – Spherical	1	12BA153	12BA153	12BA153
40	Oil Level Gauge	2	40P82	40P82	40P82
44	Screw	8	76F1	76F1	76F1
** 45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
46	Plug	8	64AC1	64AC1	64AC1
** 54	Shim Case .0025/.0035"	1	200GAB732	200GAB732	200GAB732
** 55	Shim Case .010"	1	201GAB732	201GAB732	201GAB732
** 56	Shim Case .0015/.002"	1	202GAB732	202GAB732	202GAB732
76	Compound, Loctite	50	25BC877	25BC877	25BC877
81	Dowel Pin	2	62M13	62M13	62M13
82	Locking Assembly	2	22G45	22G45	22G45
83	Slinger	2	300GAB173	300GAB173	300GAB173
84	Screw	2	75LM13	75LM13	75LM13
85	Bearing Retainer	2	300GAB205	300GAB205	300GAB205
86	Screw	8	75LM214	75LM214	75LM214
** 105	Overhaul Kit 3" R VERS Mechanical Seal Dual, Splash	1	304GAB6010	304GAB6010	304GAB6010
** 900	Group-Indent & Instruction Legend Series 3" R VERS	1	303GAB4011	303GAB4011	303GAB4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION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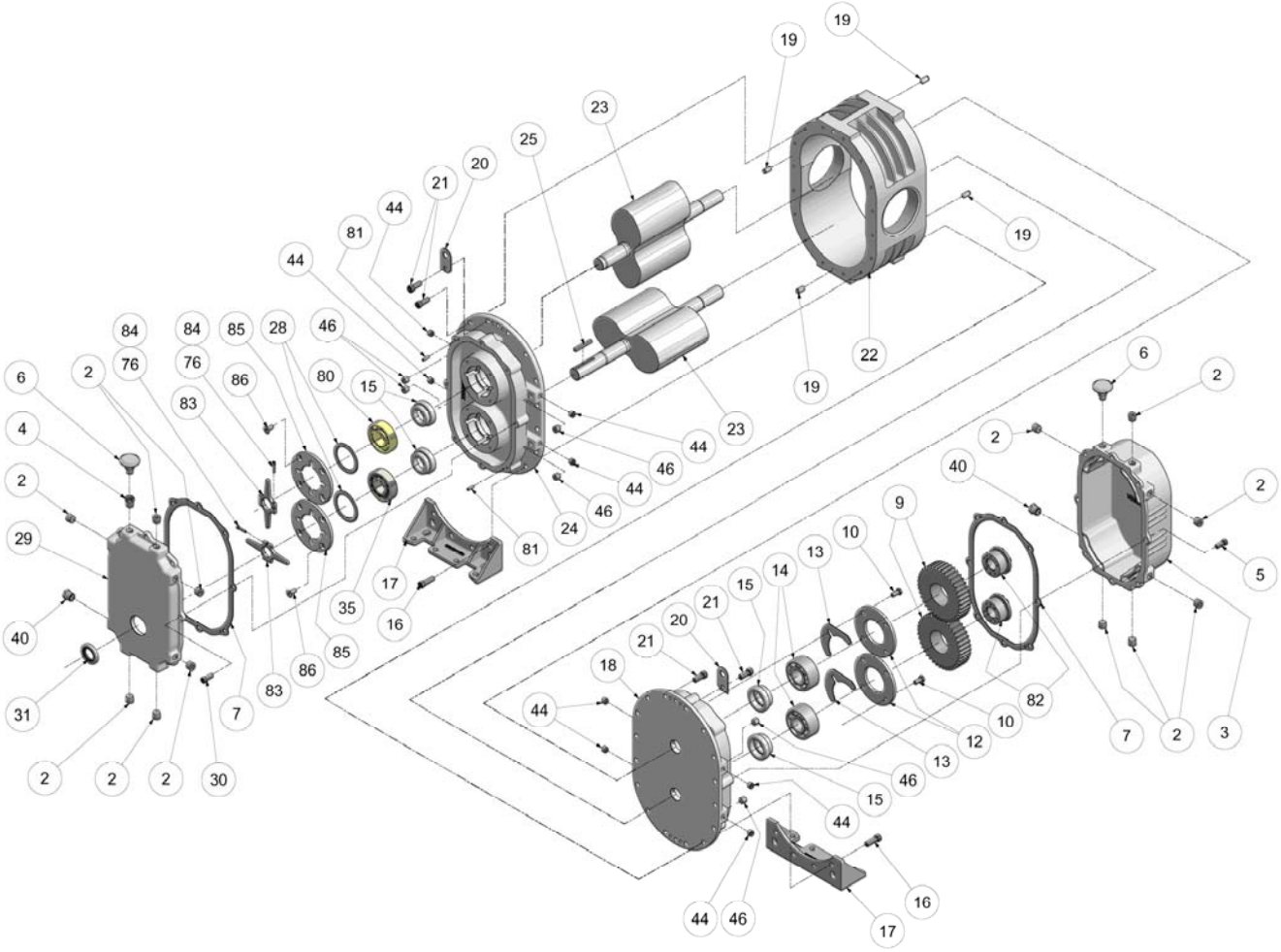
Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAC Mechanical Seal Dual Splash Lube

Ref. No.	Description	No. Req'd	Size – 4H GACH_R △ △= (E or G)	Size – 4M GACM_R △ △= (E or G)	Size -- 4L GACL_R △ △= (E or G)
2	Plug	12	64AC3	64AC3	64AC3
3	Gear Case	1	304GAC602	304GAC602	304GAC602
5	Screw	8	75P40	75P40	75P40
6	Breather	2	5L359	5L359	5L359
* 7	Gasket	2	301GAC715	301GAC715	301GAC715
9	Gear Kit	1	300GAC6008	300GAC6008	300GAC6008
* 10	Screws	8	75A33P	75A33P	75A33P
12	Bearing Retainer	2	900883040201	900883040201	900883040201
* 13	Shim Set	1	900881052900	900881052900	900881052900
* 14	Ball Bearing	3	12BA144	12BA144	12BA144
* 15	Mechanical Seal	4	900871020004	900871020004	900871020004
16	Screw	8	75P56	75P56	75P56
17	Foot – Vert. & Horiz.	2	300GAC166	300GAC166	300GAC166
18	Bearing Housing Gear End	1	304GAC006	304GAC006	304GAC006
19	Dowel Pin	4	62M48	62M48	62M48
20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
21	Screw	16	75P55	75P55	75P55
22	Impeller Case	1	900883042201	900883041801	900883042001
23	Rotor Group				
	4" Standard Clearances	1	307GAC4028	306GAC4028	305GAC4028
	4" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
24	Bearing Housing Drive End	1	305GAC006	305GAC006	305GAC006
25	Key-Square	1	900639910304	900639910304	900639910304
* 28	Wavy Spring	2	900669170304	900669170304	900669170304
29	Drive Cover	1	302GAC477	302GAC477	302GAC477
30	Screw	8	75P40	75P40	75P40
* 31	Oil Seal	1	60DD716	60DD716	60DD716
* 35	Bearing – Spherical	1	12BA255	12BA255	12BA255
40	Oil Level Gauge	2	40P34	40P34	40P34
44	Screw	8	76F1	76F1	76F1
** 45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
46	Plug	8	64AC1	64AC1	64AC1
** 54	Shim Case .0025/.0035"	1	200GAC732	200GAC732	200GAC732
** 56	Shim Case .0015/.002"	1	202GAC732	202GAC732	202GAC732
76	Compound, Loctite	50	25BC877	25BC877	25BC877
81	Dowel Pin	2	62M13	62M13	62M13
82	Locking Assembly	2	22G44	22G44	22G44
83	Slinger	2	300GAC173	300GAC173	300GAC173
84	Screw	2	75LM14	75LM14	75LM14
85	Bearing Retainer	2	300GAC205	300GAC205	300GAC205
86	Screw	8	75LM214	75LM214	75LM214
88	Washer	4	95A3	95A3	95A3
** 105	Overhaul Kit 4" R VERS Mechanical Seal, Dual Splash	1	303GAC6010	303GAC6010	303GAC6010
** 900	Group-Indent & Instruction Legend Series 4" R VERS	1	201GAC4011	201GAC4011	201GAC4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION



302GAA810-A
(Ref. Drawing)

Order by Part Number and Description. Reference Numbers are for your convenience only.

Model GAE Mechanical Seal Dual Splash Lube

	Ref. No.	Description	No. Req'd	Size – 5H GAEH_R Δ Δ= (E or G)	Size – 5M GAEM_R Δ Δ= (E or G)	Size -- 5L GAEL_R Δ Δ= (E or G)
	2	Plug	12	64AC3	64AC3	64AC3
	3	Gear Case	1	304GAE602	304GAE602	304GAE602
	5	Screw	8	75P40	75P40	75P40
	6	Breather	2	5L359	5L359	5L359
*	7	Gasket	2	300GAE715	300GAE715	300GAE715
	9	Gear Kit	1	300GAE6008	300GAE6008	300GAE6008
*	10	Screws	8	75A33P	75A33P	75A33P
	12	Bearing Retainer	2	900883050501	900883050501	900883050501
*	13	Shim Set	1	900881052900	900881052900	900881052900
*	14	Ball Bearing	2	8500397	8500397	8500397
*	15	Mechanical Seal	4	900871020005	900871020005	900871020005
	16	Screw	8	75P56	75P56	75P56
	17	Foot – Vert. & Horiz.	2	300GAE166	300GAE166	300GAE166
	18	Bearing Housing Gear End	1	303GAE006	303GAE006	303GAE006
	19	Dowel Pin	4	62M48	62M48	62M48
	20	Lifting Lug	2	200GAA451	200GAA451	200GAA451
	21	Screw	24	75P55	75P55	75P55
	22	Impeller Case	1	900883051701	900883051801	900883051901
	23	Rotor Group				
		5" Standard Clearances	1	327GAE4028	326GAE4028	325GAE4028
		5" High Temperature Clearances	1	To be assigned	To be assigned	To be assigned
	24	Bearing Housing Drive End	1	304GAE006	304GAE006	304GAE006
	25	Key-Square	1	900639910305	900639910305	900639910305
*	28	Wavy Spring	2	900669170405	900669170405	900669170405
	29	Drive Cover	1	300GAE477	300GAE477	300GAE477
	30	Screw	8	75P40	75P40	75P40
*	31	Oil Seal	1	60DD726	60DD726	60DD726
*	35	Bearing – Spherical	1	12BA253	12BA253	12BA253
	40	Oil Level Gauge	2	40P34	40P34	40P34
	44	Screw	8	76F92	76F92	76F92
**	45	Paint, Bulk, GDP188, Aluminum	0.125	28H284	28H284	28H284
	46	Plug	8	64AC2	64AC2	64AC2
**	54	Shim Case .0025/.0035"	1	200GAE732	200GAE732	200GAE732
**	55	Shim Case .010"	1	201GAE732	201GAE732	201GAE732
**	56	Shim Case .0015/.002"	1	202GAE732	202GAE732	202GAE732
	76	Compound, Loctite	5	25BC877	25BC877	25BC877
*	80	Bearing – Conrad	1	12BA254	12BA254	12BA254
	81	Dowel Pin	2	62M13	62M13	62M13
	82	Locking Assembly	2	22G43	22G43	22G43
	83	Slinger	2	300GAE173	300GAE173	300GAE173
	84	Screw	2	75LM14	75LM14	75LM14
	85	Bearing Retainer	2	300GAE205	300GAE205	300GAE205
	86	Screw	8	75LM214	75LM214	75LM214
**	105	Overhaul Kit 5" R VERS Mechanical Seal, Dual	1	303GAE6010	303GAE6010	303GAE6010
**	900	Group-Indent & Instruction Legend Series 5" R	1	205GAE4011	205GAE4011	205GAE4011

* INCLUDED IN OVERHAUL KIT.
** NOT SHOWN ON ILLUSTRATION

Gardner Denver

WARRANTY
SUTORBILT BLOWERS
Legend SERIES

GENERAL PROVISIONS AND LIMITATIONS

Gardner Denver (the "Company") warrants to each original retail purchaser ("Purchaser") of its products from the Company or its authorized distributor that such products are, at the time of delivery to the Purchaser, made with good material and workmanship. No warranty is made with respect to:

1. Any product which has been repaired or altered in such a way, in the Company's judgment, as to affect the product adversely.
2. Any product which has, in the Company's judgment, been subject to negligence, accident, improper storage, or improper installation or application.
3. Any product which has not been operated or maintained in accordance with the recommendations of the Company.
4. Components or accessories manufactured, warranted and serviced by others.
5. Any reconditioned or prior owned product.

Claims for items described in (4) above should be submitted directly to the manufacturer.

WARRANTY PERIOD

The Company's obligation under this warranty is limited to repairing or, at its option, replacing, during normal business hours at an authorized service facility of the Company, any part which in its judgment proved not to be as warranted within the applicable Warranty Period as follows.

BARE BLOWERS

Basic grease lubricated bare blowers, consisting of all parts within, are warranted for 18 months from date of initial use or 24 months from date of shipment to the first purchaser, whichever occurs first. Basic dual splash lubricated bare blowers, consisting of all parts within, are warranted for 24 months from date of initial use or 30 months from date of shipment to the first purchaser, whichever occurs first. Any disassembly or partial disassembly of the blower, or failure to return the "unopened" blower per Company instructions, will be cause for denial of warranty.

OTHER COMPONENTS

All other components are warranted for 12 months from date of initial use or 18 months from date of shipment to first purchaser, whichever comes first. The Company reserves the right to withdraw the Warranty where evidence indicates application outside the stated performance area, or where there is evidence of abuse

LABOR TRANSPORTATION AND INSPECTION

The Company will provide labor, by Company representative or authorized service personnel, for repair or replacement of any product or part thereof which in the Company's judgment is proved not to be as warranted. Labor shall be limited to the amount specified in the Company's labor rate schedule.

Labor costs in excess of the Company rate schedules caused by, but not limited to, location or inaccessibility of equipment, or labor provided by unauthorized service personnel is not provided by this warranty.

All costs of transportation of product, labor or parts claimed not to be as warranted and, of repaired or replacement parts to or from such service facilities shall be borne by the Purchaser. The Company may require the return of any part claimed not to be as warranted to one of its facilities as designated by the Company, transportation prepaid by Purchaser, to establish a claim under this warranty. Replacement parts provided under the terms of the warranty are warranted for the remainder of the Warranty Period of the product upon which installed to the same extent as if such parts were original components.

DISCLAIMER

THE FOREGOING WARRANTY IS EXCLUSIVE AND IT IS EXPRESSLY AGREED THAT, EXCEPT AS TO TITLE, THE COMPANY MAKES NO OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY.

THE REMEDY PROVIDED UNDER THIS WARRANTY SHALL BE THE SOLE, EXCLUSIVE AND ONLY REMEDY AVAILABLE TO THE PURCHASER AND IN NO CASE SHALL THE COMPANY BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES. UNDER NO CIRCUMSTANCES SHALL THE COMPANY BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, LOSSES OR DELAYS HOWSOEVER CAUSED.

No statement, representation, agreement, or understanding, oral or written, made by any agent, distributor, representative, or employee of the Company which is not contained in this Warranty will be binding upon the Company unless made in writing and executed by an officer of the Company.

This warranty shall not be effective as to any claim which is not presented within 30 days after the date upon which the product is claimed not to have been as warranted. Any action for breach of this warranty must be commenced within one year after the date upon which the cause of action occurred.

Any adjustment made pursuant to this warranty shall not be construed as an admission by the Company that any product was not as warranted.

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www.contactgd.com/mobile

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ENERGY STAR PARTNER

CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2008 ANAB DNV

NATIONAL TRUCK EQUIPMENT ASSOCIATION Member

NTTC NATIONAL TANK TRUCK CARRIERS

Please recycle after use.

COMPRESSOR
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AEON PD XD OIL

AEON® Synthetic Lubricants

AEON® PD, AEON® PD-FG, AEON® PD-XD

GARDNER DENVER®

Experience Proven Results

AEON®
Synthetic Lubricants

AEON PD-XD is now available!

– AEON PD-XD has the highest viscosity offered by Gardner Denver for Extreme Duty applications

– Designed specifically for high ambient and high discharge temperature conditions

More Economical than Mineral Oil

- Longer service life
- Fewer oil changes and less replacement oil
- Less down time = higher productivity
- Reduced maintenance personnel and material costs
- Reduced oil disposal costs
- Better for the environment

Application

- Positive Displacement blowers & vacuum pumps
- AEON PD Synthetic Lubricants provide maximum protection for demanding operating conditions in any environment or application

Description

- AEON PD Synthetic Lubricants are custom blended, synthetic hydrocarbon (polyalphaolefin) based oils
- AEON PD products are free of toxic materials or heavy metals per OSHA and EPA guidelines
- AEON PD is compatible with the majority of seal materials: teflon, viton, nitrile buna N, fluorocarbon, polysulfide, polyacrylic and fluorosilicone
- AEON PD-FG Food Grade complies with FDA 21 CFR 178.3570 requirements for lubricants with the possibility of incidental food contact
- AEON PD-FG is National Science Foundation approved

Usage & Performance

- Superior performance in a variety of application and temperatures
- Factory recommended for Gardner Denver Sutorbilt®, DuroFlow®, CycloBlower®, HeliFlow® and TriFlow® PD blowers and vacuum pumps
- Formulated for minimal blower wear and maximum equipment life
- Optimized viscosity provides superior lubrication in severe hot and cold temperatures with minimal energy consumption

Benefits OF AEON PD VS. MINERAL OIL

Longer Service Life & Improved Performance

- AEON PD typically lasts up to 4 times longer than mineral oils operating under the same conditions
  - *– Severe operating conditions may warrant more frequent oil changes*
  - *– Laboratory analysis of the oil should be used to help determine the optimum oil change interval*
- AEON PD Lubricants have a higher viscosity index
- AEON PD lubricates equipment more effectively and better maintains viscosity at high temperatures
- No need for seasonal oil changes (refer to Operating & Maintenance manuals for specific information)
- Mineral Oils have poor low temperature properties, resulting in increased wear during start-up, ultimately shortening equipment life

Advanced Chemistry

- AEON PD superior oil/water separation and corrosion inhibitors protect bearings and extend blower life significantly
- Rust and oxidation inhibitors, and anti-foam additives provides improved performance
- Mineral oils have increased water content reducing bearing life exponentially

AEON® PD Blower Lubrication Chart

Blower Discharge Temperatures	Ambient Temperatures: Less than 10° F	10° F to 32° F	32° F to 90° F	Greater than 90° F
Less than 32° F	AEON PD AEON PD-FG	AEON PD AEON PD-FG		
32° F to 100° F	AEON PD AEON PD-FG	AEON PD AEON PD-FG	AEON PD AEON PD-FG	
100° F to 225° F	AEON PD AEON PD-FG	AEON PD AEON PD-FG	AEON PD AEON PD-FG	AEON PD AEON PD-FG
225° F to 300° F	AEON PD AEON PD-FG	AEON PD AEON PD-FG	AEON PD AEON PD-FG	AEON PD-XD
Greater than 300° F			AEON PD-XD	AEON PD-XD

Recommended AEON PD lubricant based on operating conditions.

Technical Data

Properties		AEON PD	AEON PD-FG	AEON PD-XD
Viscosity	at 40°C cSt	214	217	365.7
	at 100°C cSt	22.2	24	39.32
	at 100°F SUS	1115	1130	1911.5
	at 210°F SUS	110.7	120	190.4
Pour Point °F/°C		-38/-39	-46/-43	-44/-42
Flash Point °F/°C		450/232	535/279	515/268

Order Information

NOW AVAILABLE in convenient gallon size containers

Convenient Package Sizes	AEON PD Part No.	AEON PD-FG Part No.	AEON PD-XD Part No.
1 quart	28G23	28H97	28G46
Case 12 quarts	28G24	28H98	28G47
1 gallon	28G40	28H333	28G42
Case 6 gallons	28G41	28H334	28G43
5 gallon pail	28G25	28H99	28G44
55 gallon drum	28G28	28H100	28G45

Protect your investment:
Insist on genuine Gardner Denver AEON® PD Lubricants

Cost Savings OF AEON PD VS. MINERAL OIL

- Sutorbilt 1024-8000 blower with an oil capacity of 13 quarts
- Based on an operating time of 6000 hours for one blower

OVER $195 SAVINGS PER BLOWER

Savings may vary based on your specific conditions.

	AEON PD	MINERAL OIL
Cost of initial fill (13 quarts)	$148.79	$52.40
Lube change interval	6000 hours	1500 hours
Cost of replacement lubricant	$0	$157.20
Labor ($45/change)	$0	$135.00
TOTAL COST	$148.79	$344.60

Gardner Denver®

For additional information contact your local representative or
Gardner Denver, Inc.
1800 Gardner Expressway, Quincy, IL 62305
Customer Service Department
Telephone: (800) 682-9868 FAX: (217) 221-8780
Sales and Service in all major cities.
www.GardnerDenverProducts.com pd.blowers@gardnerdenver.com

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ROTRON REGENERATIVE BLOWER

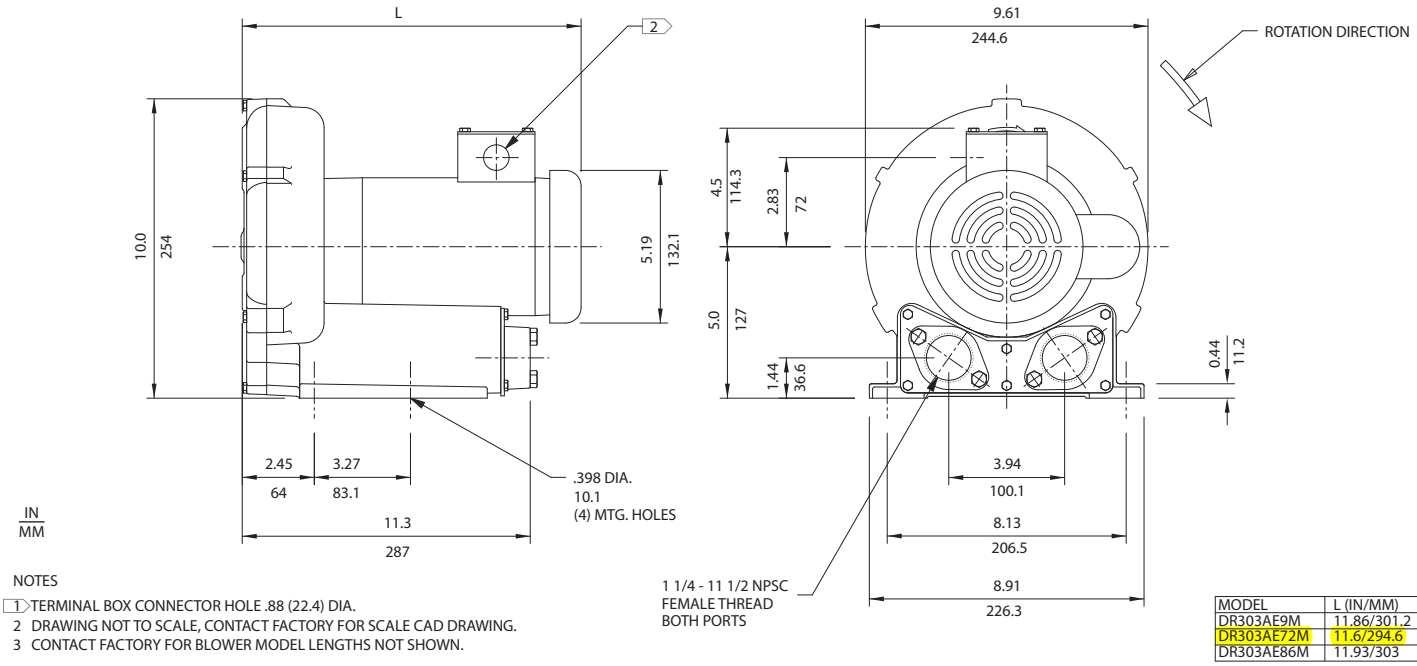
DR303AE72M

Industrial / Chemical Processing Blowers

DR 303 & CP 303

ROTRON®

.33 HP Regenerative Blower



NOTES

1. TERMINAL BOX CONNECTOR HOLE .88 (22.4) DIA.
2. DRAWING NOT TO SCALE, CONTACT FACTORY FOR SCALE CAD DRAWING.
3. CONTACT FACTORY FOR BLOWER MODEL LENGTHS NOT SHOWN.

MODEL	L (IN/MM)
DR303AE9M	11.86/301.2
DR303AE72M	11.6/294.6
DR303AE86M	11.93/303

		Part/ Model Number			
		DR303AE9M	DR303AE72M	DR303AE86M	CP303FA91MLR
Specification	Units	038841	038842	038843	080148
Motor Enclosure - Shaft Mtl.	-	TEFC - CS	TEFC - CS	TEFC - CS	Chem TEFC - SS
Horsepower	-	0.5	0.5	0.5	0.5
Voltage	AC	115/230	230/460	575	230/460
Phase - Frequency	-	Single - 60 Hz	Three - 60 Hz	Three - 60 Hz	Three - 60 Hz
Insulation Class	-	F	F	F	F
NEMA Rated Motor Amps	Amps (A)	6.2/3.1	1.3-1.2/0.6	0.6	1.3-1.2/0.6
Service Factor	-	1.25	1.25	1.25	1.25
Max. Blower Amps	Amps (A)	6/3	1.63/0.83	0.7	1.63/0.83
Locked Rotor Amps	Amps (A)	21/10.5	10-9.2/4.6	4.2	10-9.2/4.6
NEMA Starter Size	-	00/00	00/00	00	00/00
Shipping Weight	Lbs	34	42	42	42
	Kg	15.4	19.1	19.1	19.1

Voltage - ROTRON motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

Operating Temperatures - Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

Maximum Blower Amps - Corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

This document is for informational purposes only and should not be considered as a binding description of the products or their performance in all applications. The performance data on this page depicts typical performance under controlled laboratory conditions. AMETEK is not responsible for blowers driven beyond factory specified speed, temperature, pressure, flow or without proper alignment. Actual performance will vary depending on the operating environment and application. AMETEK products are not designed for and should not be used in medical life support applications. AMETEK reserves the right to revise its products without notification. The above characteristics represent standard products. For product designed to meet specific applications, contact AMETEK Technical & Industrial Products Sales department.

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Customer Service Fax: +1 215.256.1338
www.ametektip.com

AMETEK® TECHNICAL & INDUSTRIAL PRODUCTS

DR 303 & CP 303

ROTRON®

.33 HP Regenerative Blower

FEATURES

- Manufactured in the USA - ISO 9001 and NAFTA compliant
- CE compliant - Declaration of Conformity on file
- Maximum flow: 55 SCFM
- Maximum pressure: 48 IWG
- Maximum vacuum: 45 IWG
- Standard motor: 0.5 HP, TEFC
- Cast aluminum blower housing, impeller & cover; cast iron flanges (threaded)
- UL & CSA approved motor with permanently sealed ball bearings
- Inlet & outlet internal muffling
- Quiet operation within OSHA standards

MOTOR OPTIONS

- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty, or industry-specific designs
- Various horsepowers for application-specific needs

BLOWER OPTIONS

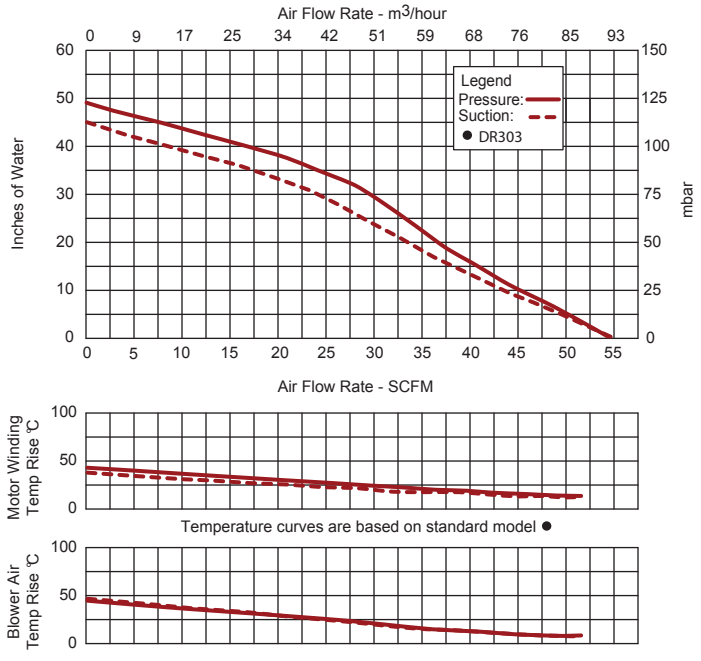
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on flanges or face flanges for application-specific needs

ACCESSORIES

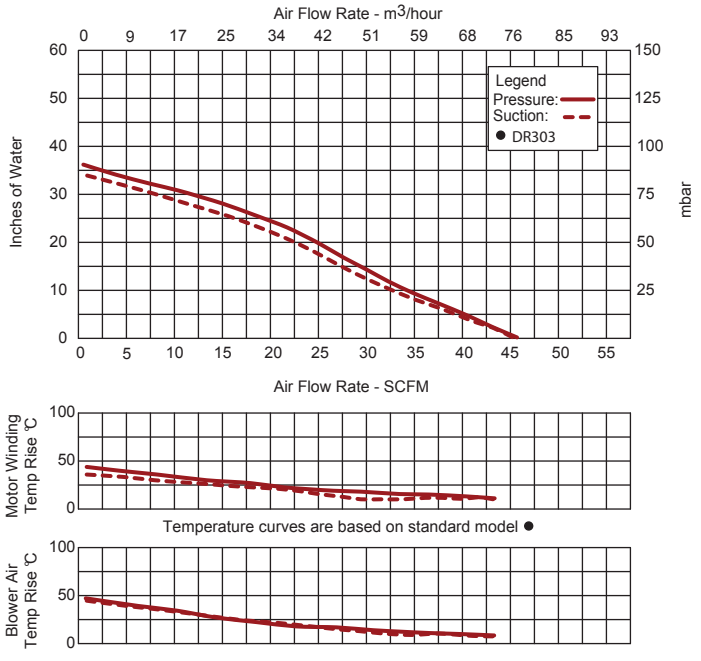
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges, & relief valves
- Switches - air flow, pressure, vacuum, or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

Blower Performance at Standard Conditions

60 Hz



50 Hz



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SERVICES, INC.

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PALM DESERT, CA 92260
(442) 600-2444
INFO@COMPRESSORDS.COM

PRICE PUMPS

.25 HP - HP75BS-600-06111-50-18-3T6
.5 HP - HP75BS-600-06111-50-18-3T6

PRICE PUMP CO.

Centrifugal Pumps

HP75CN Shown

HP75 (End Bell Gasket Design)

Pump Volute / Impeller Materials

HP75 (BN) – Bronze / CPVC
HP75 (BS) – Bronze / 316SS
HP75 (KN) – Kanigen Plated / CPVC
HP75 (KS) – Kanigen Plated / 316SS
HP75 (CN) – CPVC / CPVC
HP75 (CS) – CPVC / 316SS

Features

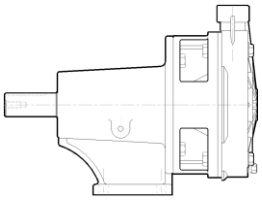
- **End Bell Gasket Design** – Isolates cast iron motor bracket from liquid flow
- **Configuration** – Compact, close coupled design
- **Motor shaft** – Threaded

Applications

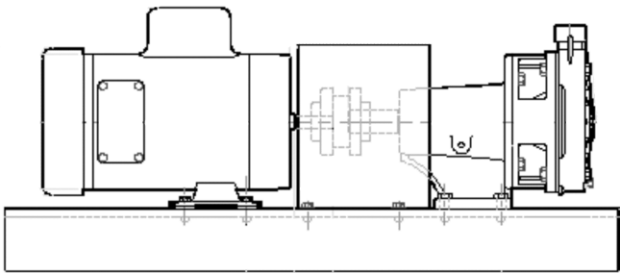
- Chillers / Liquid Cooling
- Chemical Processing
- Booster Pumps
- Water Purification
- Circulation / Filtration
- Air Conditioning / Heat Recovery

Optional Configurations

- **Power Frame Mounting:**



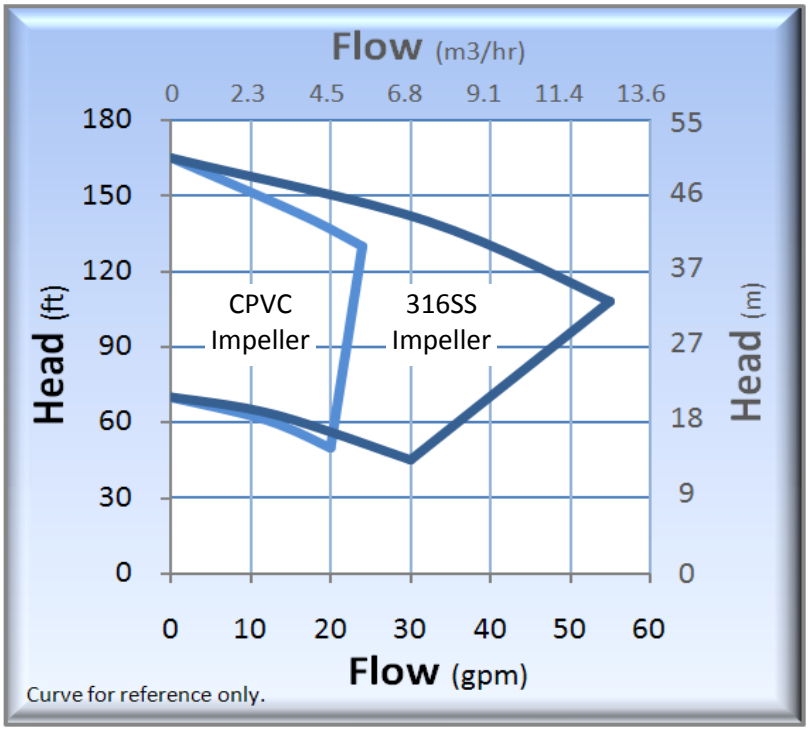
- **Long-Coupled Mounting:**



Standard Specifications

- Discharge 3/4” FNPT, Suction 3/4” FNPT
- Maximum Impeller Diameter: 6.00”
- Motor: NEMA 56J Footless (Multiple enclosures available)
- Mechanical Seal:
  Single, 5/8” Type 6 Buna, Carbon vs. Ceramic
  Note: Additional seal options available
- Bracket Material: Cast Iron (Bronze optional)
- Bell Gasket Material: EPR (Viton optional)

Performance Curve – 60 Hz



HP75 (Gasket Design)

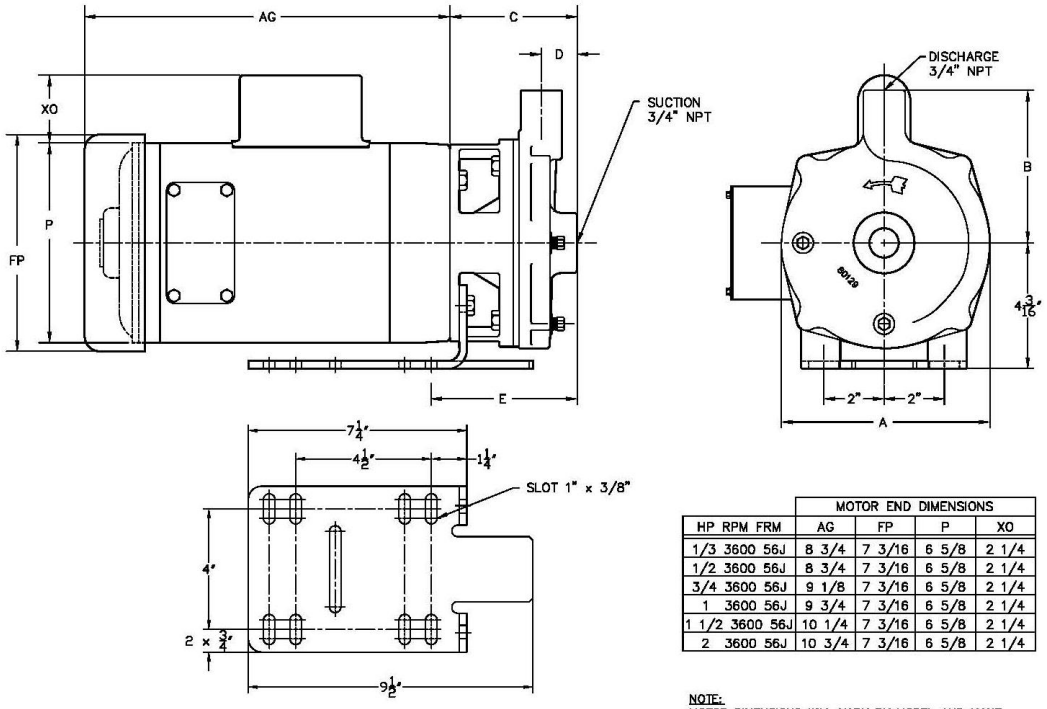
Technical Information	
Max Flow (CPVC Impeller)	**20 GPM** (4.5 m3/hr)
Max Flow (316SS Impeller)	**55 GPM** (12.5 m3/hr)
Max Head	**165 feet** (50 m)
Min. Flow	**0.5 GPM** (0.12 m3/hr)
Max Solid Size	**0.030"** (0.76 mm)
Max Working Pressure (Type 6 Seal) (Type 2106 Seal) (Type 21 Seal)	**75 PSI** (5.2 bar) **150 PSI** (10.3 bar) **150 PSI** (10.3 bar)
Max Temp. (CN, KN, BN, CS)	**140°F** (60°C)*
Max Temp. (KS, BS)	**300°F** (149°C)*

** Temperature limits are based on standard seal and gasket materials, and will vary according to the liquid being pumped.*

Materials of Construction						
HP75	**BN**	**BS**	**KN+**	**KS+**	**CN**	**CS**
Volute	Bronze	Bronze	Kanigen	Kanigen	CPVC	CPVC
Impeller	CPVC	316SS	CPVC	316SS	CPVC	316SS
Bracket	Cast Iron (Bronze Optional)					
Fasteners	Stainless Steel		Steel - Zinc Plated		Steel – Zinc Plated	
Gasket	EPR (Viton Optional)					

+ *Kanigen is an Electroless nickel plating*

Dimensions: HP75 (Gasket Design)



		MOTOR END DIMENSIONS			
HP	RPM	FRM	AG	FP	P	XO
1/3	3600	56J	8 3/4	7 3/16	6 5/8	2 1/4
1/2	3600	56J	8 3/4	7 3/16	6 5/8	2 1/4
3/4	3600	56J	9 1/8	7 3/16	6 5/8	2 1/4
1	3600	56J	9 3/4	7 3/16	6 5/8	2 1/4
1 1/2	3600	56J	10 1/4	7 3/16	6 5/8	2 1/4
2	3600	56J	10 3/4	7 3/16	6 5/8	2 1/4

NOTE:
MOTOR DIMENSIONS WILL VARY BY MODEL AND MAKE.
DIMENSIONS ARE TO BE USED FOR REFERENCE ONLY.

MATERIAL	MODEL	A	B	C	D	E
BRONZE	HP75BN/ HP75BS	6 15/16	5 1/8	4 1/8	1 3/16	4 7/8
KANIGEN	HP75KN/ HP75KS	6 15/16	5 1/8	4 1/8	1 3/16	4 7/8
CPVC	HP75CN/ HP75CS	7 1/8	4 11/16	4	1 3/16	4 5/8

NS ARE ROUNDED TO THE
INCH.

Contact factory for special pump configurations, same day, and next day delivery options.

PRICE PUMP CO.

21775 Eighth Street East
Sonoma, CA 95476-0329
MAIN (707) 938-8441
TOLL FREE (800) 345-7867
FAX (707) 938-0764
E-mail: sales@pricepump.com
Website: www.pricepump.com

Member of Hydraulic Institute

Rev. A Date: May 2011

Price® Pump Co.

INSTALLATION, OPERATING AND MAINTENANCE MANUAL

TYPE HP CENTRIFUGAL PUMPS

MODELS: HP75 CN/CS, BN/BS, KN/KS, NN
HP75 SS/SC, AB
HP100 SS/SC, AB

PLEASE FILL IN FROM PUMP NAMEPLATE

Pump Model_____

BOM. No._____

Serial No._____

RETAIN MANUAL FOR REFERENCE

Price® Pump Company
21775 8th. Street East
Sonoma, CA 95476
Tel: 707-938-8441
Fax 707-938-0764
Email: sales@pricepump.com

Congratulations

You are now the owner of a Price® Pump Co. Centrifugal Pump. This pump was carefully inspected and subjected to final performance evaluation before being released for shipment. In order to achieve maximum performance and reliability, please follow the simple instructions in this manual.

RECOMMENDED PRECAUTIONS

1. For satisfactory operation and safety, maximum system pressure must not exceed 350 psi* (24.6kg/sq cm).

2. For satisfactory operation and safety, maximum fluid temperature must not exceed 300°F* (121°C).

3. No modifications, additions or deletions should be made to the pump without prior approval of the factory.

4. Drain pump completely and flush with water before servicing a pump handling volatile or harmful liquids.

READ CAREFULLY THE CAUTION BELOW

The performance of your Price® Pump Co. Centrifugal Pump is based on clean, room temperature, water with suction conditions as shown on the performance curves. If used to pump liquids other than water , pump performance may differ from rated performance based on the different specific gravity, temperature, viscosity, etc. of the liquid being pumped. A standard pump, however, may not be safe for pumping all types of liquids, such as toxic, volatile or chemical liquids, or liquids under extreme temperatures or pressures.

Please consult Price® Pump Co. technical specifications as well as local codes and general references to determine the appropriate pump for your particular application. Since it is impossible for us to anticipate every application of a Price® Centrifugal pump, if you plan to use the pump for a non-water application, contact Price® Pump Co. beforehand to determine whether such application may be appropriate and safe under the operating conditions. Failure to do so could result in property damage or personal harm.

***** Depends on seal materials and seal type

Visit our website for product information and technical support

www.pricepump.com

INSTALLATION / OPERATING INSTRUCTIONS
CENTRIFUGAL PUMPS

Warning

Before installing, repairing or performing maintenance on this pump, read these instructions completely.

Disconnect power to pump before servicing to avoid dangerous or fatal electrical shock.

Match supply voltage and frequency to motor nameplate values. Incorrect voltage can cause fire or serious motor damage and void warranty.

Ground motor before connection to electrical power supply! Failure to ground motor can cause severe or fatal electrical shock!

Do not ground to gas supply line!

Before disassembling pump, be certain all liquid has been removed. If pump was used to pump hazardous or toxic fluid, it must be decontaminated prior to disassembly.

Close Coupled Motor Pumps

It is suggested that these pumps be firmly bolted to a level surface. Adequate air movement around motor will help prevent overheating.

Do not over tighten inlet and outlet piping or volute may be damaged.

Power Frame Mounted Pumps

Power Frame mounted pumps must be mounted on a rigid base that will not warp or flex. Each pump must be mounted such that the pump shaft centerline is in-line with the driver shaft centerline. Pads and/or shims will be required on the pump, the driver or both to insure proper alignment. The two shafts should not touch each other (end to end) and the distance between them depends on the coupling used to connect them.

Misalignment will cause vibration, bearing failure and void warranty. Pumps are rough aligned at the factory but must be realigned after shipment and installation.

Pulley driven pump must have pulleys inline and proper belt tightness practices followed.

Direction of Rotation

Note: Motor shaft rotation is viewed from the suction end of pump. A rotational arrow is shown on the front of the pump volute casing. Incorrect rotation can cause pump damage, failure or reduced performance, voiding warranty. It is best to check rotation by momentarily energizing or jogging the motor prior to filling pump with liquid.

Warning! Do not operate pump without liquid as damage may result to the pump internal wear surfaces.

Plumbing

All piping needs to be supported independently of the pump. Piping connections should not exert any stress on the pump volute or fittings.

Suction Piping (Inlet)

(Horizontal Pumps)

Suction line must provide adequate suction pressure and even (Laminar) liquid flow for proper pump operation. Air, entrapped in the suction line due to leaks or improper piping design, may cause the pump to lose prime. Non-priming pumps must have their suction 'flooded' at start up (see datasheets for minimum NPSHR). Also, the suction line must provide sufficient pressure (NPSH) and even flow to pump inlet to prevent pump cavitation. The suction pipe entering the pump should be straight and a minimum length of 5 times and preferably 10 times the pump inlet diameter. Elbows, fittings or valves installed close to the pump inlet can disrupt liquid flow and cause cavitation. Suction lines must be at least the same diameter as the pump inlet or larger if possible.

Price Pump Company recommends against using foot valves in the suction line to maintain liquid in the pump when it's not operating. If foot valves are used, due to suction lift conditions, they must be properly maintained to avoid leaks resulting from wear or fouling. Suction piping must be designed to prevent vapor from being trapped in high spots in the piping. This condition may cause the pump to vapor lock.

Discharge Piping (Outlet)

To control flow and discharge head, it is advisable to install a valve (globe, ball, or other adjustable and non-leak type) in the discharge line adjacent to the pump. The valve may be closed during system repairs to prevent backflow. By installing a check valve in the discharge line, backflow can also be prevented during maintenance or during periods of pump stoppage.

Operation

All centrifugal pumps must be filled with liquid prior to start up. It is suggested that during initial start up the discharge valve be closed and then opened as the motor reaches full rpm's. If pump does not build up pressure as motor speed increases, shut down and make sure that liquid flow into pump is not restricted (see "Troubleshooting").

Note: A centrifugal pumps flow rate and head (pressure) will vary with the amount of resistance (pipe friction and flow restrictions) in the discharge line. As the valve on the discharge line opens, the flow rate and motor amperes draw will increase and head (pressure) will decrease. As the valve on the discharge line is closed, the flow rate and amperes draw will decrease and the head (pressure) will increase.

If resistance in the discharge line is not sufficient, the pump will operate at a condition of maximum flow, sometimes called "end of curve" performance. Maximum horse-power is required to operate at this point and motor overload may result. If excessive amperes draw and motor overload is occurring, reduce the system flow rate by installing a valve or orifice in the discharge line to control (restrict) the pumps flow rate. Alternatively, reduce pump head by trimming impeller to a smaller diameter.

Consult Price Pump or a local Price Pump distributor for assistance.

appsupport@pricepump.com

1. Pump fails to build head pressure:

Check for:

a. Pump not primed.

b. Incorrect pump rotation.

c. Driver speed too low.

d. Suction line restricted.

e. Driver failure.

f. Plugged or damaged impeller.

g. Pump or impeller undersized.

h. Pump cavitation.

i. Improper impeller clearance.

2. Pump fails to provide enough flow rate.

Check for:

a. System resistance too high.

b. Pump undersized.

c. Pump not primed.

d. Driver speed too low.

e. Poor suction conditions.

f. Improper impeller clearance.

3. Excessive noise or vibration during operation.

Check for:

a. Motor bearing failing.

b. Pump cavitation.

c. Improper impeller clearance.

4. Leaking mechanical seal.

Check for:

a. Improper assembly.

b. Worn or cracked seal faces.

c. Abrasive material in fluid.

d. Liquid flashing at seal faces (Fluid temperature too high).

e. Seal pressure rating too low for the service.

f. Chemical attack of seal components.

g. Seal operated dry or with a liquid having poor lubricating properties.

5. Pump gradually loses pressure and head.

Check for:

a. Increasing temperature causing cavitation or liquid vaporization.

b. Driver failure.

c. Suction lift too high.

d. Air entering suction line.

6. Motor overheating.

Check for:

a. Excessive flow and amp draw (Throttle discharge).

b. Low voltage or frequency.

c. Flow rate too low with resulting heat rise.

d. Bearing failure.

e. System temperature too high.

TYPE HP MAINTENANCE AND REPAIR

Before attempting any repairs under warranty, contact Distributor to obtain factory authorization. Repairs carried out without authorization may void warranty. Many causes of pump system failure are due to improper system design. Refer to the trouble shooting -list in this manual before carrying out pump inspection.

DISASSEMBLY

1. Disconnect power source to motor.

2. Disconnect electrical connections tagging wires carefully to preserve correct rotation. Loosen motor base.

3. Remove pump and motor assembly to repair area. Observe position of all parts prior to disassembly. (Note: Volute may be left in piping.)

4. Remove bolts and remove volute from pump.

5. Remove impeller. Unscrew CCW. (note: remove center cap from rear of motor, insert screwdriver to hold shaft while un -screwing impeller).

6. Remove seal head from motor shaft. Type 8 & 9: Loosen set screws and slide seal head off shaft.

7. Remove motor bolts and remove bracket from motor.

8. Remove seal seat from bracket using fingers.

REASSEMBLY

1. Clean seat cavity of the bracket thoroughly. (For Bell Gasket Design, assure that there are no cuts or tearing in the end bell gasket.)

2. Thoroughly clean pump shaft. Assure that the shaft is not grooved and that there is no evidence of pitting or fretting. Polish the shaft with extra fine emery cloth if needed. If the shaft is grooved, fretted or worn, replace the motor.

3. **For Type 6, 8, 9 and 21 seals:**

a. Place the bracket on a firm surface with the seat cavity (pump end) up. (For Bell Gasket Design, place new end bell gasket on bracket).

b. Install seal seat into seat cavity. (For Bell Gasket Design remove the rubber seat cup and discard). Evenly push seat into cavity with fingers. To help ensure the seat is not damaged place cardboard disk over the seat face then gently tap seat into place with a wooden dowel or plastic rod (1 -1/8" outside diameter).

T6 seal only:

a. Set seal on shaft with carbon facing ceramic seat. Do not push seal head past shoulder on shaft (note: when impeller is threaded onto motor shaft seal height will automatically be set.)

T21 only:

a. Lubricate shaft and elastomer with vegetable oil.

b. Install rotary seal head onto motor shaft and slide toward seat until carbon face touches seal seat.

c. Install seal spring and seal retainer.

T 8 & 9 only:

a. Install seal head onto pump shaft sliding gently past shoulder of shaft. Slide seal head toward seat until carbon face contacts ceramic seat.

b. Tighten seal head setscrews to pump shaft. Remove clips in seal head and discard.

4. Install impeller. Thread impeller onto shaft CW. (For st ainless steel / bronze impellers, apply L octite 242, For CPVC / Noryl impellers, apply L octite 248 or equivalent to the motor shaft before threading the impeller onto the motor shaft) Place screwdriver in motor shaft slot in rear of motor to hold while tightening impeller firmly. (For O-ring Design, install the O - ring on to the bracket face).

Note: For type 21: Ensure that the spring retainer does not slip between the shoulder of the shaft and the hub of the impeller.

5. Install volute and tighten bolts evenly (star pattern) to required torque.

Volute Bolt T orque Specifications

SS / Bronze - 10-12 ft/ lbs.
(13.5-16.3 Nm)

CPVC - 6 ft / lbs.
(9.5 Nm)

Noryl- 10 ft / lbs.
(13.5 Nm)

6. Rotate shaft by hand to make sure impeller does not rub against volute.

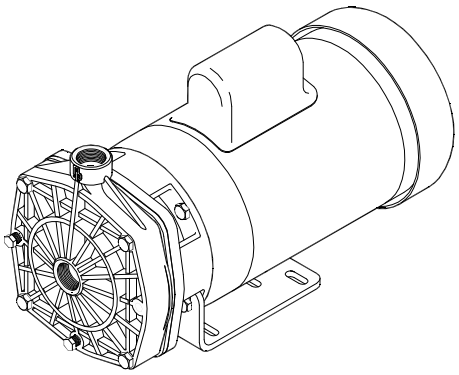
7. Ret urn pump to installation, reconnect electric connections.

8. Start pump momentarily to observe shaft rotation. If rotation corresponds to the rotation arrow pump may be put into service. If rotation is incorrect, switch any two leads on 3 -phase motors. Che ck the wiring diagram of motor for single phase rotation.

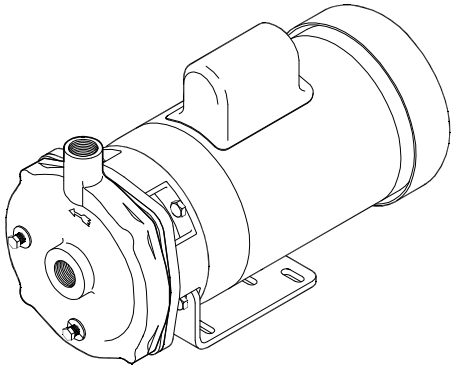
9. Prime pump thoroughly, making sure all air is purged.

10. Start pump allowing adequate time to purge any additional air from system. Observe any gauges, flow meters, etc. to verify that pump is performing properly.

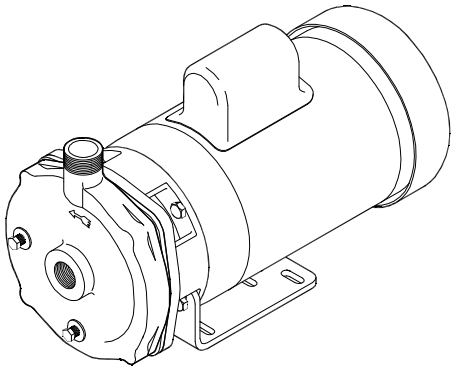
HP75 CN/CS/NN



HP75 BN/BS/KN/KS/SS/SC/AB



HP100 SS/AB



INSTALLING A PEO (PUMP END ONLY) STUB SHAFT PUMP

a. Place the bracket on a firm surface, loosen stub shaft setscrews and carefully remove shipping plug.

b. Place motor in an upright position with motor shaft pointing upward. Make sure motor shaft and end bell flange are free of burrs and surfaces are clean.

c. Align PEO stub shaft setscrews (if applicable) with motor shaft keyway and carefully slid the PEO onto the motor shaft until it sits firmly onto the motor end bell flange.

d. Oriented the PEO's discharge port or base to preferred motor configuration while referencing the motors electrical box position.

e. Install flange bolts and tighten. (Install pump base if applicable)

f. Reposition pump back onto motor base.

g. Refer to pump Reassembly Instructions and proceed to **setting the impeller clearance** (if applicable).

INSTALLING A PEO (PUMP END ONLY) NON-STUB SHAFT PUMP

a. Carefully un-pack all components received with your shipment and remove any shipping plugs.

b. Place the bracket on a firm surface with the s eat cavity (pump end) up. Follow seal Installation / reassembly instructions contained within this manual.

c. Make sure motor shaft and motor end bell flange are free of burrs and surfaces are clean.

d. Carefully place the Bracket assembly over the motor shaft and align bracket with motor end bell flange.

e. Install impeller, gasket or o -ring, volute and volute mounting bolts.

f. Oriented the PEO's discharge port or base to preferred motor configuration while referencing the motors electrical box position.

g. Install motor flange bolts and tighten all bolts to proper torque . (Install pump base if applicable)

PRICE PUMP CO.

HP75/HP100 (O-Ring Design) Parts List

Key #	Description	QTY.	HP75/100 SS&SC:	HP75/100 AB:	HP75 NN:
A.	Volute HP75	1	0241(A[1])	0229-0(A[1])	8300NN(A[3])
	Volute HP100	1	0241-2(A[2])	0229-2(A[2])	N/A
B.	1/8" Pipe Plug	2	0559(B[1])	0558(B[1])	8012BF(B[2]) (1ea)
C.	Volute Bolts	4	0579(C[1])	0592(C[1])	0723(C[2])
D.	Washers	12	N/A	N/A	1137
E.	Volute Nuts	4	N/A	N/A	1138
F.	Impeller	1	0918SS-(dia.)	0918BR-(dia.)	N/A
	Impeller CPVC	1	0918-(dia.)	N/A	0918-(dia.)
G	Bracket	1	0238(SS)(G[1])	0242(BR)(G[1])	8019NN-1(G[2])
H[1].	T.21 Viton	1	0553 (std)	0553 (std)	0553
H[2].	T.8 Viton	1	2394-PU	2394-PU	N/A
H[2].	T.9 Teflon	1	1150	1150	N/A
H[3].	T.6 Buna	1	N/A	N/A	0118 (std)
J.	O-ring	1	3565	3565	0871
K.	Slinger	1	0515	0515	0515
L.	Base	1	0197	0197	0198
M.	Bolts, Motor				
	Upper	2	0579	0579	0588
	Lower	2	0724	0724	0673
N[1].	Motor	1	Specify P/N	Specify P/N	Specify P/N
N[2].	Power Frame	1	5479	5479	5479

HP75 / HP100 Repair Parts Kits (O-ring Design)

(Repair kits for SC pumps only)

P/N	Includes
0661SC-8	4.00" CPVC Imp., Viton O-ring, and Slinger
0661SC-6	4.25" CPVC Imp., Viton O-ring, and Slinger
0661SC-5	4.50" CPVC Imp., Viton O-ring, and Slinger
0661SC-7	4.75" CPVC Imp., Viton O-ring, and Slinger
0661SC-4	5.00" CPVC Imp., Viton O-ring, and Slinger
0661SC-3	5.25" CPVC Imp., Viton O-ring, and Slinger
0661SC-2	5.50" CPVC Imp., Viton O-ring, and Slinger
0661SC-1	5.75" CPVC Imp., Viton O-ring, and Slinger
0661SC	6.00" CPVC Imp., Viton O-ring, and Slinger

Note: Seal/Seat must be ordered in addition to repair kit

Standard Pump Configurations

Model:	Volute Material:	Bracket Material:	Impeller Material:
SS	316SS	316SS	316SS
SC	316SS	316SS	CPVC
AB	Bronze	Bronze	Bronze
NN	Noryl	Noryl	CPVC

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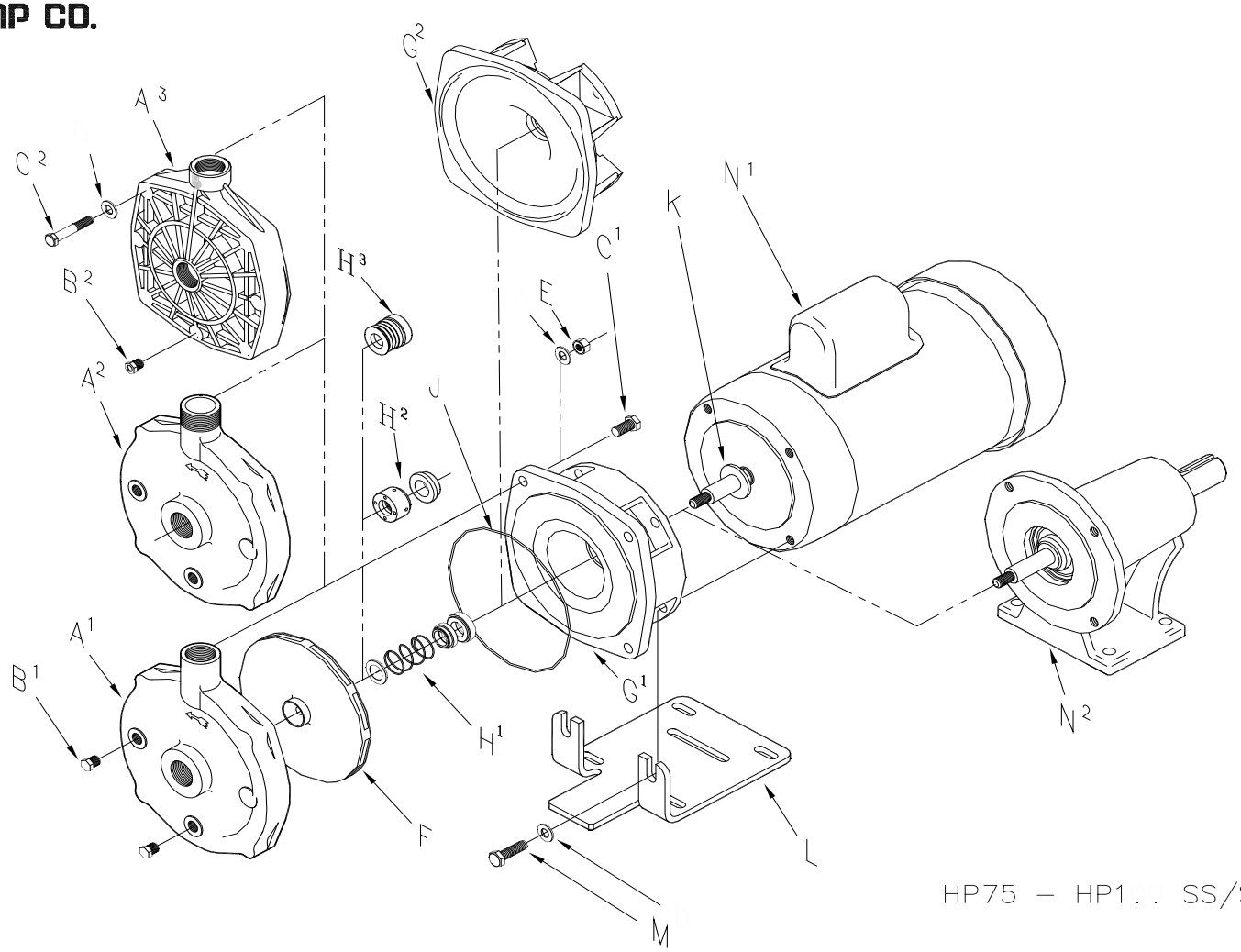

HP75 – HP1.. SS/SC/AB/NN

Price® Pump C..
21775 Eighth Street East * Sonoma, CA 95476-0329 * (707) 938-8441 * Fax (707) 938-0764

PRICE PUMP CO.

HP75 (Gasket Design) Parts List

Key #	*Description*	*QTY.*	*HP75 BN/BS:*	*HP75 KN/KS:*	*HP75* **CN / CS:**
A.	Volute	1	0229(A[1])	0229KP(A[1])	8300CP(A[2])
B.	1/8" Pipe Plug	2	0558(B[1])	0559(B[1])	8012PF(B[2]) (1ea.)
C.	Volute Bolts	4	0592(C[1])	0588(C[1])	1136(C[2])
D.	Washers	4	N/A	N/A	1137
E.	Volute Nuts	4	N/A	N/A	1138
F.	Impeller CPVC	1	0918-(Imp. Dia.)	0918-(Imp. Dia.)	0918-(Imp. Dia.)
	Impeller 316SS	1	0918SS-(Imp. Dia.)	0918SS-(Imp. Dia.)	0918SS-(Imp. Dia.)
G[1].	T.6 Buna (std)	1	0118	0118	0118
G[2].	T.21Viton	1	0553	0553	0553
H.	Gasket, EPDM	1	0232	0232	0232
J.	Bracket	1	0228	0228	0228
K.	Slinger	1	0515	0515	0515
L.	Base	1	0198	0198	0198
M.	Bolts, Motor				
	Upper	2	0588	0588	0588
	Lower	2	0673	0673	0673
N[1].	Motor	1	Specify P/N	Specify P/N	Specify P/N
N[2].	Power Frame	1	5479	5479	5479

HP75 Repair Parts Kits (Bell Gasket Design)

(Repair kits for BN, KN, & CN pumps only)

P/N	Includes
0661-8	4.00" CPVC Imp., EPR Gasket, and Slinger
0661-6	4.25" CPVC Imp., EPR Gasket, and Slinger
0661-5	4.50" CPVC Imp., EPR Gasket, and Slinger
0661-7	4.75" CPVC Imp., EPR Gasket, and Slinger
0661-4	5.00" CPVC Imp., EPR Gasket, and Slinger
0661-3	5.25" CPVC Imp., EPR Gasket, and Slinger
0661-2	5.50" CPVC Imp., EPR Gasket, and Slinger
0661-1	5.75" CPVC Imp., EPR Gasket, and Slinger
0661	6.00" CPVC Imp., EPR Gasket, and Slinger

Note: Seal/Seat must be ordered in addition to repair kit .

Standard Pump Configurations

Model:	Volute Material:	Bracket Material:	Impeller Material:
BN	Bronze	Cast Iron	CPVC
KN	Kanigen	Cast Iron	CPVC
CN	CPVC	Cast Iron	CPVC
BS	Bronze	Cast Iron	316SS
KS	Kanigen	Cast Iron	316SS
CS	CPVC	Cast Iron	316SS

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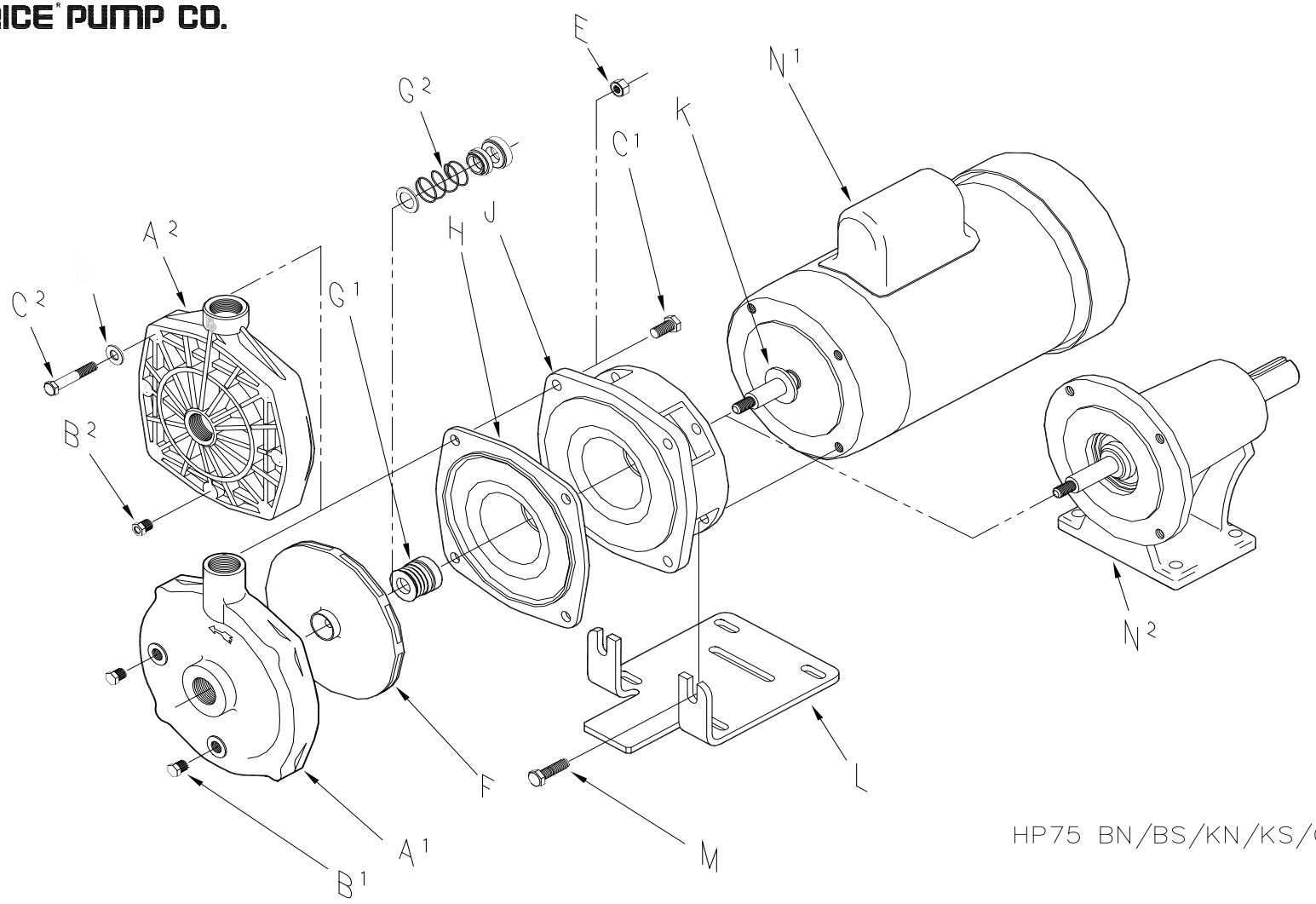

HP75 BN/BS/KN/KS/CN/CS

Price® Pump Co.
21775 Eighth Street East * Sonoma, CA 95476-0329 * (707) 938-8441 * Fax (707) 938-0764

PRICE CENTRIFUGAL PUMP CAUTIONS & WARNINGS

- **CAUTION:** Price Pump centrifugal pumps must be operated above minimum flow rate to avoid damage.
- **CAUTION:** All Price Pump centrifugal pumps require the suction to be flooded.
- **CAUTION:** It is recommended that all piping connections to the pump be flexible.
- **WARNNING:** Verify chemical compatibility of the pump materials of construction with the fluid being pumped.
- **WARNNING:** Price centrifugal pumps are not designed for use in sanitary or food applications.
- **CAUTION:** Use only Price Pump original equipment factory replacement parts.
- **WARNNING:** Price pump fluid temperature limits must be observed. Maximum operating temperature is 300°F.
- **CAUTION:** The pump should be thoroughly flushed and drained before disassembly.
- **CAUTION:** For larger pump motor units, weight may exceed 65 1bs. (30 kg).

CAUTION: Maximum working pressure for seals:

- Type 6 Seal **75 PSI** (5.2 bar)
- Type 6A Seal **75 PSI** (5.2 bar)
- Type 8 Seal **325 PSI** (22.4 bar)
- Type 9 Seal **350 PSI** (24.1 bar)
- Type 21 Seal **150 PSI** (10.3 bar)
- Type 2106 Seal **150 PSI** (10.3 bar)

CAUTION: Maximum solid size by pump

- HP75 / MS50 **0.030"** (0.76mm)
- SP150 **0.060"** (1.50mm)
- LT25 **0.120"** (3.05mm)
- F50/75/95 **0.150"** (3.81mm)
- OH75 **0.150"** (3.81mm)
- CD100/150 **0.150"** (3.81mm)
- CL150 **0.150"** (3.81mm)
- RC200/300 **0.380"** (9.60mm)
- XJ-JB100 **0.120"** (3.05mm)
- XJ-JB150 **0.250"** (6.40mm)
- XJ-JB200 **0.440"** (11.2mm)
- XL-XT100 **0.120"** (3.05mm)
- XL-XT150 **0.250"** (6.40mm)
- XL-XT200 **0.440"** (11.2mm)

CAUTION: Minimum flow rate by pump

- HP75 / MS50 **0.5 GPM** (1.9 LPM)
- SP150 **10 GPM** (38 LPM)
- LT25 **0.5 GPM** (1.9 LPM)
- F50/75/95 **5.0 GPM** (19 LPM)
- OH75 **7.0 GPM** (26 LPM)
- CD100 **12 GPM** (45 LPM)
- CD150 **25 GPM** (94 LPM)
- CL150 **40 GPM** (150 LPM)
- RC200 **10 GPM** (38 LPM)
- RC300 **50 GPM** (189 LPM)
- XJ-JB150 **20 GPM** (75 LPM)
- XJ-JB150 **40 GPM** (150 LPM)
- XJ-JB200 **90 GPM** (340 LPM)
- XL-XT100 **10 GPM** (38 LPM)
- XL-XT150 **35 GPM** (132 LPM)
- XL-XT200 **50 GPM** (189 LPM)

GENERAL TERMS OF SALE

1. GENERAL

A. Seller's price is based on these sales terms and conditions. The agreement and inclusion of other or amended terms in this contract will result in a change (including increase) in Seller's price (as may be contained in any price books or quotations) to reflect such other or amended terms. This contract shall represent the final, complete and exclusive statement of the agreement between the parties and may not be modified, supplemented, explained or waived by parole evidence, any Terms and Conditions contained in Buyer's purchase order or request for quotation, any course of dealings between the parties, Seller's performance or delivery, or in any other way. The Terms and Conditions of this contract may only be modified or waived in a written document signed by an Officer of Seller. These terms are intended to cover all activity of Seller and Buyer hereunder, including sales and use of products, parts and work and all related matters (references to products include parts and references to work include construction, installation and start-up). Any reference by Seller to Buyer's specifications and similar requirements are only to describe the products and work covered hereby and no warranties or other terms therein shall have any force of effect. Any information provided by Seller including, but not limited to, suggestions as to specific equipment does not imply any guarantee of specific suitability and/or material compatibility in a particular application, since many factors outside the control of Seller may affect the suitability of products in a particular application. Catalogs, circulars, similar pamphlets and information contained on websites of the Seller are issued for general information purposes only and shall not be deemed to modify the provisions hereof.

B. The agreement formed hereby and the language herein shall be construed and enforced under the Uniform Commercial Code as in effect in the State of California on the date hereof.

2. TAXES

Any sales, use or other similar type taxes imposed on this sale or on this transaction and/or any import or export duties or fees as may be assessed or imposed on or as a result of deliveries under this transaction are not included in the price. Such taxes shall be billed separately to the Buyer. Seller will accept a valid exemption certificate from the Buyer if applicable; however, if an exemption certificate previously accepted is not recognized by the governmental taxing authority involved and the Seller is required to pay the tax covered by such exemption certificate. Buyer agrees to promptly reimburse Seller for the taxes paid.

3. PERFORMANCE, INSPECTION AND ACCEPTANCE

A. Unless Seller specifically assumes installation, construction or start-up responsibility, all products shall be finally inspected and accepted within thirty (30) days after arrival at point of delivery. Where seller has responsibility for installation, construction or start-up all work shall be finally inspected and accepted with thirty (30) days after completion of the applicable work by Seller. All claims whatsoever by Buyer, (including claims for shortages) except only those provided for under the WARRANTY AND LIMITATION OF LIABILITY and PATENTS Clauses, hereof, must be asserted in writing by Buyer within said thirty (30) day period or they are waived. If this contract involves partial performance, all such claims must be asserted within said thirty- (30) day period for each partial performance. There shall be no revocation of acceptance. Rejection may be only for defects substantially impairing the value of products or work and Buyer's remedy for lesser defects shall be those provided for under the WARRANTY AND LIMITATION OF LIABILITY Clause.

B. Seller shall not be responsible for non-performance or for delays in performance occasioned by any causes beyond Seller's reasonable control, including, by way of example and not limitation, to labor difficulties, delays of vendors or carriers, fires, governmental actions, or shortages of material, components, labor, or manufacturing facilities. Any delays so occasioned shall affect a corresponding extension of Seller's performance dates, which are, in any event, understood to be approximate. IN NO EVENT SHALL BUYER BE ENTITLED TO INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LATE PERFORMANCE OR FOR A FAILURE TO PERFORM. Seller reserves the right to make partial shipments and to ship products, parts or work which may be completed prior to the scheduled performance date.

C. In the event that Seller has agreed to mount motors, turbines, gears, or other products which are not manufactured by Seller and which are not an integral part of Seller's manufactured product, and a delay in the delivery of such products to Seller occurs that will cause a delay in Seller's performance date, Seller reserves the right to ship its product upon completion of manufacture and to refund an equitable portion of the amount originally included in the purchase price for mounting without incurring liability for non-performance.

D. Seller reserves to itself the right to change its specifications, drawings and standards if such changes will not impair the performance of its products, and parts, and further those products, and parts, will meet any of Buyer's specifications and other specific product requirements which are a part of this agreement. Seller is a global supplier of products and utilizes parts and products obtained worldwide, and Seller's products supplied under this contract shall be subject to Seller's sole determination as to all manufacturing, sourcing, assembly and supply unless otherwise specifically agreed in writing.

E. The manufacture and inspection of products and parts shall be to Seller's Engineering and Quality Assurance standards, plus such other inspections or tests of documentation as are specifically agreed to by Seller. Requirements for any additional inspection, tests, documentation, or Buyer witness of manufacture, test, and/or inspection shall be subject to additional charges.

4. TITLE AND RISK OF LOSS

Title and risk of loss shall pass to buyer upon delivery of products at the designated "Ex Works" as defined by Incoterms, unless other wise agreed by the parties.

5. EROSION AND CORROSION

It is specifically understood that products and parts sold hereunder are not warranted for operation with erosive or corrosive fluids or for operation with any fluid or under any operating condition in variance with the specifications of this contract. No product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action of any fluid and Buyer shall have no claim whatsoever against Seller therefore. No product shall be deemed defective by reason of any effect on Seller's products of the action or results (such as vibration) of any goods or system (such as piping) not supplied by Seller.

6. BUYER'S RESPONSIBILITY

The design specifications of the equipment require the operation of the equipment within certain parameters and may call for the use of speed controls, safety devices, set points or other control devices to insure that the operation remains within design parameters. Buyer agrees and understands that the equipment must be operated and maintained within design specifications and operated within the specifications of the contract, irrespective of whether controls or devices are otherwise required.

7. WARRANTY AND LIMITATION OF LIABILITY.

A. Seller warrants only that its product and parts, when shipped, will be free from defects in materials and workmanship. All claims for defective products or parts under this warranty must be made in writing immediately upon discovery and, in any event, within two (2) years of shipment by seller and all claims for defective work must be made in writing immediately upon discovery. Defective items must be held for Seller's inspection and returned to the sellers' point of original shipment upon request.
ANY UNAUTHORIZED DISSASSEMBLY, ALTERATION OF OR TAMPERING WITH ANY PRODUCT OR COMPONENT MAY "VOID" THE WARRANTY, IN THAT SUCH ACTION WILL RESULT IN SELLER BEING RELEASED AND RELIEVED FROM ITS OBLIGATIONS UNDER THIS WARRANTY AND FOR ANY FURTHER COSTS OR ACTIONS UNDER CLAUSE 7.C, FOLLOWING, AND THE BUYER ASSUMING SOLE RESPONSIBILITY FOR THE COSTS AND RESULTS OF SUCH ACTION. THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING WITHOUT LIMITATION, THE IMPLIED, WARRANTIES OF MERCHANTABILITY AND FITNESS.

B. ANY PRODUCT (S) SOLD HEREUNDER WHICH ARE NOT MANUFACTURED BY SELLER ARE NOT WARRANTED BY SELLER and shall be covered only by the express warranty, if any, of the manufacturer thereof. With respect to products and parts not manufactured by Seller, Seller's only obligation shall be to assign to Buyer, to the extent possible, whatever warranty Seller obtains from the manufacturer.

C. Upon Buyer's submission of a claim as provided above and its substantiation, Seller shall at its option either (i) repair or replace its product, part or work at the original place of shipment, or (ii) refund an equitable portion of the purchase price.

D. THE FOREGOING IS SELLER'S ONLY OBLIGATION AND BUYER'S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY AND, EXCEPT FOR THE REMEDIES PERMITTED UNDER THE PERFORMANCE, INSPECTION AND ACCEPTANCE AND THE PATENTS CLAUSES HEREOF, THE FOREGOING IS BUYER EXCLUSIVE REMEDY AGAINST SELLER FOR ALL CLAIMS ARISING HEREUNDER OR RELATING HERETO WHETHER SUCH CLAIMS ARE BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY), INDEMNITY OR OTHER THEORIES. BUYER'S FAILURE TO SUBMIT A CLAIM AS PROVIDED ABOVE SHALL SPECIFICALLY WAIVE ALL CLAIMS FOR DAMAGES OR OTHER RELIEF, INCLUDING BUT NOT LIMITED TO CLAIMS BASED ON LATENT DEFECTS. IN NO EVENT SHALL BUYER BE ENTITLED TO INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, NOR FOR DAMAGES FOR LOSS OF USE, LOST PROFITS OR REVENUE, INTEREST, LOST GOODWILL, WORK OR PRODUCTION STOPPAGE, IMPAIRMENT OF OTHER GOODS, INCREASED EXPENSES OF OPERATION, OR THE COST OF PURCHASING REPLACEMENT POWER OR OTHER SERVICES BECAUSE OF SERVICE INTERRUPTIONS. FURTHERMORE, IN NO EVENT SHALL SELLER'S TOTAL LIABILITY FOR DAMAGES OF BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS OR PARTS MANUFACTURED BY SELLER AND UPON WHICH SUCH LIABILITY IS BASED. ANY ACTION ARISING HEREUNDER RELATED HERETO, WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHER THEORIES, MUST BE COMMENCED WITHIN ONE (1) YEAR AFTER THE CAUSE OF ACTION ACCRUES OR IT SHALL BE BARRED.

8. PURCHASER'S REPRESENTATIONS & WARRANTIES

Purchaser represents and warranties that the products(s) covered by this contract shall not be used in or in connection with a nuclear facility or application. The parties agree that this representation and warranty is material and is being relied on by seller. This provision may be modified in a separate writing signed by an officer of Price Pump Co.

9. PATENTS

Seller agrees to assume the defense of any suit for infringement of any patents brought against Buyer to the extent of such suit charges infringement of an apparatus or product claim by Seller's product in and of itself, provided (i) said product is built entirely to Seller's design, (ii) Buyer notifies Seller in writing of the filing of such suit within ten (10) days after the service of process thereof, and (iii) Seller is given complete control of the defense of such suit, including the right to defend, settle and make changes in the product for the purpose of avoiding infringement of any process or method claims. Provided however, Seller will not defend any suit for infringement of a claimed patent where such alleged infringement is the result of following specific instruction furnished by Seller.

10. EXTENT OF SUPPLY

Only products as listed in Seller's proposal are included in this agreement. It must not be assumed that Seller has included anything beyond same.

11. MANUFACTURING SOURCES

To maintain delivery schedules, Seller reserves the right to have all or any part of the Buyer's order manufactured at any of Sellers', sellers' licensees or sub contractors' plants, globally.

12. TERMS OF PAYMENT

Net 30 days from date of invoice.

13. ARBITRATION

In the event a dispute arises between the parties relating to or arising out of this agreement, the parties agree to attempt to have their senior management amicably settle the matter. In the event that the matter cannot be settled, the parties shall submit all disputes relating to this Agreement (whether contract, tort, products liability or otherwise) to binding Arbitration before a panel of arbitrators under the Commercial Dispute Resolution Procedures of the American Arbitration Association. Each party shall appoint an arbitrator and the third shall be selected in accordance with the rules of the American Arbitration Association. Judgment upon the award may be entered in any court having jurisdiction. The parties shall cooperate in providing reasonable disclosure of relevant documents. Each party shall bear its own expenses, and the costs and fees of the arbitration shall be borne as allocated by the Arbitrator.

COMPRESSOR DESIGN AND SERVICES, INC.

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MOISTURE SEPARATORS

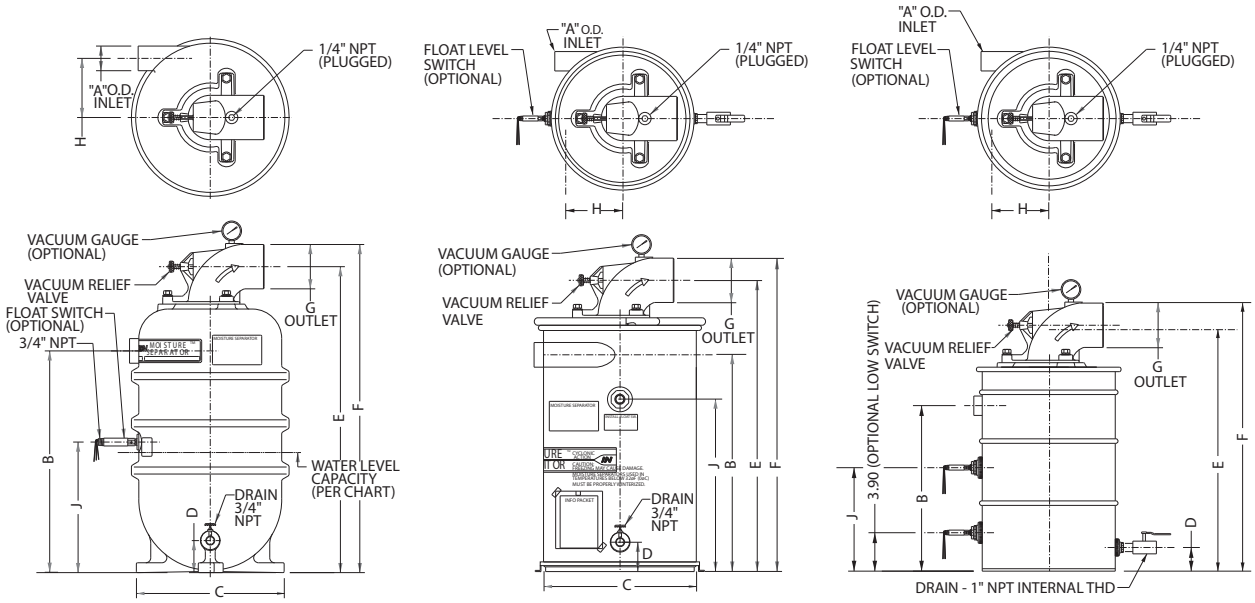
ROTRON AMETEK MS1000B3S

Filtration - Moisture Separator

ROTRON®

By separating and containing entrained liquids, ROTRON'S™ moisture separator helps protect our regenerative blowers and the end treatment system from corrosion and mineralization damage. Recommended for all soil vacuum extraction applications.

SPECIFICATIONS:
SEPARATION METHOD – High E□ciency Cyclonic
RELIEF VALVE MATERIAL – Brass & Stainless Steel
FLOAT MATERIAL – Copper
FLOAT SWITCH – SPDT, Explosion-proof NEMA 7&9, 5 Amp max.



PLASTIC "P" DESIGN | METAL "D" DESIGN | METAL "B" DESIGN

Models without □oat switch available. Metal MS200/300DS models are not the standard stocked, but are available.

		Part/Model Number							
		MS200PS	MS300PS	MS200DS	MS300DS	MS350BS	MS500BS	MS600BS	MS1000BS
Specification	Units	038519	038520	080086	080087	038357	080660	080659	038914
Dimension A	Inches	2.38	2.88	2.00	2.50	3.25	3.25	4.00	6.00
	mm	60.5	73.2	50.8	63.5	82.6	82.6	101.6	152.4
CFM Max.	CFM	200	300	200	300	350	500	600	1000
	m3/hr	340	510	340	510	595	850	1020	1700
Dimension B	Inches	22.46	22.46	22.12	22.12	28.00	28.00	27.00	31.00
	mm	570.5	570.5	561.8	561.8	711.2	711.2	685.8	787.4
Dimension C	Inches	16.00	16.00	16.75	16.75	23.00	23.00	23.00	27.00
	mm	406.4	406.4	425.5	425.5	584.2	584.2	584.2	685.8
Dimension D	Inches	3.25	3.25	2.75	2.75	4.00	4.00	4.00	4.00
	mm	82.6	82.6	69.9	69.9	101.6	101.6	101.6	101.6
Dimension E	Inches	31.05	31.05	27.92	27.92	37.25	37.37	37.37	47.32
	mm	788.7	788.7	709.2	709.2	946.2	949.2	949.2	1201.9
Dimension F	Inches	33.30	33.30	30.17	30.17	39.50	54.50	54.50	51.70
	mm	845.8	845.8	766.3	766.3	1003.3	1384.3	1384.3	1313.2
Dimension H	Inches	6	6.00	6.56	6.81	9.75	9.75	9.25	10.00
	mm	152.4	152.4	166.6	173	247.7	247.7	235	254
Dimension G	Inches	4.50 OD	4.50 D	4.50 D	4.50 OD	4.50 OD	6.63 ID	6.63 ID	8.62 OD
	mm	114.3	114.3	114.3	114.3	114.3	168.4	168.4	218.9
Dimension J	Inches	13.25	13.25	12.62	12.62	17.50	17.50	17.50	19.88
	mm	336.6	336.6	320.5	320.5	444.5	444.5	444.5	505
Drain Internal Thd	-	3/4	3/4	3/4	3/4	1	1	1	1
Shipping Weight	Lbs	42	42	42	42	82	95	96	150
	Kg	19.1	19.1	19.1	19.1	37.2	43.1	43.5	68

This document is for informational purposes only and should not be considered as a binding description of the products or their performance in all applications. The performance data on this page depicts typical performance under controlled laboratory conditions. AMETEK is not responsible for blowers driven beyond factory specified speed, temperature, pressure, flow or without proper alignment. Actual performance will vary depending on the operating environment and application. AMETEK products are not designed for and should not be used in medical life support applications. AMETEK reserves the right to revise its products without notification. The above characteristics represent standard products. For product designed to meet specific applications, contact AMETEK Technical & Industrial Products Sales department.

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Customer Service Fax: +1 215.256.1338
www.ametektip.com

2.0 Moisture Separator™ Specifications

2.1 Duty

The moisture separator shall be designed for use in a soil vapor extraction system capable of continuous operation with a pressure drop of less than six inches of water at the rated flow of _____ SCFM. The separator shall be capable of operation under various inlet conditions randing from a fine mist to slugs of water with high efficiency.

2.2 Principle of Operation

The moisture separator shall incorporate cyclonic separation to remove entrained water. The separator must protect against an overflow by fail safe mechanical means. An electrical switch or contact(s) alone is not an acceptable means of protection against overflow, but is a good backup.

2.3 Construction

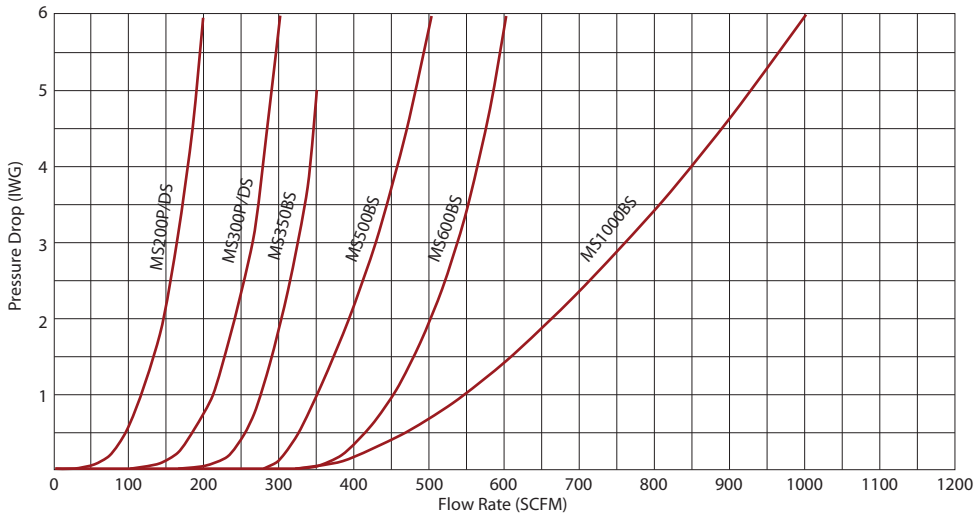
The body of the moisture separator shall be constructed of heavy wall plastic or heavy gauge cold rolled steel. The steel interior and exterior shall be epoxy (powder) coated to resist abrasion, corrosion, and chipping that might expose the surface. The inlet shall be tangentially located and welded to the body. The outlet port shall be constructed of PVC or cast aluminum alloy, flanged and sealed to the center of the top of the separator. The separator shall incorporate a non-sparking copper float ball and an adjustable relief valve to protect against overflow and overheating the blower.

2.4 Capacity and Dimension

The moisture separator must have a liquid capacity of _____ gallons. The inlet shall be _____ inch OD slip-on type. The outlet shall be _____ inch OD slip-on type.

For DR/EN/CP Blower Model	Selector Moisture Separator Model	Liquid-holding Capacity (gallons)	Inlet (OD)	Outlet	Max Vacuum Allow (IHG)
404 454 505 513	MS200PS	7	2.38	4.5 OD	12
523 555 633 833	MS200DS	10	2.0		22
656	MS300PS	7	2.88		12
6 757	MS300DS	10	2.5		22
808	MS350BS	40	3.25	6.63 ID	
858 1233	MS500BS				
909	MS600BS		4.0		
979 14	MS1000BS	65	6.0	8.62 OD	

2.5 Pressure Drop



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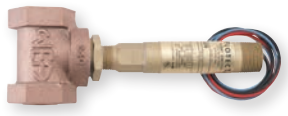
FLOAT SWITCHES

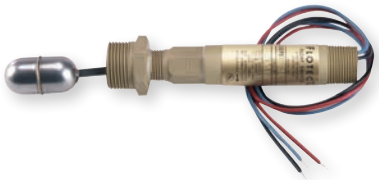
L6EPB-B-S-3-0

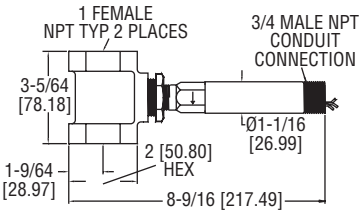
Dwyer

FLOTECT® LIQUID LEVEL SWITCH

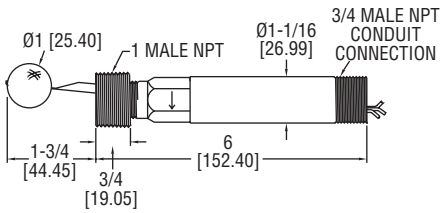
Easy In-wall or External Installation, Up to 2000 psig (138 bar)



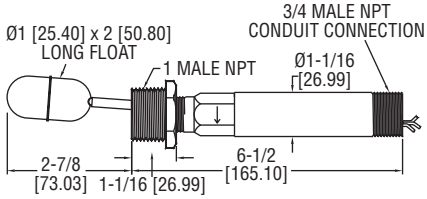




Model L6 with External Float Chamber



Model L6 with Spherical Float



Model L6 with Cylindrical Float

Scan here to watch product video

The **SERIES L6** Flotect® Float Switches is a rugged and reliable float switch which operates automatically to indicate tank level. It is offered with a 303 SS or brass body with spherical or cylindrical float options.

FEATURES/BENEFITS

- Compact design is built for years of trouble-free service
- Simple and dependable operation with no mechanical linkage
- Float lever pivoted within the body moves when the process liquid displaces the float and magnet on the opposite end of the float lever controls a second magnet on the switch actuating lever located in the switch housing
- Leak proof lower body machined from bar stock
- Side wall or direct tee mounting options available to act as an external float chamber
- Weatherproof and explosion-proof body for demanding outdoor applications
- Electrical assembly can be easily replaced without removing the unit from the installation so that the process does not have to be shut down
- Sensitive to level changes of less than 1/2″ (12 mm)

APPLICATIONS

- Direct pump control for maintaining level
- Automatic tank dump operations
- Level control
- Valve control
- Level alarm in sumps, scrubber systems, hydro-pneumatic tanks, boilers, and water/wastewater treatment processes

OPTIONS

To order add suffix:	Description	Price
-MV	Gold plated contacts for dry circuits (see electrical rating in specifications)	+$11.25
-MT	High temperature rated 400°F (204°C) (see electrical rating in specifications, no listings or approvals, only available on models with stainless steel floats)	+33.25
-CSA	CSA and UL approved construction, includes weatherproof and explosion-proof junction box	+55.00
-AT	ATEX compliant construction includes, weatherproof and explosion-proof, junction box	+84.00
-IEC	IECEx certified construction	+84.00
DPDT Contacts		

Note: To order, change seventh character in model number to "D" and +**$33.00** to above prices. **Example:** L6EPB-B-D-3-O

Options Not Shown: 1-1/2″ and 2″ male NPT process connection, 2″ female NPT connection tee, and top mount.

SPECIFICATIONS

Service: Liquids compatible with wetted materials.
Wetted Materials: Float: Solid polypropylene or 304 SS; Lower Body: Brass or 303 SS; Magnet: Ceramic; External Float Chamber (Tee): Matches lower body choice of brass or 303 SS; Other: Lever Arm, Spring, Pin, etc.: 301 SS.
Temperature Limit: -4 to 220°F (-20 to 105°C) Standard, MT high temperature option 400°F (205°C)(MT not UL, CSA, ATEX, IECEx and KC). ATEX compliant AT, IECEx IEC and KC option ambient temperature -4 to 167°F (-20 to 75°C) process temperature: -4 to 220°F (-20 to 105°C).
Pressure Limits: See model chart.
Enclosure Rating: Weatherproof and Explosion-proof. Listed with UL and CSA for Class I, Groups A, B, C and D; Class II, Groups E, F, and G. (Group A on stainless steel body models only).
ATEX CE 0344 Ex II 2 G Ex d IIC T6 Gb Process Temp≤75°C.
EC-Type Certificate No.: KEMA 04ATEX2128.
ATEX Standards: EN 60079-0: 2009; EN60079-1: 2007.
IECEx Certified: For Ex d IIC T6 Gb Process Temps≤ 75°C.
IECEx Certificate of Conformity: IECEx DEK II.0039.
IECEx Standards: IEC 60079-00: 2007; IEC 60079-1: 2007.
Korean Certified (KC) for Ex d IIC T6 Gb Process Temp≤75°C.
KTL Certificate Number: 2012-2454-75.
Switch Type: SPDT snap switch standard, DPDT snap switch optional.
Electrical Rating: UL models: 5 A @ 125/250 VAC (V~). CSA, ATEX and IECEx models: 5 A @ 125/250 VAC (V~); 5 A res., 3 A ind. @ 30 VDC (V⎓). MV option: .1 A @ 125 VAC (V~). MT option: 5 A @125/250 VAC (V~). [MT option not UL, CSA, ATEX or IECEx].
Electrical Connections: UL models: 18 AWG, 18″ (460 mm) long. ATEX/CSA/IECEx models: terminal block.
Upper Body: Brass or 303 SS.
Conduit Connection: 3/4″ male NPT standard, 3/4″ female NPT on junction box models.
Process Connection: 1″ male NPT on models without external float chamber, 1″ female NPT on models with external float chamber.
Mounting Orientation: Horizontal with index arrow pointing down.
Specific Gravity: See chart.
Weight: Approximately 1 lb (.5 kg) without external float chamber, 1.75 lb (.8 kg) with external float chamber.
Agency Approvals: ATEX, CE, CSA, IECEx, KTL, UL.

MODEL CHART

Model	Body	Installation	Float Material	Max. Pressure psig (bar)	Min. S.G.	Price
L6EPB-B-S-3-O	Brass	Side wall mounting	Polypropylene spherical	1000 (69)	0.9	**$158.00**
L6EPB-B-S-3-A	Brass	Side wall mounting	304 SS cylindrical	200 (13.8)	0.5	**183.00**
L6EPB-B-S-3-C	Brass	Side wall mounting	304 SS spherical	350 (24.1)	0.7	**194.00**
L6EPB-B-S-3-B	Brass	Brass external float chamber (tee)	Polypropylene spherical	250 (17.2)	0.9	**197.00**
L6EPB-B-S-3-H	Brass	Brass external float chamber (tee)	304 SS spherical	250 (17.2)	0.7	**223.00**
L6EPS-S-S-3-O	303 SS	Side wall mounting	Polypropylene spherical	2000 (138)	0.9	**201.00**
L6EPS-S-S-3-A	303 SS	Side wall mounting	304 SS cylindrical	200 (13.8)	0.5	**232.00**
L6EPS-S-S-3-C	303 SS	Side wall mounting	304 SS spherical	350 (24.1)	0.7	**240.00**
L6EPS-S-S-3-S	303 SS	304 SS external float chamber (tee)	Polypropylene spherical	2000 (138)	0.9	**292.00**
L6EPS-S-S-3-L	303 SS	304 SS external float chamber (tee)	304 SS spherical	350 (24.1)	0.7	**316.00**

COMPRESSOR
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CONTROL PANELS

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UL RATED BREAKER BOXES

EZ BOX 20X48
EZ BOX 20X36

Eaton's EZ Panel™ factory-assembled panelboards

Available directly through stock

Eaton EZ Panel™ panelboards

Eaton's EZ Panel factory-assembled panelboards help simplify delivery, reduce costs and save time – with the most common configurations of Eaton® EZ Box™, EZ Trim™, main device and panelboards interior all in a single package.*

The pre-assembled offering is available directly through distributor stock to help shorten lead times while providing a reliable solution for light commercial projects where the dependability of bolt-on branch breakers is desired. By adding bolt-on type BAB, GHB or GHQ breakers in the field, Eaton's EZ Panel provides the flexibility to meet the needs of nearly any application.

With Eaton EZ Panel –

- Simplify light commercial construction projects
- Shorten lead times and expedite delivery
- Reduce ordering complexity, labor and time

EZ Panel factory-assembled panelboard features and benefits

Save time

Expedite the delivery of panelboard configurations with field-installed bolt-on Type BAB, GHB or GHQ breakers to quickly meet customer needs with improved inventory access and availability.

Reduce cost

Order factory assembled EZ Panel panelboards to reduce installation time and labor, onsite coordination and ordering complexity

Minimize installation error

Confidently supply solutions assembled by Eaton to help ensure reliable operation and accurate installation

Simplify specification

Reduce complexity and time with four primary box sizes, common circuit breaker configurations and a single catalog number

*Eaton's EZ Box and EZ Trim, the revolutionized panelboard boxes and trims, are provided standard for Eaton's lighting panelboards

Powering Business Worldwide

Catalog reference charts

Main breaker, three-phase, four-wire—top cable entry—NEMA® 1 enclosure—trim surface mount

Main Breaker Type	kAIC Rating	Ampere Rating	Bus Type	Thru-Feed Lugs	Subfeed Breaker Provision	Max. Number of Spaces	Max. Number of Circuits	Enclosure Height (Inches)	Catalog Number
208Y/120 Vac									
ED	65	225	Aluminum	■		30	30	48	**AP13225TET30AS**
ED	65	200	Aluminum	■		30	30	48	**AP13200TET30AS**
ED	65	150	Aluminum	■		30	30	48	**AP13150TET30AS**
ED	65	225	Aluminum			42	42	48	**AP13225TE42AS**
ED	65	200	Aluminum			42	42	48	**AP13200TE42AS**
ED	65	150	Aluminum			42	42	48	**AP13150TE42AS**
ED	65	225	Aluminum	■		42	42	60	**AP13225TET42AS**
ED	65	200	Aluminum	■		42	42	60	**AP13200TET42AS**
ED	65	150	Aluminum	■		42	42	60	**AP13150TET42AS**
KD	65	400	Aluminum		■	42	42	72	**AP13400TKF42AS**
HKD	100	400	Aluminum		■	42	42	72	**AP13400THF42AS**
ED	65	225	Copper	■		30	30	48	**AP13225TET30CS**
ED	65	200	Copper	■		30	30	48	**AP13200TET30CS**
ED	65	150	Copper	■		30	30	48	**AP13150TET30CS**
ED	65	225	Copper			42	42	48	**AP13225TE42CS**
ED	65	200	Copper			42	42	48	**AP13200TE42CS**
ED	65	150	Copper			42	42	48	**AP13150TE42CS**
ED	65	225	Copper	■		42	42	60	**AP13225TET42CS**
ED	65	200	Copper	■		42	42	60	**AP13200TET42CS**
ED	65	150	Copper	■		42	42	60	**AP13150TET42CS**
KD	65	400	Copper		■	42	42	72	**AP13400TKF42CS**
HKD	100	400	Copper		■	42	42	72	**AP13400THF42CS**
480Y/277 Vac									
HFD	65	225	Aluminum	■		30	30	48	**AP23225THT30AS**
HFD	65	200	Aluminum	■		30	30	48	**AP23200THT30AS**
HFD	65	150	Aluminum	■		30	30	48	**AP23150THT30AS**
HFD	65	225	Copper	■		30	30	48	**AP23225THT30CS**
HFD	65	200	Copper	■		30	30	48	**AP23200THT30CS**
HFD	65	150	Copper	■		30	30	48	**AP23150THT30CS**
HFD	65	225	Aluminum			42	42	48	**AP23225TH42AS**
HFD	65	200	Aluminum			42	42	48	**AP23200TH42AS**
HFD	65	150	Aluminum			42	42	48	**AP23150TH42AS**
HFD	65	225	Copper			42	42	48	**AP23225TH42CS**
HFD	65	200	Copper			42	42	48	**AP23200TH42CS**
HFD	65	150	Copper			42	42	48	**AP23150TH42CS**

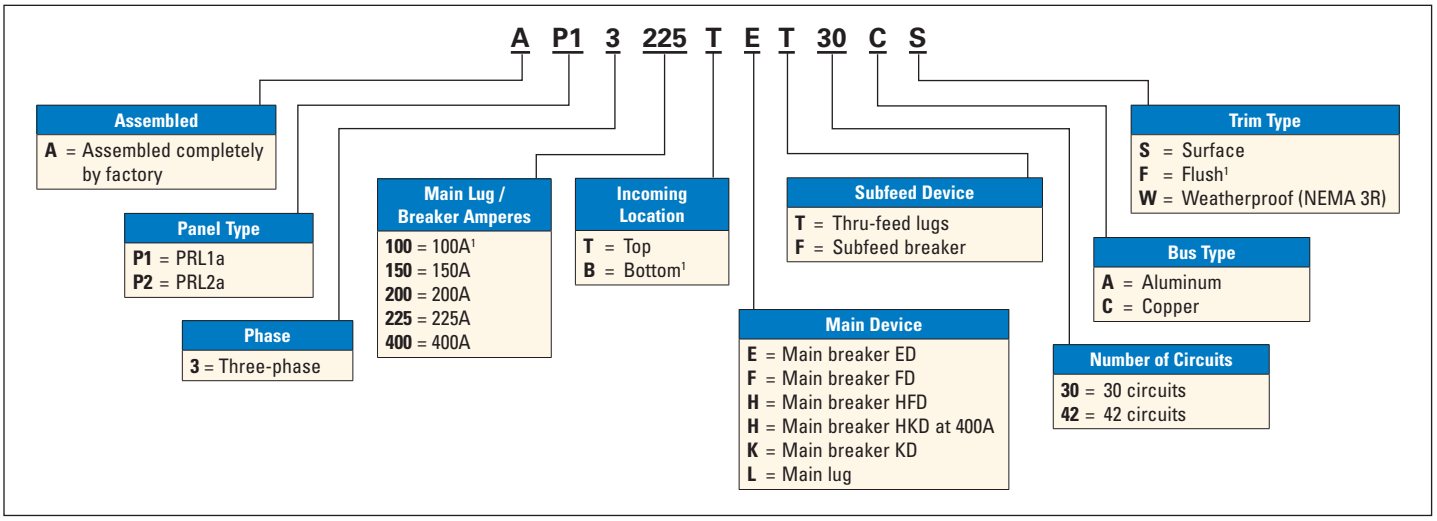
Main lug, three-phase, four-wire—top cable entry—NEMA 1 enclosure—trim surface mount

Ampere Rating	Bus Type	Thru-Feed Lugs	Subfeed Breaker Provision	Max. Number of Spaces	Max. Number of Circuits	Enclosure Height (Inches)	Catalog Number
208Y/120 Vac							
225	Aluminum	■		30	30	48	**AP13225TLT30AS**
225	Aluminum			42	42	42	**AP13225TL42AS**
400	Aluminum		■	42	42	72	**AP13400TLF42AS**
225	Copper	■		30	30	48	**AP13225TLT30CS**
225	Copper			42	42	42	**AP13225TL42CS**
400	Copper		■	42	42	72	**AP13400TLF42CS**
480Y/277 Vac							
225	Aluminum	■		30	30	48	**AP23225TLT30AS**
225	Copper	■		30	30	48	**AP23225TLT30CS**
225	Aluminum			42	42	42	**AP23225TL42AS**
225	Copper			42	42	42	**AP23225TL42CS**

Summary of branch breakers available

Breaker Type	Number of Poles	Ampere Rating	Voltage	kAIC Rating	Panel Type	Example
BAB	1	15–60	120V	10	PRL1a	**BAB1020**
	2	15–100	120/240V	10	PRL1a	**BAB2020**
	2	15–100	240V	10	PRL1a	**BAB2040H**
	2	15–100	240V	10	PRL1a	**BAB3030H**
QBGF	1	15–30	120V	10	PRL1a	**QBGF1020**
	2	15–40	120/240V	10	PRL1a	**QBGF2040**
QBHW	1	15–60	120V	22	PRL1a	**QBHW1020**
	2	15–100	120/240V	22	PRL1a	**QBHW2020**
	2	15–100	240V	22	PRL1a	**QBHW2040H**
	3	15–100	240V	22	PRL1a	**QBHW3030H**
GHQ	1	15–20	277V	14	PRL2a	**GHQ1020**
GHB	1	15–100	277V	14	PRL2a	**GHB1020**
	2	15–100	480Y/277V	14	PRL2a	**GHB2040**
	3	15–100	480Y/277V	14	PRL2a	**GHB3060**

Catalog numbering system



1. These items are not part of the initial launch.
Please consult VISTA or your Eaton sales engineer for product availability.

Features

- UL® 67 and UL 50 Listed
- 208Y/120V, three-phase four-wire
- 480Y/277V, three-phase four-wire
- Ratings up to 400A
- Aluminum or copper bus available
- Indoor enclosures
- Available for service entrance applications
- EZ Box™ and EZ Trim™

EZ Panel panelboards are offered under Eaton Pow-R-Stock^{Plus} program, a unique stocking program that provides unparalleled access to Eaton's light commercial construction solutions – allowing for more competitive pricing, simplified ordering, faster inventory turnover and enhanced customer service.

For more information, please contact your local Eaton sales representative or visit:
Eaton.com/EZpanel

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UL RATED FUSE ENCLOSURE

EZ BOX 13X32

Safety Switches

For more information on these products, order publications from Section 27.

General Duty Safety Switch Short Circuit Ratings

Maximum System Voltage	Ampere Rating	Switch Type	UL Listed Fusing		Enclosure Type
			Class	Withstand Rating (rms Sym Amps)	
240 Vac 250 Vdc	30-600[1]	Fusible[2]	K	10,000	N1 N3R
			H	10,000	
			R	100,000	
		Non-fusible	K	10,000	
			H	10,000	
			R	10,000	

TG4322

Heavy Duty Safety Switch Short Circuit Ratings

Maximum System Voltage	Ampere Rating	Switch Type	UL Listed Fusing		Enclosure Type
			Class	Withstand Rating (rms Sym Amps)	
600Vac 600Vdc	30-1200	Fusible	H	10,000	N1 N3R N4/4X N5 N12
			R	200,000[4]	
			J	200,000[4]	
			L[3]	100,000	
		Non-fusible[1]	H	10,000	
			R	10,000	
			J	10,000	
			L[3]	10,000	

TH3361SS

Double Throw Safety Switch Short Circuit Ratings

Maximum System Voltage	Ampere Rating	Switch Type	UL Listed Fusing		Enclosure Type
			Class	Withstand Rating (rms Sym Amps)	
600Vac	30-1200	Fusible	R	100,000	N1 N3R N4X
			J	100,000	
			T	100,000	
			L	100,000	
		Non-fusible[1]	R	10,000	
			J	10,000	
			T	10,000	
			L	10,000	

[1] Non-fusible switch withstand ratings apply when protected by corresponding listed fuse type.
[2] Class R fuse is not available for 400A or 600A General Duty switches.
[3] Class L fuses are only applicable when used with 800 and 1200A Type TC safety switches.
[4] Unless otherwise noted.

TC10323R

TDT3362

Enclosure Types

Type 1—Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection against falling dirt.

Type 3R—Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, and snow; and that will be undamaged by the external formation of ice on the enclosure

Type 4—Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water; and that will be undamaged by the external formation of ice on the enclosure.

Type 4X—Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, hose-directed water, and corrosion; and that will be undamaged by the external formation of ice on the enclosure.

Type 5—Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against settling airborne dust, lint, fibers, and flyings; and to provide a degree of protection against dripping and light splashing of liquids.

Type 12—Enclosures constructed (without knockouts) for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against circulating dust, lint, fibers, and flyings; and to provide a degree of protection against dripping and light splashing of liquids.

Application Note: For applications of disconnecting means in motor circuit applications, disconnect must be sized based on ampacity per NEC 430-110, but not less than 115% of Motor Name-Plate current.

Comparison of Specific Applications of Enclosures for Indoor Nonhazardous Locations

	Type of Enclosure				
Provides a Degree of Protection Against the Following Environmental Conditions	**1***	**4**	**4X**	**5**	**12**
Incidental contact with the enclosed equipment	X	X	X	X	X
Falling dirt	X	X	X	X	X
Falling liquids and light splashing	–	X	X	X	X
Circulating dust, lint, fibers, and flyings**	–	X	X	–	X
Settling airborne dust, lint, fibers, and flyings**	–	X	X	X	X
Hosedown and splashing water	–	X	X	–	–
Oil and coolant seepage	–	–	–	–	X
Corrosive agents	–	–	X	–	–

*These enclosures may be ventilated.

** These fibers and flyings are nonhazardous materials and are not considered Class III type ignitable fibers or combustible flyings. For Class III type ignitable fibers or combustible flyings see the National Electrical Code, Article 500.

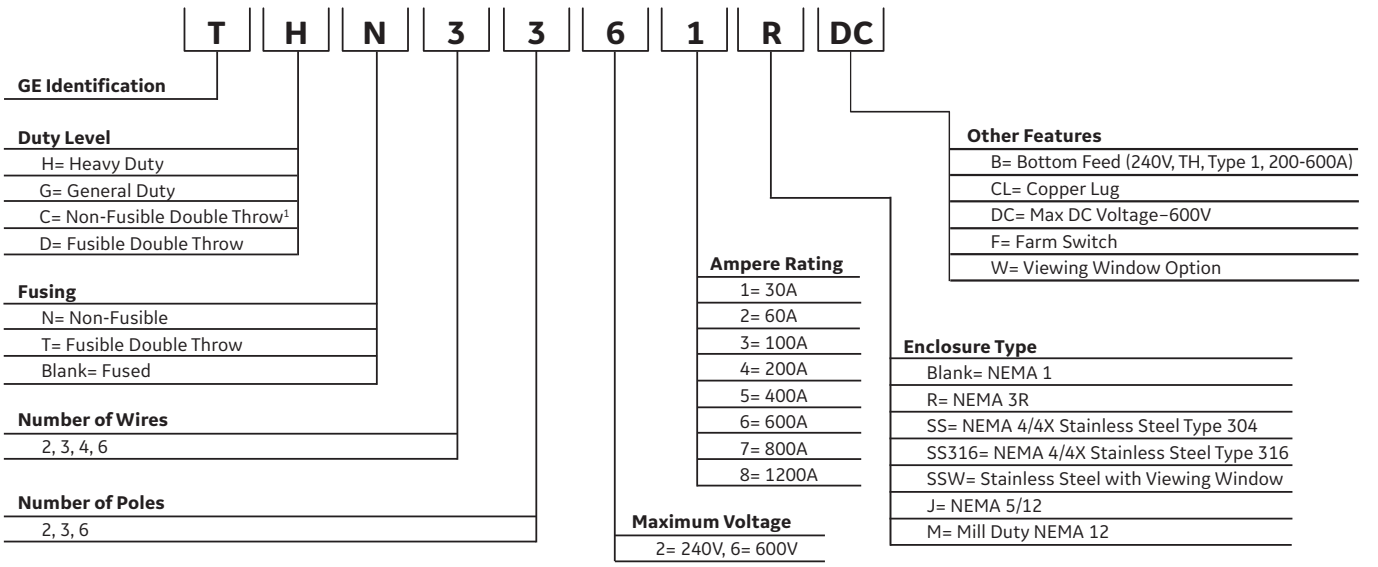
Applications of Enclosures for Outdoor Nonhazardous Locations

	Type of Enclosure		
Provides a Degree of Protection Against the Following Environmental Conditions	**3R***	**4**	**4X**
Incidental contact with the enclosed equipment	X	X	X
Rain, snow, and sleet**	X	X	X
Windblown dust, lint, fibers, and flyings	–	X	X
Hosedown	–	X	X
Corrosive agents	–	–	X

* These enclosures may be ventilated.

** External operating mechanisms are not required to be operable when the enclosure is ice covered.

Product Number Structure



[1] 800A and 1200A non-double throw safety switches also use the C nomenclature

Note: This information is provided for interpreting numbers. It should not be used to build product numbers.

Safety Switches
General Duty, Type TG

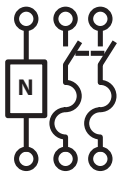
Spec-Setter™ Safety Switches
30-600 Amperes
240 Volts AC
250 Volts DC

Type TG Switches

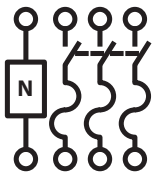
—Designed for residential or light commercial applications where duty is not severe
—30-600 amps
—240Vac / 250Vdc maximum in fusible or non-fusible units
—NEMA Type 1 (indoor) or NEMA Type 3R (outdoor) enclosures
—Direct-drive, quick-make, quick-break mechanism "snaps" contacts open and closed providing positive ON/OFF indication
—Self-leveling, three-point mounting system
—Integral cover interlock
—Visible confirmation of plated blade contact positions
—Spring reinforced fuse clips assure reliable contact for cool operation. Suitable for Class H, K, J or R fuses, where applicable.
—UL Listed short-circuit rating is 10,000 rms symmetrical amps standard
—With Class R fuses and fuse kits installed, 30-200 amp switches have UL Listed short circuit rating of 100,000 rms symmetrical amps
—UL Listed as service entrance equipment when installed in accordance with the National Electric Code

All GE General Duty safety switches carry the following certifications:

—UL Listed and cUL Listed (UL98 Enclosed Switches/CSA-C22.2 No. 4-04)
—Federal Specification WS-865C
—NEMA Enclosed Safety Switch Standard KS1-2013
—Seismic Certified



Fusible, Two-pole, 120/240 and 240 Volts AC; 250 Volts DC; Three-wire switching neutral, 240 Volts AC



Fusible, Four-wire switching neutral, 208/120 and 240 Volts AC

No Fuse, Two-pole, 240 Volts AC; 250 Volts DC (100-600 amps only); Three-pole, 240 Volts AC or Two-pole with Switching Neutral

General Duty Safety Switches

	Amperage Rating	Product Number NEMA Type 1 Indoor	Product Number NEMA Type 3 Outdoor	Horsepower Rating Single-Phase 240 Vac Standard Fuse	Horsepower Rating Single-Phase 240 Vac Time Delay	Horsepower Rating Three-Phase 240 Vac Standard Fuse	Horsepower Rating Three-Phase 240 Vac Time Delay	DC Hp 250 Vdc Standard Fuse	Neutral Kit Insulated, Groundable and Bondable
Fusible / 2 Pole / 3 Wire / 240V / 50/60 Hz									
	30	TG3221	TG3221R	1.5	3			5	Factory Installed
	60	TG3222	TG3222R	3	10			10	
	100	TG3223	TG3223R	7.5	15			20	
	200	TG3224[1]	TG3224R	15	15				
	400	TG3225[1,2]	TG3225R[2]						
	600	TG3226[1,2]	TG3226R[2]						
Fusible / 3 Pole / 4 Wire /240V / 50/60 Hz									
	30	TG4321	TG4321R	1.5	3	3	7.5	5	Factory Installed
	60	TG4322	TG4322R	3	10	7.5	15	10	
	100	TG4323	TG4323R	7.5	15	15	30	20	
	200	TG4324[1]	TG4324R	15	15	25	50		
	400	TG4325[1,2]	[4]			50	100		
	600	TG4326[1,2]	[4]			75	100		

	Amperage Rating	Product Number NEMA Type 1 Indoor	Product Number NEMA Type 3 Outdoor	Horsepower Rating Single-Phase 240 Vac Standard	Horsepower Rating Three-Phase 240 Vac Standard	DC Hp 250 Vdc Standard	Neutral Kit Insulated, Groundable and Bondable
Non-Fusible / 3 Pole / 3 Wire / 240V / 50 /60 Hz							
	30	TGN3321	TGN3321R	3	7.5	5	TNI21
	60	TGN3322[3]	TGN3322R[3]	10	15	10	
	100	TGN3323[3]	TGN3323R[3]	15	30	20	
	200	TGN3324[1]	TGN3324R	15	50		TNIA64
	400	TGN3325[1,2]	[4]		100		TNI65 or TNI65A
	600	TGN3326[1,2]	[4]		100		TNI66

For Type 3R Enclosure: 30-200 amp devices have removable closing cap. Order hubs for these devices separately on page 4-25.
Larger amp devices require field cut openings and customer-supplied hub.
General Duty safety switches are not suitable for use as service equipment in Canada. Use Heavy Duty safety switches.

[1] Add "B" suffix for factory reversed bottom feed. (e.g., TG3224B.) UL Listed.

[2] Single make– single break mechanism

[3] Not suitable for use as service equipment. Solid neutral not available.

[4] NEMA Type 3R Fusible or Non-Fusible versions, 400-600 ampere rating, available in heavy duty, type TH models. See pages 4-8 to 4-10.

Spec-Setter™ Safety Switches
30-1200 Amperes
240 Volts AC
250 Volts DC

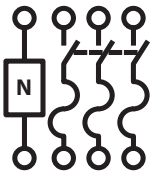
Type TH Switches

—Designed for commercial and industrial applications where safety, high performance and continuity of service are essential
—30-1200 amps
—600Vac maximum, 600Vdc maximum in fusible or non-fusible units
—NEMA Type 1 (indoor), Type 3R (outdoor), Type 4/4X (water and dust-tight, corrosion resistant) or Type 5/12 (drip and dust-tight) enclosures
—Donut handle ideal for hook stick operation and accepts 3 padlocks in the OFF position
—Direct-drive, quick-make, quick-break mechanism "snaps" contacts open and closed providing positive ON/OFF indication
—Self-leveling, three-point mounting system
—Coin-proof, defeatable interlock
—Visible confirmation of plated blade contact positions
—Spring reinforced fuse clips assure reliable contact for cool operation. Suitable for Class H, K, J or R fuses, where applicable.
—With Class R fuses or J fuses, 30-600 amp switches have UL Listed short circuit rating of 200,000 rms symmetrical amps
—Switches rated 800-1200 amps use Class L fuses and have a UL Listed short circuit rating of 100,00 rms symmetrical amps
—UL Listed as service entrance equipment when installed in accordance with the National Electric Code

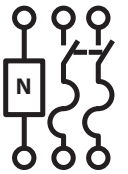
All GE Heavy Duty safety switches carry the following certifications:

—UL Listed and cUL Listed (UL98 Enclosed Switches/CSA-C22.2 No. 4-04)
—Federal Specification WS-865C
—NEMA Enclosed Safety Switch Standard KS1-2013
—Seismic Certified

Fusible, Two-pole, 240 Volts AC; 250 Volts DC and Fusible Two-pole, 600 Volts DC, (2 poles in series for 600 Vdc)



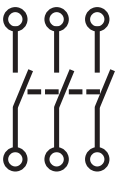
Fusible, Four-wire switching neutral, 208/120 and 240 Volts AC



Fusible, Three-pole, Three-wire switching neutral, 120/240 and 240 Volts AC

Non-fusible, Two-pole, 600 Volts DC

Fusible, Three-pole, 240 Volts AC 480, 480Y/277 and 600 Volts AC-250 Volts DC



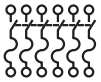
Non-fusible, Three-pole, 480 and 600 Volts AC-250 Volts DC or Two-pole with switching neutral

Heavy Duty Safety Switches

	Amperage Rating	Product Number NEMA Type 1 Indoor	Product Number NEMA Type 3R Outdoor	Product Number NEMA Type 5, 12	Horsepower Rating Single-Phase 240 Vac Standard Fuse	Horsepower Rating Single-Phase 240 Vac Time Delay	Horsepower Rating Three-Phase 240 Vac Standard Fuse	Horsepower Rating Three-Phase 240 Vac Time Delay	DC Hp 250 Vdc Standard Fuse
Fusible / 2 Pole / 3 Wire / 240V / 50/60 Hz *(Neutral factory installed)*									
	30	TH3221	TH3221R	TH3221J[4]	1.5	3			5
	60	TH3222	TH3222R	TH3222J[4]	3	10			10
	100	TH3223	TH3223R	TH3223J[4]	7.5	15			20
	200	TH3224[1,2]	TH3224R[2]	TH3224J[4]	15				40
	400	TH3225[1,2]	TH3225R[2]	TH3225J			50	125	50
	600	TH3226[1,2]	TH3226R[2]	TH3226J			75	200	50
	800	TC72267[3,6,7]	TC72267R[3,6,7]						
	1200	TC72268[3,6,7]	TC72268R[3,6,7]						

	Amperage Rating	Product Number NEMA Type 1 Indoor	Product Number NEMA Type 3R Outdoor	Product Number NEMA Type 5, 12	Horsepower Rating Single-Phase 240 Vac Standard Fuse	Horsepower Rating Single-Phase 240 Vac Time Delay	Horsepower Rating Three-Phase 240 Vac Standard Fuse	Horsepower Rating Three-Phase 240 Vac Time Delay	DC Hp 250 Vdc Standard Fuse
Fusible / 3 Pole / 3 Wire / 240V / 50/60 Hz									
	30			TH3321J[4]	1.5	3	3	7.5	5
	60			TH3322J[4]	3	10	7.5	15	10
	400	TH3325[1]	TH3325R				50	125	50
	600	TH3326[1]	TH3326R				75	200	50
Fusible / 3 Pole / 4 Wire / 240V / 50/60 Hz *(Neutral factory installed)*									
	30	TH4321	TH4321R	TH4321J[4]	1.5	3	3	7.5	5
	60	TH4322	TH4322R	TH4322J[4]	3	10	7.5	15	10
	100	TH4323	TH4323R	TH4323J[4]	7.5	15	15	30	20
	200	TH4324[1,2]	TH4324R[2]	TH4324J[4]	15		25	60	40
	400	TH4325[1,2]	TH3325R[5,8]	TH4325J			50	125	50
	600	TH4326[1,2]	TH3326R[5,9]	TH4326J			75	200	50

Heavy Duty Safety Switches 6-Pole

	Amperage Rating	Product Number NEMA Type 1, 3R, 5, 12 Indoor/Outdoor	Horsepower Rating Single-Phase 240 Vac Standard Fuse	Horsepower Rating Single-Phase 240 Vac Time Delay	Horsepower Rating Three-Phase 240 Vac Standard Fuse	Horsepower Rating Three-Phase 240 Vac Time Delay	DC Hp 250 Vdc Standard Fuse
Fusible / 6 Pole / 6 Wire / 240V / 50/60 Hz							
	30	TH6621	1.5	3	3	7.5	5
	60	TH6622	3	10	7.5	15	10
	100	TH6623	7.5	15	15	30	20
	200	TH6624	15		25	60	40

[1] Type 1 Enclosure: 200-600 Amp devices available factory reversed for bottom feed. Add "B" suffix.
[2] For switches CSA Certified for service entrance, add "C" suffix.
[3] For switches suitable for service entrance applications in Canada, order TH3267C, TH3267RC, TH3268C and TH3268RC.
[4] Available with Viewing Window. Add "W" suffix.
[5] For switches suitable for service entrance applications in Canada, order TH4325RC and TH4326RC.
[6] Rated 600 Vac only. Accepts Class L fuses only. Type HD electrical performance does not apply.
[7] 3 wire with neutral kit ordered separately. For 800A use TNI67; for 1200A use TNI68A.
[8] 4 wire with neutral kit ordered separately. For 400A use TNI65 or TNI65A.
[9] 4 wire with neutral kit ordered separately. For 600A use TNI66.

Note: Many Heavy Duty Switches are available with a Stainless Steel enclosure. See page 4-12.

Safety Switches
Heavy Duty, Type TH
Spec-Setter™ Safety Switches
30-1200 Amperes
240 Volts AC
250 Volts DC

Heavy Duty Safety Switches

	Amperage Rating	Product Number NEMA Type 1 Indoor	Product Number NEMA Type 3R Outdoor	Horsepower Rating Three-Phase 240 Vac Standard Fuse	Three-Phase 240 Vac Time Delay	Single-Phase 480 Vac Standard Fuse	Single-Phase 480 Vac Time Delay	Three-Phase 480 Vac Standard Fuse	Three-Phase 480 Vac Time Delay	Single-Phase 600 Vac Standard Fuse	Single-Phase 600 Vac Time Delay	Three-Phase 600 Vac Standard Fuse	Three-Phase 600 Vac Time Delay	DC Hp 125 Vdc Standard Fuse	DC Hp 250 Vdc Standard Fuse
Fusible / 2 Pole / 2 Wire / 600V / 50/60 Hz															
	800	TC72267[1,2,7]	TC72267R[1,2,7]												
	1200	TC72268[1,2,7]	TC72268R[1,2,7]												
Fusible / 3 Pole / 3 Wire / 600V / 50/60 Hz															
	30	TH3361	TH3361R		7.5	3	7.5	5	15	3	10	7.5	20		5
			TH3361RF[5]												
			TH3361RF2[5]												
	60	TH3362	TH3362R			5	20	15	30	10	25	15	50	5	10
			TH3362RF[5]												
	100	TH3363	TH3363R			10	30	25	60	15	40	30	75		20
	200	TH3364[3]	TH3364R[6]			25	50	50	125	30	50	60	150		40
	400	TH3365[3]	TH3365R	50	125			100	250			125	350		50
	600	TH3366[3]	TH3366R	75	200			150	400			200	500		50
	800	TC72367[2,4]	TC72367R[4]												
	1200	TC72368[2,4]	TC72368R[4]												
Fusible / 3 Pole / 4 Wire / 600V / 50/60 Hz CSA Certified for service entrance *(Neutral factory installed)*															
	200	TH4364C	TH4364RC			25	50	50	125	30	50	60	150		40
	400	TH4365C	TH4365RC	50	125			100	250			125	350		50
	600	TH4366C	TH4366RC	75	200			150	400			200	500		50
	800	TH4367C	TH4367RC												
	1200	TH4368C	TH4368RC												

	Amperage Rating	Product Number NEMA Type 5, 12 Indoor	Product Number NEMA Type 3R, 5, 12 Outdoor	Horsepower Rating Three-Phase 240 Vac Standard Fuse	Three-Phase 240 Vac Time Delay	Single-Phase 480 Vac Standard Fuse	Single-Phase 480 Vac Time Delay	Three-Phase 480 Vac Standard Fuse	Three-Phase 480 Vac Time Delay	Single-Phase 600 Vac Standard Fuse	Single-Phase 600 Vac Time Delay	Three-Phase 600 Vac Standard Fuse	Three-Phase 600 Vac Time Delay	DC Hp 125 Vdc Standard Fuse	DC Hp 250 Vdc Standard Fuse
Fusible / 3 Pole / 3 Wire / 600V / 50/60 Hz															
	30	TH3361J[6]	TH3361JR		7.5	3	7.5	5	15	3	10	7.5	20		5
	60	TH3362J[6]	TH3362JR			5	20	15	30	10	25	15	50	5	10
	100	TH3363J[6]	TH3363JR			10	30	25	60	15	40	30	75		20
	200	TH3364J[6]	TH3364JR			25	50	50	125	30	50	60	150		40
	400	TH3365J	TH3365JR	50	125			100	250			125	350		50
	600	TH3366J	TH3366JR	75	200			150	400			200	500		50

Heavy Duty Safety Switches 6-Pole

	Amperage Rating	Product Number NEMA Type 1, 3R, 5, 12 Indoor/Outdoor	Horsepower Rating Single-Phase 480 Vac Standard Fuse	Single-Phase 480 Vac Time Delay	Three-Phase 480 Vac Standard Fuse	Three-Phase 480 Vac Time Delay	Single-Phase 600 Vac Standard Fuse	Single-Phase 600 Vac Time Delay	Three-Phase 600 Vac Standard Fuse	Three-Phase 600 Vac Time Delay	DC Hp 250 Vdc Standard Fuse
Fusible / 6 Pole / 6 Wire / 600V / 50/60 Hz											
	30	TH6661	3	7.5	5	15	3	10	7.5	20	5
	60	TH6662	5	20	15	30	10	25	15	50	10
	100	TH6663	10	30	25	60	15	40	30	75	20
	200	TH6664	25	50	50	125	30	50	60	150	40

[1] 3 wire with neutral kit ordered separately. For 800A use TNI67; for 1200A use TNI68A.
[2] Rated 600 Vac only. Accepts Class L fuses only. Type HD electrical performance does not apply.
[3] Type 1 Enclosure: 200-600 Amp devices available, factory reversed for bottom feed. Add "B" suffix.
[4] 4 wire with neutral kit ordered separately. For 800A use TNI67; for 1200A use TNI68A.
[5] Farm Switch with oversize Type 3R enclosure with vertical hinge. See page 4-28 for dimensions.
[6] Available with Viewing Window. Add "W" suffix.
[7] For switches suitable for service entrance applications in Canada, order TH3267C, TH3267RC, TH3268C and TH3268RC.

Safety Switches
Heavy Duty, Type TH
Spec-Setter™ Safety Switches
30-1200 Amperes
240, 480, 600 Volts AC
600 Volts DC

Heavy Duty Safety Switches

	Amperage Rating	Product Number NEMA Type 1 Indoor	NEMA Type 3R Outdoor	NEMA Type 5, 12	Horsepower Rating Single-Phase 240 Vac Standard	Three-Phase 240 Vac Standard	Single-Phase 480 Vac Standard	Three-Phase 480 Vac Standard	Single-Phase 600 Vac Standard	Three-Phase 600 Vac Standard	DC Hp 250 Vdc Standard
Non-Fusible / 3 Pole / 3 Wire / 240V / 50/60 Hz											
	30	THN3321			3	10					5
Non-Fusible / 3 Pole / 3 Wire / 600V / 50/60 Hz											
	30	THN3361[2]	THN3361R	THN3361J[2,3]	3	10	7.5	20	10	30	5
			THN3361RF[4]								
			THN3361RF2[4]								
	60	THN3362[2]	THN3362R	THN3362J[2,3]	10	20	20	50	25	60	10
			THN3362RF[4]								
	100	THN3363[2]	THN3363R	THN3363J[2,3]	20	40	30	75	40	100	20
	200	THN3364[1,2]	THN3364R	THN3364J[3]	30	60	50	125	50	150	40
	400	THN3365[1]	THN3365R	THN3365J		125		250		350	50
	600	THN3366[1]	THN3366R	THN3366J		200		400		500	50
	800	TC36367									
	1200	TC36368									

Heavy Duty Safety Switches 6-Pole

Non-Fusible / 6 Pole / 6 Wire / 600V / 50/60 Hz									
	30	THN6661	3	7.5		15	10	20	5
	60	THN6662	10	20		30	25	50	10
	100	THN6663	15	30		60	40	75	20
	200	THN6664	15	50		125	50	150	40

[1] Type 1 Enclosure: 200-600 Amp devices available factory reversed for bottom feed. Add "B" suffix.
[2] Available with Copper Lug. Add "CL" suffix
[3] Available with Viewing Window. Add "W" suffix.
[4] Farm switch with oversize Type 3R enclosure and vertical hinge. See page 4-28 for dimensions.

DC Rated Heavy Duty Safety Switches

	Amperage Rating	Product Number NEMA Type 1 Indoor	NEMA Type 3R Outdoor	NEMA Type 5, 12	DC Horsepower Ratings 125 Vdc Standard Fuse	125 Vdc Time Delay	250 Vdc Standard Fuse	600 Vdc Standard Fuse	600 Vdc Time Delay
Fusible / 2 Pole / 2 Wire / 600Vdc / 50/60 Hz									
	30	TH2261DC	TH2261RDC	TH2261JDC	2	3	5	10	15
	60	TH2262DC	TH2262RDC	TH2262JDC	5		10	25	
	100	TH2263DC	TH2263RDC	TH2263JDC			20	25	
Non-Fusible / 2 Pole / 2 Wire / 600Vdc / 50/60 Hz									
	30	THN2261DC	THN2261RDC	THN2261JDC	3		5	15	
	60	THN2262DC	THN2262RDC	THN2262JDC	5		10	25	
	100	THN2263DC	THN2263RDC	THN2263JDC			20	25	

Interlocked Receptacle Switches

	Amperage Rating	Product Number NEMA Type 5, 12 Indoor	NEMA Type 4/4X	Receptacle Manufacturer	Mating Receptable	Horsepower Rating
Fusible / 3 Pole / 3 Wire / 600V / 50/60 Hz						
	60	TH3362JCH	TH336JCHSS	Crouse Hinds	Arktite #APJ6485	For horsepower ratings, see switch without "CH" or "CHSS" suffix.
Non-Fusible / 3 Pole / 3 Wire / 600V / 50/60 Hz						
	60	THN3362JCH	THN3362JCHSS	Crouse Hinds	Arktite #APJ6485	For horsepower ratings, see switch without "CH" or "CHSS" suffix.

Heavy Duty Stainless Steel, Type TH

Spec-Setter™ Safety Switches
30-600 Amperes
240, 600 Volts AC
600 Volts DC

Heavy Duty Stainless Steel, Type TH

—Designed for commercial and industrial applications in **corrosive environments** where safety, high performance and continuity of service are essential.
—30-600 amps
—600 Vac maximum, 600 Vdc maximum in fusible or non-fusible units, indoor or outdoor enclosures
—Donut handle ideal for hook stick operation and accepts 3 padlocks in the OFF position
—Three or four welded mounting brackets
—Spring reinforced fuse clips assure reliable contact for cool operation. Suitable for Class H, K, J or R fuses.
—The conductor rating is 60/75°C
—Short circuit ratings are UL Listed to 200,000 rms symmetrical amps when Class J or R fuses are installed
—Horsepower ratings are to UL Listed maximums
—UL Listed as service entrance equipment when installed in accordance with the National Electric Code

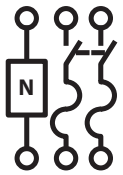
We offer two types of NEMA 4X enclosures:

—**Grade 304 Stainless Steel (order product numbers with SS suffix)**
NEMA Type 4X Grade 304 Stainless Steel
—Helps protects against falling dirt, rain, sleet, snow, wind-blown dust, splashing water, hose-directed water and corrosion
—Applications in harsh environments such as food and beverage, coastal, mining

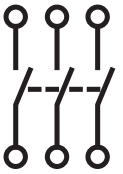
—**Grade 316 Stainless Steel (order product numbers with SS316 suffix)**
NEMA Type 4X 316 Stainless Steel, Water and Dust-tight
—Chemical composition that makes it more resistant to general corrosion and pitting/crevice corrosion than 304 Stainless Steel
—Higher creep, stress-to-rupture and tensile strength at elevated temperatures than 304 Stainless Steel
—Excellent resistance to reducing acids and similar media
—Provides enhanced protection over 304 Stainless Steel in environments with salts and chemicals
—Applications in extremely harsh environments such as water/waste water, marine

All GE Heavy Duty Stainless Steel safety switches carry the following certifications:

—UL Listed and cUL Listed (UL98 Enclosed Switches/CSA-C22.2 No. 4-04)
—Federal Specification WS-865C
—NEMA Enclosed Safety Switch Standard KS1-2013
—Seismic Certified



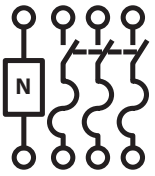
Fusible, Two-pole, Three-wire switching neutral, 240 Volts AC, 250 Volts DC



Non-fusible, Three-pole, Three -wire, 600 Volts AC

Fusible, Three-pole, Three-wire, 600 Volts AC

Fusible, Two-pole, Two-wire, 600 Volts DC



Fusible, Three-pole, Four-wire switching neutral, 240 Volts AC

Non-fusible, Two-pole, Two-wire, 600 Volts DC

Heavy Duty Stainless Steel, Type TH

Spec-Setter™ Safety Switches
30-600 Amperes
240, 600 Volts AC
600 Volts DC

NEMA Type 4X Enclosure Grade 304 Stainless Steel (see footnote below for 316 Stainless Steel offering)

			Horsepower Ratings				DC Horsepower Ratings
			Single-Phase 240 Vac		Three-Phase 240 Vac		250 Vdc
	Amperage	Product Number	Standard Fuse	Time Delay	Standard Fuse	Time Delay	Standard Fuse
Fusible / 2 Pole / 2 Wire / 240V / 50/60 Hz							
	30	TH2221SS[1,2]	1.5	3			5
	60	TH2222SS[1,2]	3	10			10
Fusible / 2 Pole / 3 Wire / 240V / 50/60 Hz *(Neutral factory installed)*							
	30	TH3221SS[1,2]	1.5	3			5
	60	TH3222SS[1,2]	3	10			10
	100	TH3223SS[1,2]	7.5	15			20
	200	TH3224SS[1,2]	15				40
	400	TH3225SS			50	125	50
	600	TH3226SS			75	200	50
Fusible / 3 Pole / 3 Wire / 240V / 50/60 Hz							
	30	TH3321SS[1,2]	1.5	3	3	7.5	5
	60	TH3322SS[1,2]	3	10	7.5	15	10
Fusible / 3 Pole / 4 Wire / 240V / 50/60 Hz *(Neutral factory installed)*							
	30	TH4321SS[1,2]	1.5	3	3	7.5	5
	60	TH4322SS[1,2]	3	10	7.5	15	10
	100	TH4323SS[1,2]	7.5	15	15	30	20
	200	TH4324SS[1,2]	15		25	60	40
	400	TH4325SS			50	125	50
	600	TH4326SS			75	200	50

			Horsepower Ratings								DC Horsepower Ratings		
			Three-Phase 240 Vac		Single-Phase 480 Vac		Three-Phase 480 Vac		Single-Phase 480 Vac		Three-Phase 600 Vac		125 Vdc		250 Vdc
	Amperage	Product Number	Std Fuse	Time Delay	Std Fuse	Time Delay	Std Fuse	Time Delay	Std Fuse	Time Delay	Std Fuse	Time Delay	Std Fuse	Time Delay	Std Fuse
Fusible / 3 Pole / 3 Wire / 600V / 50/60 Hz															
	30	TH3361SS[1,2,4]		7.5	3	7.5	5	15	3	10	7.5	20	2	3	5
	60	TH3362SS[1,2,4]			5	20	15	30	10	25	15	50	5		10
	100	TH3363SS[1,2,4]			10	30	25	60	15	40	30	75			20
	200	TH3364SS[1,2,4]			25	50	50	125	30	50	60	150			40
	400	TH3365SS[4]	50	125			100	250			125	350			50
	600	TH3366SS[4]	75	200			150	400			200	500			50
Non-Fusible / 3 Pole / 3 Wire / 600V / 50/60 Hz															
	30	THN3361SS[1,2,3,4]	10		7.5		20		10		30		3		5
	60	THN3362SS[1,2,3,4]	20		20		50		25		60		5		10
	100	THN3363SS[1,2,4]	40		30		75		40		100				20
	200	THN3364SS[1,2,3,4]	60		50		125		50		150				40
	400	THN3365SS[4]	125				250				350				50
	600	THN3366SS[4]	200				400				500				50

DC Rated Heavy Duty Stainless Steel Safety Switches

			DC Horsepower Ratings					
			125 Vdc		250 Vdc		600 Vdc	
	Amperage	Product Number	Standard Fuse	Time Delay	Standard Fuse	Time Delay	Standard Fuse	Time Delay
Fusible / 2 Pole / 2 Wire / 600Vdc / 50/60 Hz								
	30	TH2261SSDC	2	3	5		10	15
	60	TH2262SSDC	5		10		25	
	100	TH2263SSDC			20		25	
Non-Fusible / 2 Pole / 2 Wire / 600Vdc / 50/60 Hz								
	30	THN2261SSDC	3		5		15	
	60	THN2262SSDC	5		10		25	
	100	THN2263SSDC			20		25	

[1] For switches manufactured in the USA, add BA suffix.
[2] Available with Viewing Window - add W suffix
[3] Available with Copper Lugs - add CL suffix
[4] Available in NEMA Type 4X Enclosure Grade 316 Stainless Steel - add "316" suffix.

Selected Double Throw safety switches available in stainless steel. Refer to page 4-16.
Note: See page 4-2 for Short Circuit Ratings and page 4-20 for Lug Wire Sizes Line and Load Terminals.

Safety Switches
Mill Duty, Type TH

Spec-Setter™ Safety Switches
30-600 Amperes
240, 480, 600 Volts AC
250, 600 Volts DC

Mill Duty, Type TH Switches

—Designed for mill, foundry and industrial applications where safety, high performance and continuity of service are required
—30-600 amps
—600Vac maximum, 600Vdc maximum in fusible or non-fusible units
—NEMA Type 4/4X Grade 304 Stainless Steel (hose directed, splashing and falling liquids, dust, lint, fibers, coolants, metal filings)
—NEMA Type 12 (dust, lint, fibers, coolants, metal filings and other non-corrosive contaminants) enclosures
—Donut handle ideal for hook stick operation and accepts 3 padlocks in the OFF position
—Manual interlock defeat knob permits contact inspection when switch is in the OFF position
—Three or four point mounting brackets
—Spring reinforced fuse clips assure reliable contact for cool operation. Suitable for Class H, K, J or R fuses, where applicable.
—Equipment ground lugs provided. Lugs approved for both copper and aluminum wire; 60/75°C rated tang lugs are field convertible to compression (crimp) connectors
—Short circuit ratings are UL Listed to 200,000 rms symmetrical amps when Class J or R fuses are installed
—UL Listed as service entrance equipment when installed in accordance with the National Electric Code

All GE Mill Duty safety switches carry the following certifications:

—UL Listed and cUL Listed (UL98 Enclosed Switches/CSA-C22.2 No. 4-04)
—Federal Specification WS-865C
—NEMA Enclosed Safety Switch Standard KS1-2013
—Seismic Certified

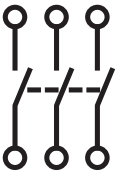
Fusible, Two-pole, 240 Volts AC - 250 Volts DC

Fusible, Three-pole, 240 Volts AC, Fusible

Fusible, Two-pole, 240 Volts AC; 250 Volts DC and Fusible, Two-pole, 600 Volts DC (2 poles in series for 600 Vdc)

Fusible, Three-pole, 480 and 600 Volts AC - 250 Volts DC

Non-fusible, Two-pole, 600 Volts DC



Non-fusible, Three-pole, 480 and 600 Volts AC - 250 Volts DC

Safety Switches
Mill Duty, Type TH

Spec-Setter™ Safety Switches
300-600 Amperes
240, 480, 600 Volts AC
250, 600 Volts DC

Mill Duty Safety Switches

	Amperage Rating	Product Number[2] NEMA Type 12	NEMA Type 4X Grade 304 Stainless Steel	Horsepower Rating Single-Phase 240 Vac Standard Fuse	Single-Phase 240 Vac Time Delay	Three-Phase 240 Vac Standard Fuse	Three-Phase 240 Vac Time Delay	DC Horsepower Rating 250 Vdc Standard Fuse
Fusible / 2 Pole / 2 Wire / 240V / 50/60 Hz								
	30	TH2221M	TH2221MSS	1.5	3			5
	60	TH2222M	TH2222MSS	3	10			10
	100	TH2223M	TH2223MSS	7.5	15			10
	200	TH2224M	TH2224MSS	15				40
Fusible / 3 Pole / 3 Wire / 240V / 50/60 Hz								
	30	TH3321M	TH3321MSS	1.5	3	3	7.5	5
	60	TH3322M[1]	TH3322MSS	3	10	7.5	15	10
	100	TH3323M	TH3323MSS	7.5	15	15	30	20
	200	TH3324M	TH3324MSS	15		25	60	40
	400	TH3325M	TH3325MSS			50	125	50
	600	TH3326M	TH3326MSS			75	200	50

	Amperage Rating	Product Number[2] NEMA Type 12	NEMA Type 4X Grade 304 Stainless Steel	Horsepower Rating Three-Phase 240 Vac Standard Fuse	Three-Phase 240 Vac Time Delay	Single-Phase 480 Vac Standard Fuse	Single-Phase 480 Vac Time Delay	Three-Phase 480 Vac Standard Fuse	Three-Phase 480 Vac Time Delay	Single-Phase 600 Vac Standard Fuse	Single-Phase 600 Vac Time Delay	Three-Phase 600 Vac Standard Fuse	Three-Phase 600 Vac Time Delay	DC Horsepower Rating 125 Vdc Standard Fuse	125 Vdc Time Delay	250 Vdc Standard Fuse
Fusible / 3 Pole / 3 Wire / 600V / 50/60 Hz																
	30	TH3361M[1]	TH3361MSS		7.5	5	7.5	5	15	3	10	7.5	20	2	3	5
	60	TH3362M	TH3362MSS[1]			5	20	15	30	10	25	15	50	5		10
	100	TH3363M	TH3363MSS			10	30	25	60	15	40	30	75			20
	200	TH3364M	TH3364MSS			25	50	50	125	30	50	60	150			40
	400	TH3365M	TH3365MSS	50	125			100	250			125	350			50
	600	TH3366M	TH3366MSS	75	200			150	400			200	500			50
Non-Fusible / 3 Pole / 3 Wire / 600V / 50/60 Hz																
	30	THN3361M	THN3361MSS[1]	10		7.5		20		10		30				5
	60	THN3362M[1]	THN3362MSS	20		20		50		25		60				10
	100	THN3363M	THN3363MSS	40		30		75		40		100				20
	200	THN3364M	THN3364MSS	60		50		125		50		150				40
	400	THN3365M	THN3365MSS	125				250				350				50
	600	THN3366M	THN3366MSS	200				400				500				50

DC Rated Mill Duty Safety Switches

	Amperage Rating	Product Number[2] NEMA Type 12	Horsepower Rating 125 Vdc Standard Fuse	125 Vdc Time Delay	250 Vdc Standard Fuse	250 Vdc Time Delay	600 Vdc Standard Fuse	600 Vdc Time Delay
Fusible / 2 Pole / 2 Wire / 600Vdc / 50/60 Hz								
	30	TH2261MDC	2	3	5		10	15
	60	TH2262MDC	5		10		25	
	100	TH2263MDC			20		25	
Non-Fusible / 2 Pole / 2 Wire / 600Vdc / 50/60 Hz								
	30	THN2261MDC	3		5		15	
	60	THN2262MDC	5		10		25	
	100	THN2263MDC			20		25	

[1]Available with Viewing Window - add W suffix.

[2]All Mill Duty switches accept neutral and auxiliary contact kits. Order from page 4-20 and 4-21.

Type TH Interrupting and Withstand Ratings

Ampere Rating	Interrupting Rating Amps[3] Symmetrical 600 volts AC, 3-phase	Fuse Clearing[4] ($I^2t \times 10^3$)
30A	360	50
60A	1200	200
100A	1200	500
200A	3,400	2,000
400A	10,000	6,000
600A	10,000	12,000

[3]Maximum current at rated voltage that switch will interrupt three times without assistance from an external device.

[4]Peak let-through energy for withstandability and circuit closing tests.

Lug Wire Sizes Line and Load Terminals

Ampere Rating	Wire Range AWG/kcmil Copper	Wire Range AWG/kcmil Aluminum
30A (240V)	14-8	12-8
30A (600V)	14-6	14-6
60A	14-2	14-2
100A	14-1/0	12-1/0
200A	2-250	–
400A	(1) 2-600 or (2) 1/0-250	–
600A	(2) 4-600	–

Double Throw Switches

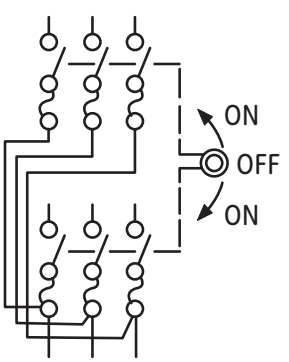
Spec-Setter™ Safety Switches
Type TC, Type TDT
240, 480, 600 Volts AC
250 Volts DC

Non-Fused Double Throw Type TC
Fusible Double Throw Type TDT

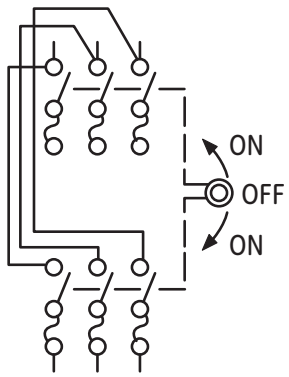
—Designed for application where safety, high performance, and continuity of service are required
—Highly visible ON/OFF label
—Bright red handle
—Self-leveling three point mounting pattern
—Lockable three position (ON-OFF-ON) handle
—Lockable cover latch
—60°C and 75°C conductor ratings
—Quick-make, quick-break mechanisms 30-1200 amps
—Use of common fuses in stacked design 600-1200 amps; fewer fuses required and reduced enclosure size

Our Double Throw safety switches meet the following standards:

—UL Listed and cUL Listed (UL98 Enclosed Switches/CSA-C22.2 No. 4-04)
—Federal Specification W-S-865C
—NEMA Enclosed Switch Standard KS1 – 2013
—Seismic Certified



Fusible / 3 Pole / 3 Wire / Two Sources / One Load

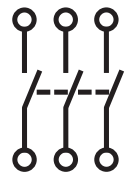


Fusible / 3 Pole / 3 Wire / Two Loads / One Source

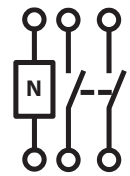
TC35322, Type TC Indoor Double Throw Switch

TDT3362, Type TDT Indoor Double Throw Switch

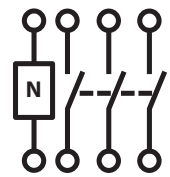
Non-fusible, Three-pole, Three-wire, 240 Volts AC, 250 Volts DC



Non-fusible, Three-pole, Three-wire, 600 Volts AC, 250 Volts DC



Non-fusible, Three-wire switching neutral, 120/240 Volts AC



Non-fusible, Four-wire switching neutral, 240 Volts AC

Safety Switches
Double Throw Switches
Spec-Setter™ Safety Switches
Type TC, Type TDT
240, 480, 600 Volts AC
250 Volts DC

Fusible

Amperage Rating	Product Number: NEMA Type 1 Indoor	Product Number: NEMA Type 3R Outdoor	Horsepower Rating: Single-Phase 120 Vac Std Fuse	Single-Phase 120 Vac Time Delay	Single-Phase 240 Vac Std Fuse	Single-Phase 240 Vac Time Delay	Three-Phase 120 Vac Std Fuse	Three-Phase 120 Vac Time Delay	Three-Phase 240 Vac Std Fuse	Three-Phase 240 Vac Time Delay	Three-Phase 480 Vac Std Fuse	Three-Phase 480 Vac Time Delay	Three-Phase 600 Vac Std Fuse	Three-Phase 600 Vac Time Delay	DC Horsepower Rating: 125 Vdc Std Fuse	125 Vdc Time Delay	250 Vdc Std Fuse	250 Vdc Time Delay
Fusible / 3 Pole / 3 Wire / 240V																		
30	TDT3321	TDT3321R	0.5	2	1.5	3	1.5	3	3	7.5					2	3	5	5
60	TDT3322	TDT3322R	1.5	3	3	10	3	7.5	7.5	15					5		10	10
100	TDT3323[1]	TDT3323R[1]			7.5	15			15	30							20	
200	TDT3324[1]	TDT3324R[1]			15	15			25	60							40	40
400	TDT3325[1]	TDT3325R[1]							50	125							50	
600	TDT3326[3,4]	TDT3326R[3,4]							50	125	100	250	125	350			50	50
800	TDT3327[3,4]	TDT3327R[3,4]							100	125								
1200	TDT3328[4]	TDT3328R[4]																

Amperage Rating	Product Number: NEMA Type 1 Indoor	Product Number: NEMA Type 3R Outdoor	Product Number: NEMA Type 4X Stainless Steel	Horsepower Rating: Single-Phase 120 Vac Std Fuse	Single-Phase 120 Vac Time Delay	Single-Phase 240 Vac Std Fuse	Single-Phase 240 Vac Time Delay	Single-Phase 480 Vac Std Fuse	Single-Phase 480 Vac Time Delay	Single-Phase 600 Vac Std Fuse	Single-Phase 600 Vac Time Delay	Three-Phase 120 Vac Std Fuse	Three-Phase 120 Vac Time Delay	Three-Phase 240 Vac Std Fuse	Three-Phase 240 Vac Time Delay	Three-Phase 480 Vac Std Fuse	Three-Phase 480 Vac Time Delay	Three-Phase 600 Vac Std Fuse	Three-Phase 600 Vac Time Delay	DC Horsepower Rating: 125 Vdc Time Delay	250 Vdc Std Fuse	250 Vdc Time Delay
Fusible / 3 Pole / 3 Wire / 600V																						
30	TDT3361	TDT3361R	TDT3361SS	0.5	2			3	7.5	3	10	1.5	3	3	7.5	5	15	7.5	20	3		5
60	TDT3362[1]	TDT3362R[1]	TDT3362SS[1]	1.5	3	3	10	5	20	10	25	3	7.5	7.5	15	15	30	15	50	5		10
100	TDT3363[1]	TDT3363R[1]	TDT3363SS[1]			7.5	15	10	30	15	40			15	30	25	60	30	75			20
200	TDT3364[1]	TDT3364R[1]	TDT3364SS[1]			15	15	25	50	30	50			25	25	50	125	60	150		40	40
400	TDT3365[2]	TDT3365R[2]	TDT3365SS[2]											50	125	100	250	125	350		50	50
600	TDT3366[3,4]	TDT3366R[3,4]												50	125	100	250	125	350		50	
800	TDT3367[3,4]	TDT3367R[3,4]												100	125	200	250	250	350			
1200	TDT3368[4]	TDT3368R[4]																				

[1] Class J fuse option available when load base is moved.
[2] 400 Amp at 600V switches available with Class T fuse provision only.
[3] Field convertible to Class T.
[4] Stacked design requiring only one set of fuses (Class L).

Non-Fusible

Amperage Rating	Product Number: NEMA Type 1 Indoor	Product Number: NEMA Type 3R Outdoor	Product Number: NEMA Type 4X Stainless Steel	Horsepower Rating: Three-Phase 240 Vac	Three-Phase 480 Vac	Three-Phase 600 Vac	DC Horsepower Rating: 125 Vdc	250 Vdc	Lug Wire Sizes Line and Load Terminals: AWG/kcmil
Non-Fusible / 3 Pole / 3 Wire / 240V / 50/60 Hz									
30	TC35321	TC35321R		2					14-8 (Cu)
60	TC35322	TC35322R		3					14-4 (Cu)
100	TC35323	TC35323R		7.5					14-1/0 (Cu)
200	TC35324	TC35324R		15					6-250 (Cu)
400	TC35325	TC35325R		30					(2) 1/0-250 (Cu) or 2-600 (Cu)
600	TC35326[2]			50					(2) 3/0-350 (Cu) or 2-600 (Cu)
		TC35326R		125	250	350		50	(2) 250 - (2) 500 (Cu/Al)
800	TC35327[4]	TC35327R[4]		125					(3) 250 - (3) 500 (Cu/Al)
1200	TC35328	TC35328R							(4) 1/0 - (4) 750 (Cu/Al)
Non-Fusible / 3 Pole / 3 Wire / 600V / 50/60 Hz									
30	TC35361	TC35361R	TC35361SS	10	20	30	3	5	14-2 (Cu/Al)
60	TC35362	TC35362R		10	10	10			14-4 (Cu)
			TC35362SS	20	50	60	5	10	14-2 (Cu/Al)
100	TC35363	TC35363R		15	15	15			14-1/0 (Cu)
			TC35363SS	40	75	100		20	14-1/0 (Cu/Al)
200	TC35364	TC35364R		30	30	30			6-250 (Cu)
			TC35364SS	60	125	150		40	6-250 (Cu/Al)
400	TC35365[1,2,3]								(2) 1/0-250 (Cu) or 2-600 (Cu)
		TC35365R	TC35365SS	125	250	350		50	(2) 1/0 - (2) 300 (Cu/Al) or [5] (1) 1/0 - 750 (Cu/Al)
600	TC35366[1,2]								(2) 3/0-350 (Cu) or 2-600 (Cu)
		TC35366R	TC35366SS	125	250	350			(2) 250 - (2) 500 (Cu/Al)
800	TC35367[4]	TC35367R[4]	TC35367SS	125	250	350			(3) 250 - (3) 500 (Cu/Al)
1200	TC35368	TC35368R							(4) 1/0 - (4) 750 (Cu/Al)

[1] Not UL Listed.
[2] Not suitable for use as service equipment per NEC Article 702
[3] No provision for auxiliary contact kit
[4] Available with factory installed neutral. Add N suffix. For example: TC35327N.
[5] Single barrel lug that accepts one or two cables per phase.

Safety Switches
Double Throw Switches

Spec-Setter™ Safety Switches
Type TC, Type TDT
240, 480, 600 Volts AC
250 Volts DC

Type TC Accessories

Amperage Rating	Product Number: NEMA Type 1 Indoor	Product Number: NEMA Type 3R Outdoor	Product Number: NEMA Type 4X Grade 304 Stainless Steel	Neutral Kit	Ground Kit	Aux Contact: 1 Normally Open 1 Normally Closed	Aux Contact: 2 Normally Open 2 Normally Closed	Control Pole
Non-Fusible / 3 Pole / 3 Wire / 240V								
30	TC35321	TC35321R		TNK100	TGL1	THAUXDT		
60	TC35322	TC35322R						
100	TC35323	TC35323R		TNK100	TNG3			
200	TC35324	TC35324R		TNK200	TNG3			
400	TC35325	TC35325R		TNK400	TGL6			
600	TC35326				TGL6			
		TC35326R		DT600NK	DS468GK	DS200EK1	DS200EK2	DS16CP
800	TC35327	TC35327R[1]		DT800NK				DS16CP
1200	TC35328	TC35328R		DT1200NK				
Non-Fusible / 3 Pole / 3 Wire / 600V								
30	TC35361	TC35361R	TC35361SS	DT100NK	DS100GK	DS200EK1	DS200EK2	DS16CP
60	TC35362	TC35362R		TNK100	TGL1	THAUXDT		
			TC35362SS	DT100NK	DS100GK	DS200EK1	DS200EK2	DS16CP
100	TC35363	TC35363R		TNK100	TNG3	THAUXDT		
			TC35363SS	DT100NK	DS100GK	DS200EK1	DS200EK2	DS16CP
200	TC35364	TC35364R		TNK200	TNG3	THAUXDT		
			TC35364SS	DT200NK	DS200GK	DS200EK1	DS200EK2	DS16CP
400	TC35365			TNK400	TGL6	THAUXDT		
		TC35365R	TC35365SS	DT400NK	DS468GK	DS200EK1	DS200EK2	DS16CP
600	TC35366				TGL6			
		TC35366R	TC35366SS	DT600NK	DS468GK	DS200EK1	DS200EK2	DS16CP
800	TC35367	TC35367R[1]	TC35367SS	DT800NK				DS16CP
1200	TC35368	TC35368R		DT1200NK				

[1] Order same accessories for the "N" version.

Type TDT Accessories

Amperage Rating	Product Number: NEMA Type 1 Indoor	Product Number: NEMA Type 3R Outdoor	Product Number: NEMA Type 1 Indoor	Product Number: NEMA Type 3R Outdoor	Product Number: NEMA Type 4X Stainless Steel	Neutral Kit	Ground Kit	"J" Fuse Adapter Kit	"R" Fuse Adapter Kit	"T" Fuse Adapter Kit	Aux Contact: 1 Normally Open 1 Normally Closed	Aux Contact: 2 Normally Open 2 Normally Closed	Control Pole
30	TDT3321	TDT3321R	TDT3361	TDT3361R	TDT3361SS	DT100NK	DS100GK		DS16FK		DS200EK1	DS200EK2	DS16CP
60	TDT3322	TDT3322R	TDT3362	TDT3362R	TDT3362SS			DS26JK	DS26FK				
100	TDT3323	TDT3323R	TDT3363	TDT3363R	TDT3363SS				DS36FK				
200	TDT3324	TDT3324R	TDT3364	TDT3364R	TDT3364SS	DT200NK	DS200GK		DS46FK				
400	TDT3325	TDT3325R	TDT3365	TDT3365R	TDT3365SS	DT400NK	DS468GK	DT400JK[3]	DS56FK[2]	DS526TK[2]			
600	TDT3326	TDT3326R	TDT3366	TDT3366R		DT600NK	DS468GK		DS66FK				
800	TDT3327	TDT3327R	TDT3367	TDT3367R		DT800NK				DS766TK[3]			
1200	TDT3328	TDT3328R	TDT3368	TDT3368R		DT1200NK							

[2] 240V only
[3] 600V only

Emergency Power Transfer Switches, Type TC

Spec-Setter™ Safety Switches

Type TC Outdoor Emergency Power Transfer Switches

—Designed for residential or light commercial applications where duty is not severe
—Suitable for use as service entrance equipment when installed in accordance with National Electrical Code
—Wide range of interchangeable rain-tight conduit hubs available
—Plated copper current-carrying parts increase longevity and performance
—Bonding strap can be used to ground neutral for service entrance applications
—Positive make and break is provided by fiber loop straps between knife blade contacts and one piece operating yoke
—Lockable three-position (ON-OFF-ON) handle
—Galvanized steel enclosure with drip shield
—60°C and 75°C conductor ratings
—Not quick-make, quick-break

TC10323R, Type TC Outdoor Emergency Power Transfer Switch

All GE Emergency Power Transfer Switches carry the following certifications:

—UL Listed and cUL Listed (UL98 Enclosed Switches/CSA-C22.2 No. 4-04)
—Federal Specification WS-865C
—NEMA Enclosed Safety Switch Standard KS1-2013
—Seismic Certified

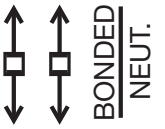
Emergency Power Transfer Switches

	Amperage Rating	Product Number NEMA Type 3 Outdoor
Non-Fusible / 2 Pole / 3 Wire / 120/240V / 50/60Hz		
	100	TC10323R
	200	TC10324R
Non-Fusible / 3 Pole / 4 Wire / 240V / 50/60Hz		
	200	TC10424R

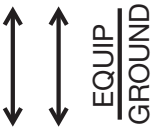
Air Conditioner Disconnects

—Puller or Non-Automatic Type
—UL and cUL Listed
Fusible – UL869
Service Equipment
No fuse – UL1429
Enclosed Pull-out Switch

c UL US LISTED



Fusible



No Fuse

Non-automatic

Steel Disconnects N3R Outdoor Enclosure

Type	Volts	Fusing	Amps	HP Rating	Product No.	Wire Range	Standard Package
Pullout	240V	Fusible	30	3	TF30R	14-3	6
			60	10	TF60R		
		Non-Fusible	60	10	TFN60R		
					TFN60RGFR[1]		
Non-Automatic	240V	Non-Fusible	60	10	TNA60R1		
					TNA60RGFR[2]		

[1]Devices do not have removable closing cap.
[2]These disconnects include a GFCI outlet

Plastic Disconnects N3R Outdoor Enclosure

Type	Volts	Fusing	Amps	HP Rating	Product No.	Wire Range	Standard Package
Pullout	240V	Fusible	30	3	TPF30R	14-3	6
			60	10	TPF60R		
		Non-Fusible	60	10	TPN60R1[1]		
Non-Automatic	240V	Non-Fusible	60	10	TPNA60R1[1]		

[1]Devices do not have removable closing cap.

TF30R, Steel Enclosure

TNA60RGFR, Steel Enclosure

TPF30R, Plastic Enclosure

TF60R, Steel Enclosure

TFN60RGFR

TPN60R1, Plastic Enclosure

TFN60R, Steel Enclosure

TPF60R, Thermoplastic Enclosure

Accessories: NEMA Type 1 and 3R Enclosures

Spec-Setter™ Safety Switches
30-600 Amperes: TG and TH
800-1200 Amperes: TC (Single Throw Fuse Only)

Equipment Ground Kits

Ampere Rating	Product Number	Wire Range AWG/kcmil Copper	Wire Range AWG/kcmil Aluminum	Std. Pkg
30A	TGL1	(4) 14-8, (3) 14-4	(4) 12-8, (3) 6-4	20
60A				
100A	TNG3	(3) 10-1/0	(3) 10-1/0	1
200A				
400A	TGL6	(3) 2-250	(3) 2-250	1
600A				

TGL1 Equipment Ground Kit

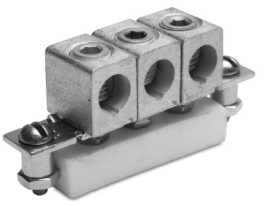
Neutral Kit Insulated, Groundable and Bondable

Ampere Rating	Product Number	System Voltage	Fusible/Non-Fusible	Wire Range AWG/kcmil Copper	Wire Range AWG/kcmil Aluminum
30A	TNI21	240Vac	Either	14-8	12-8
30A	TNI62[1]	600Vac	Either	12-2	12-2
30A	TNI62[1]	600Vac	Non-Fusible	12-2	12-2
60A	TNIA62	600Vac	Fusible	12-2	12-2
100A	TNI63[1]	600Vac	Non-Fusible	10-1/0	10-1/0
100A	TNIA63	600Vac	Fusible	10-1/0	10-1/0
200A	TNIA64	600Vac	Either	2-250	2-250
400A	TNI65	240Vac or 600Vac	Either	(1) 2-600 or (2) 1/0-250	(1) 2-600 or (2) 1/0-250
400A	TNI65A		Either	(1) 350-800	(1) 350-800
600A	TNI66		Either	(2) 4-500	(2) 4-500
800A	TNI67[2]		Either	(3) 2-600 or (6) 1/0-250	(3) 2-600 or (6) 1/0-250
1200A	TNI68A[2]		Either	(4) 3/0-800	(4) 3/0-800

Switching Neutral: Order standard switch of required number of poles and use dummy fuse in neutral pole.

[1] Not suitable for type TG switches.

[2] Not suitable for type TC Double Throw or TC Single Throw Non-Fusible



TNG3 Equipment Ground Kit

TNIA64 Neutral Kit Insulated, Groundable and Bondable

Note: All accessories are available in standard package of 1 unless otherwise noted.

Lug Wire Sizes Line and Load Terminals

Ampere Rating	Wire Range AWG/kcmil Copper	Wire Range AWG/kcmil Aluminum
30A (250V)	14-8	12-8
30A (600V)	12-2	12-2
60A	12-2	12-2
100A	10-1/0	10-1/0
200A	2-250	2-250
400A	(1) 2-600 or (2) 1/0-250	(1) 2-600 or (2) 1/0-250
600A	(2) 4-500	(2) 4-500
800A	(3) 2-600 or (6) 1/0-250	(3) 2-600 or (6) 1/0-250
1200A	(4) 3/0-800	(4) 3/0-800

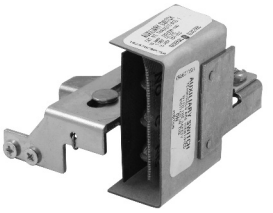
Accessories: NEMA Type 1 and 3R Enclosures

Spec-Setter™ Safety Switches
30-600 Amperes: TH

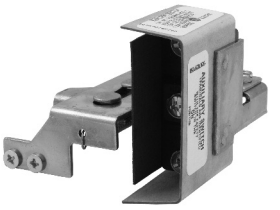
Auxiliary Contact Kits

—Auxiliary contacts designed to open before switch blades. UL Listed for field installation.
—Product number listed is for field installed kit.

Ampere Rating	No. of Poles	Contacts	Contact Ratings	Product Number
30A	2 3	DPDT	10A, 125/250Vac 0.30A, 125Vdc 0.15A, 250Vdc	THAUX21D
30A	2 3	SPDT	15A, 600Vac 0.50A, 125Vdc 0.25A, 250Vdc	THAUX61S
60A 100A 200A	2 3	DPDT	15A, 600Vac 0.50A, 125Vdc 0.25A, 250Vdc	THAUX64D
400A 600A	2 3	DPDT	15A, 600Vac 0.50A, 125Vdc 0.25A, 250Vdc	THAUX66D
30A 60A 100A	6	DPDT	15A, 600Vac 0.50A, 125Vdc 0.25A, 250Vdc	THAUX66D
200A	6	DPDT	15A, 600Vac 0.50A, 125Vdc 0.25A, 250Vdc	THAUX66D2

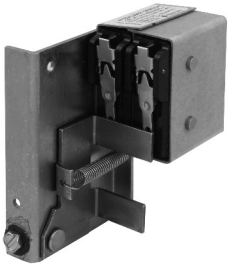


THAUX21D



THAUX61S

THAUX64D



THAUX66D

Contact Pilot Duty Ratings - 600 Volt Kits

Inrush Current			AC	DC (Resistive)	
Volts	N.C	N.O.	Break Normal Current	Volts	Break Normal Current
115	30	15	15	125	0.5
230	30	15	25	0.25	–
460	30	15	15	–	–
575	15	15	2	–	–

Semidust-tight Door Gasket Kits

—Types TH Indoor, TG and TH Outdoor Switches.
—Product Number listed is for field mounted kit.

Ampere Rating	Product Number
30A 60A 100A	THG106
200A	THG107
400A 600A	THG108

Lug Wire Sizes

Line and Load Terminals

	Factory Installed		Field Installed Crimp Lugs (see table on page 4-23)	
Ampere Rating	Wire Range AWG/kcmil Copper	Wire Range AWG/kcmil Aluminum	Wire Range AWG/kcmil Copper	Wire Range AWG/kcmil Aluminum
30A (250V)	14-8	12-8	–	–
30A (600V)	14-6	14-6	14-8	–
60A	14-2	14-2	8-4	–
100A	14-1/0	12-1/0	6-1/0	6-2/0
200A	6-250	–	1/0-250	–
400A	(1) 2-600 or (2) 1/0-250	–	(2) 300-600 or (1) 750	(2) 250-600 or (1) 750
600A	(2) 4-600	–	(2) 300-600 or (1) 750	(2) 250-600 or (1) 750

Equipment Ground Terminals—Two lugs supplied per switch, provision for one additional lug.

	Factory Installed		Field Installed Crimp Lugs (See table on page 4-23)	
Switch Ampere Rating	Copper	Aluminum	Copper	Aluminum
30A	14-6	14-6	14-8	–
60A	14-6	14-6	14-8	–
100A	14-4	14-4	8	6
200A	14-4	14-4	6	4
400A	14-1/0	14-1/0	3-2	1
600A	14-2/0	14-2/0	1	2/0

Auxiliary Contact Kits

Auxiliary contacts designed to open before switch blades. UL Listed for field installation. Product number listed is for field installed kit.

For Auxiliary Contact Kits, see page 4-21.

Optional Copper Lug Neutrals

Ampere Rating	Fusible	Lug Wire Size, AWG/kcmil, Cu Only	Product Number
30A-60A	No	14-2	TNIJA62CL

Neutral Kit Insulated, Groundable and Bondable

Ampere Rating	Product Number	System Voltage	Fusible/Non-fusible	Lug Wire Size AWG/ kcmil Factory Installed Aluminum	Lug Wire Size AWG/ kcmil Factory Installed Copper	Lug Wire Size AWG/ kcmil Field Installed Crimp Lugs Copper	Lug Wire Size AWG/ kcmil Field Installed Crimp Lugs Aluminum
30A	TNI21	240Vac	Fusible	12-8	14-8	-	-
30A	TNIJ61	600Vac[1]	Either	14-6	14-6	14-8	-
60A	TNIJ62	600Vac[2]	Fusible	14-2	14-2	8-4	-
60A	TNIJ62	240Vac[2]	Fusible	14-2	14-2	8-4	-
60A	TNIJ62	600Vac	Fusible	14-2	14-2	8-4	-
60A	TNIJA62	600Vac[2]	Non-fusible	14-2	14-2	8-4	-
60A	TNIJA62	600Vac	Non-fusible	14-2	14-2	8-4	-
100A	TNIJ63	240Vac or 600Vac	Either	12-1/0	14-1/0	6-1/0	6-2/0
200A	TNIJ64		Either	6-250	6-250	1/0-250	1/0-250
400-600A	TNIJ66		Either	(2) 4-600	(2) 4-600	(2) 300-600 or (1) 750	(2) 250-600 or (1) 750

[1] Type 4, 4X, 12

[2] Mill duty type

Crimp-type Connectors - Field Replaceable[1]

Line and Load Terminals

Switch Ampere Rating	Lug Wire Size AWG/kcmil	Thomas and Betts Product Number		Burndy Product Number	
		Copper	Aluminum	Copper	Aluminum
30A	14-12	-	-	YAV12 G2	-
30A	12-10	-	-	YAV10	-
30A	8	54104	-	YAV8C-L	-
60A	8	54130	-	YAV8C-L1	-
60A	6	54105	-	YAV6C-L	-
60A	4	54106	-	YAV4CLY1	-
100A	6	54105	60107	-	-
100A	4	54106	60112	-	-
100A	2	54017	60116	-	-
100A	1	54108	60122	-	-
100A	1/0	-	-	YA25-L	YA25A1
200A	1/0	54153	60129	-	-
200A	1/0	54109	60130	-	-
200A	2/0	54158	60135	-	-
200A	2/0	54110	60136	-	-
200A	3/0	54163	60141	-	-
200A	3/0	54111	60142	-	-
200A	4/0	54168	60147	-	-
200A	4/0	54112	60148	-	-
200A	250	54173	60153	-	-
200A	250	54174	60154	-	-
400A and 600A	250	-	60156	-	-
400A and 600A	300	54114	60162	-	-
400A and 600A	350	54115	60165	-	-
400A and 600A	400	54116	-	-	-
400A and 600A	500	54118	60171	-	-
400A and 600A	600	54120	60174	-	-
400A and 600A	750	54123	60178	-	-

Equipment Ground Terminals (provision for three per switch)

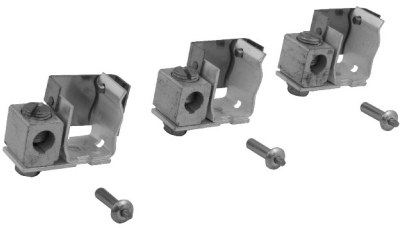
Switch Ampere Rating	Lug Wire Size AWG/kcmil	Thomas and Betts Product Number		Burndy Product Number	
		Copper	Aluminum	Copper	Aluminum
30A	10	-	-	-	-
30A	8	54104	-	YAV8C-L	-
60A	8	54104	-	YAV8C-L	-
100A	8	54105	-	-	-
100A	6	-	60106	-	-
200A	6	54105	-	-	-
200A	4	-	60112	-	-
400A	3-2	54107	-	-	-
400A	1	-	60122	-	-
600A	1	54108	-	-	-
600A	2/0	-	60134	-	-

[1] Not furnished with switches.

Class R Fusing Kit Field Installable, General Duty, Type TG, UL Listed

When specifications permit only Class R fuses to be used, these kits may be installed in the safety switch to deter fuses other than Class R from being installed.
—30–60A = Fuse Clips
—100–200A = Rejection Pins
—One kit required per two pole or three pole switch

Series Prefix	Ampere Rating	Enclosure Type	Product Number
TG	30A	NEMA Type 1, 3R	TGRK12
	60A	NEMA Type 1, 3R	TGRK22
	100A	NEMA Type 1, 3R	TGRK42
	200A	NEMA Type 1, 3R	TGRK42



TGRK22 Class R Rejection Kit

Class J Fuse Field Conversion Kit, Heavy Duty, Type TH, UL Listed

TH switches, 30-400 amperes, 600 volt and 100-400 amperes, 240 volt, may be adapted to accept Class J fuses without a kit by moving the load-block toward the switch base and remounting.

Series Prefix	Ampere Rating	System Voltage	Product Number
TH	600A	240Vac 600Vac	THJ6

Class R Fusing Kit Field Installable, Heavy Duty, Type TH, UL Listed

When specifications permit only Class R fuses to be used, these kits may be installed in the safety switch to deter fuses other than Class R from being installed.
—30–60A = Fuse Clips
—100–200A = Rejection Pins
—One kit required per two pole or three pole switch

Series Prefix	Ampere Rating	System Voltage	Enclosure Type	Product Number
TH	30A	240Vac	NEMA Type 1, 3R, 4/4X, 12	TRK12B
	30A	600Vac	NEMA Type 1, 3R	TRK16B
	30A	600Vac	NEMA Type 4/4X, 12	TRK16SA
	60A	240Vac	NEMA Type 1, 3R, 4/4X, 12	TRK22A
	60A	600Vac	NEMA Type 1, 3R, 4/4X, 12	TRK26A
	100A	240Vac 600Vac	NEMA Type 1, 3R	TRK46A
	100A	240Vac 600Vac	NEMA Type 4/4X, 12	TPBRK36A
	200A	240Vac 600Vac	NEMA Type 1, 3R, 4/4X, 12	TRK46A
	400A	240Vac 600Vac	NEMA Type 1, 3R, 4/4X, 12	TRK56A
	600A	240Vac 600Vac	NEMA Type 1, 3R, 4/4X, 12	TRK66A

TRK46A Class R Rejection Kit

Universal Raintight Aluminum Hubs

For outdoor enclosures that have removable closing caps.

Nominal Conduit Diameter (in.)	Product Number
3/4	TC75
1	TC100
1 1/4	TC125
1 1/2	TC150
2	TC200
2 1/2	TC250

TC200 Universal Raintight Hub

Closing Cap for Universal Raintight Aluminum Hub

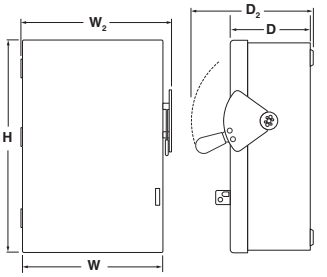
Product Number
TCCP

Replacement Red Handle Grip for HD Switches

Product Number
THGRIP

General Duty, NEMA Type 1 Approximate Dimensions in inches

Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TG3221	10.3	6.4	6.9	3.3	6.3	5	10103091SH104	1
TG3222	13.8	8.4	8.9	4.0	7.9	10	10103091SH104	15
TG3223	21.3	9.4	10.6	4.9	9.9	16	10103091SH108	3
TG3224	29.1	13.4	14.6	5.2	9.3	30	10103091SH108	4
TG3224B	29.1	13.4	14.6	5.2	9.3	30	10103091SH108	4
TG3225	49.4	21.6	22.8	8.7	14.6	102	10103091SH116	5
TG3225B	49.4	21.6	22.8	8.7	14.6	102	10103091SH116	5
TG3226	49.9	22.9	24.1	9.0	14.8	107	10103091SH116	6
TG3325	49.4	21.6	22.8	8.7	14.6	107	10103091SH116	7
TG3325B	49.4	21.6	22.8	8.7	14.6	107	10103091SH116	7
TG3326	49.9	22.9	24.1	9.0	14.8	124	10103091SH116	6
TG3326B	49.9	22.9	24.1	9.0	14.8	124	10103091SH116	6
TG4321	10.3	6.4	6.9	3.3	6.3	5	10103091SH104	1
TG4322	13.8	8.4	8.9	4.0	7.9	10	10103091SH104	15
TG4323	21.3	9.4	10.6	4.9	9.9	17	10103091SH108	3
TG4324	29.1	13.4	14.6	5.2	9.3	32	10103091SH108	4
TG4324B	29.1	13.4	14.6	5.2	9.3	32	10103091SH108	4
TG4325	49.4	21.6	22.8	8.7	14.6	111	10103091SH116	7
TG4325B	49.4	21.6	22.8	8.7	14.6	111	10103091SH116	7
TG4326	49.9	22.9	24.1	9.0	14.8	126	10103091SH116	6
TG4326B	49.9	22.9	24.1	9.0	14.8	126	10103091SH116	6
TGN3321	10.3	6.4	6.9	3.3	6.3	5	10103091SH104	1
TGN3322	13.8	8.4	8.9	4.0	7.9	10	10103091SH104	15
TGN3323	21.3	9.4	10.6	4.9	9.9	16	10103091SH108	3
TGN3324	29.1	13.4	14.6	5.2	9.3	30	10103091SH108	4
TGN3324B	29.1	13.4	14.6	5.2	9.3	30	10103091SH108	4
TGN3325	49.4	21.6	22.8	8.7	14.6	118	10103091SH116	7
TGN3325B	49.4	21.6	22.8	8.7	14.6	118	10103091SH116	7
TGN3326	49.9	22.9	24.1	9.0	14.8	120	10103091SH116	6
TGN3326B	49.9	22.9	24.1	9.0	14.8	120	10103091SH116	6



General Duty NEMA Type 1

Heavy Duty, NEMA Type 1 Approximate Dimensions in inches

Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TH2261DC	12.6	8.3	9.5	4.0	7.6	11	10103091SH102	15
TH2262DC	21.3	9.1	9.4	5.0	8.6	18	10103091SH102	3
TH2263DC	22.3	9.3	10.1	4.8	9.8	19	10103091SH105	14
TH3221	10.3	6.3	7.1	3.3	6.1	6	10103091SH102	1
TH3222	17.6	9.4	10.1	5.0	9.0	15	10103091SH102	3
TH3223	21.3	9.3	10.1	4.8	9.8	17	10103091SH105	3
TH3224	31.5	13.3	14.1	5.1	10.5	33	10103091SH105	4
TH3224B	31.5	13.3	14.1	5.1	10.5	33	10103091SH105	4
TH3224C	31.5	13.3	14.1	5.1	10.5	33	10103091SH105	4
TH3225	50.9	22.9	23.6	8.3	14.4	120	10103091SH112	6
TH3225B	50.9	22.9	23.6	8.3	14.4	120	10103091SH112	6
TH3225C	50.9	22.9	23.6	8.3	14.4	135	10103091SH112	6
TH3226	50.9	22.9	23.6	8.3	14.4	134	10103091SH112	6
TH3226B	50.9	22.9	23.6	8.3	14.4	134	10103091SH112	6
TH3226C	50.9	22.9	23.6	8.3	14.4	134	10103091SH112	6
TH3267C	61.5	40.8	44.0	11.9	18.5	500	10103091SH112	6
TH3268C	76.6	46.6	45.8	12.9	18.9	480	10103091SH112	6
TH3325	50.9	22.9	23.6	8.3	14.4	126	10103091SH112	6
TH3325B	50.9	22.9	23.6	8.3	14.4	126	10103091SH112	6
TH3326	50.9	22.9	23.6	8.3	14.4	138	10103091SH112	6
TH3326B	50.9	22.9	23.6	8.3	14.4	138	10103091SH112	6
TH3361	12.6	8.3	9.5	4.0	7.6	11	10103091SH102	15
TH3362	21.3	9.1	9.4	5.0	8.6	18	10103091SH102	3
TH3363	22.3	9.3	10.1	4.8	9.8	18	10103091SH105	14
TH3364	31.5	13.3	14.1	5.1	10.5	33	10103091SH105	4
TH3364B	31.5	13.3	14.1	5.1	10.5	34	10103091SH105	4
TH3365	53.9	22.9	23.6	8.3	14.4	126	10103091SH112	6
TH3365B	53.9	22.9	23.6	8.3	14.4	122	10103091SH112	6
TH3366	53.9	22.9	23.6	8.3	14.4	139	10103091SH112	6
TH3366B	53.9	22.9	23.6	8.3	14.4	139	10103091SH112	6
TH4321	10.3	6.3	7.1	3.3	6.1	6	10103091SH102	1
TH4322	17.6	9.4	10.1	5.0	9.0	16	10103091SH102	3
TH4323	21.3	9.3	10.1	4.8	9.8	17	10103091SH105	3
TH4324	31.5	13.3	14.1	5.1	10.5	33	10103091SH105	4
TH4324B	31.5	13.3	14.1	5.1	10.5	32	10103091SH105	4
TH4324C	31.5	13.3	14.1	5.1	10.5	32	10103091SH105	4

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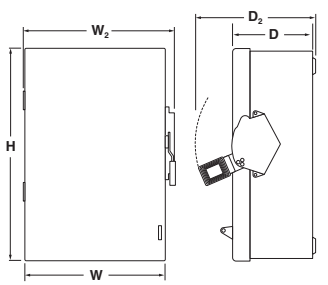
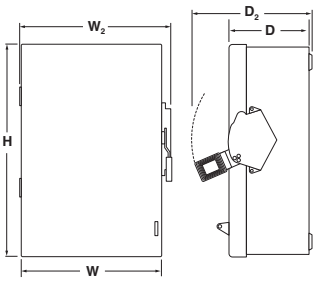


Heavy Duty NEMA Type 1

Heavy Duty, NEMA Type 1 (Cont.) Approximate Dimensions in inches

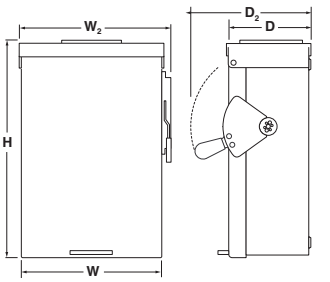
Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TH4325	50.9	22.9	23.6	8.3	14.4	128	10103091SH112	6
TH4325B	50.9	22.9	23.6	8.3	14.4	128	10103091SH112	6
TH4325C	50.9	22.9	23.6	8.3	14.4	128	10103091SH112	6
TH4326	50.9	22.9	23.6	8.3	14.4	139	10103091SH112	6
TH4326B	50.9	22.9	23.6	8.3	14.4	139	10103091SH112	6
TH4326C	50.9	22.9	23.6	8.3	14.4	80	10103091SH112	6
TH4364C	31.5	13.3	14.1	5.1	10.5	32	10103091SH105	4
TH4365C	53.9	22.9	23.6	8.3	14.4	132	10103091SH112	6
TH4366C	53.9	22.9	23.6	8.3	14.4	132	10103091SH112	6
TH4367C	61.5	40.8	44.0	11.9	18.5	331	10103091SH118	No KO
TH4368C	76.6	46.6	45.8	12.9	18.9	377	10103091SH118	No KO
TH6621	14.4	18.7	19.9	5.9	12.3	33	10103091SH121	20
TH6622	23.9	18.7	19.9	5.9	12.7	40	10103091SH121	20
TH6623	23.9	18.7	19.8	5.8	10.9	45	10103091SH127	20
TH6624	35.1	26.0	26.8	5.7	10.4	45	10103091SH127	20
TH6661	14.4	18.7	19.9	5.9	12.3	33	10103091SH121	20
TH6662	23.9	18.7	19.9	5.9	12.7	46	10103091SH121	20
TH6663	23.9	18.7	19.8	5.8	10.9	46	10103091SH127	20
TH6664	35.1	26.0	26.8	5.7	10.4	45	10103091SH127	20
THN2261DC	10.3	8.3	9.3	4.0	7.7	9	10103091SH102	15
THN2262DC	17.6	9.4	10.1	5.0	8.1	15	10103091SH102	3
THN2263DC	17.6	9.3	10.1	4.8	9.8	23	10103091-SH105	3
THN3321	10.3	6.3	7.1	3.3	6.1	6	10103091SH102	1
THN3361	10.3	8.3	9.3	4.0	7.7	9	10103091SH102	15
THN3361CL	10.3	8.3	9.3	4.0	7.7	9	10103091SH102	15
THN3362	17.6	9.4	10.1	5.0	9.0	15	10103091SH102	3
THN3362CL	17.6	9.4	10.1	5.0	9.0	15	10103091SH102	3
THN3363	17.6	9.3	10.1	4.8	9.8	15	10103091SH105	3
THN3363CL	17.6	9.3	10.1	4.8	9.8	15	10103091SH105	3
THN3364	31.5	13.3	14.1	5.1	10.5	32	10103091SH105	4
THN3364B	31.5	13.3	14.1	5.1	10.5	32	10103091SH105	4
THN3364CL	31.5	13.3	14.1	5.1	10.5	33	10103091SH105	4
THN3365	42.6	22.9	23.6	8.3	14.4	108	10103091SH112	6
THN3365B	42.6	22.9	23.6	8.3	14.4	108	10103091SH112	6
THN3366	42.6	22.9	23.6	8.3	14.4	109	10103091SH112	6
THN3366B	42.6	22.9	23.6	8.3	14.4	109	10103091SH112	6
THN3366CL	42.6	22.9	23.6	8.3	14.4	109	10103091SH112	6
THN6661	14.4	18.7	19.9	5.9	12.3	33	10103091SH121	20
THN6662	23.9	18.7	19.9	5.9	12.7	46	10103091SH121	20
THN6663	23.9	18.7	19.8	5.8	10.9	46	10103091SH127	20
THN6664	35.1	26.0	26.8	5.7	10.4	47	10103091SH127	20



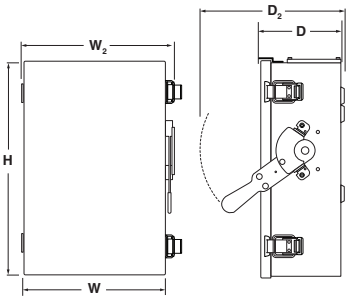
Heavy Duty NEMA Type 1

General Duty, NEMA Type 3R Approximate Dimensions in inches

Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TG3221R	9.8	6.4	6.8	3.3	6.3	6	10103091SH103	8
TG3222R	13.7	8.4	8.8	3.9	7.9	11	10103091SH103	19
TG3223R	21.1	9.3	10.3	5.0	9.1	17	10103091SH107	10
TG3224R	29.3	13.4	13.7	5.4	9.9	31	10103091SH183	11
TG3225R	49.7	21.7	22.4	8.9	14.7	110	10103091SH141	12
TG3226R	50.1	23.0	23.8	9.4	15.1	119	10103091SH141	13
TG3325R	49.7	21.7	22.4	8.9	14.7	109	10103091SH141	12
TG3326R	50.1	23.0	23.8	9.4	15.1	124	10103091SH141	13
TG4321R	9.8	6.4	6.8	3.3	6.3	6	10103091SH103	8
TG4322R	13.7	8.4	8.8	3.9	7.9	11	10103091SH103	19
TG4323R	21.1	9.3	10.3	5.0	9.1	17	10103091SH107	10
TG4324R	29.3	13.4	13.7	5.4	9.9	32	10103091SH183	11
TGN3321R	9.8	6.4	6.8	3.3	6.3	6	10103091SH103	8
TGN3322R	13.7	8.4	8.8	3.9	7.9	10	10103091SH103	19
TGN3323R	15.6	9.3	10.3	5.0	9.1	13	10103091SH107	10
TGN3324R	29.3	13.4	13.7	5.4	9.9	31	10103091SH183	11



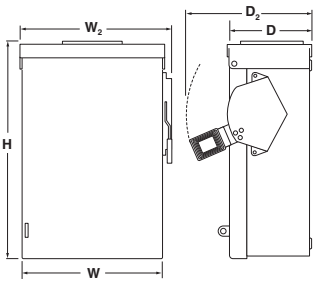
General Duty NEMA Type 3R



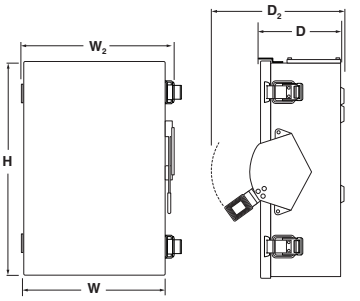
General Duty NEMA Type 3R
200-600A Side Swing

Heavy Duty, NEMA Type 3R Approximate Dimensions in inches

Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TH2261RDC	13.1	8.2	8.9	4.0	7.9	11	10103091SH101	19
TH2262RDC	22.0	9.2	9.7	4.8	7.9	19	10103091SH101	10
TH2263RDC	22.1	9.3	10.2	4.9	9.8	20	10103091SH106	10
TH3221R	10.5	6.2	6.6	3.1	7.7	7	10103091SH101	8
TH3222R	17.2	9.2	9.7	4.8	7.9	16	10103091SH101	10
TH3223R	22.1	9.3	10.2	4.9	9.8	18	10103091SH106	10
TH3224R	31.7	13.4	14.3	5.4	9.5	34	10103091SH182	11
TH3224RC	31.7	13.4	14.3	5.4	9.5	34	10103091SH182	11
TH3225R	49.5	23.0	24.1	8.5	13.9	128	10103091SH140	18
TH3225RC	49.5	23.0	24.1	8.5	13.9	128	10103091SH140	18
TH3226R	53.5	23.0	24.1	8.5	13.9	134	10103091SH140	18
TH3226RC	53.5	23.0	24.1	8.5	13.9	134	10103091SH140	18
TH3267RC	61.5	40.8	44.0	11.9	18.5	500	10103091SH118	No KO
TH3268RC	76.6	46.6	45.8	12.9	18.9	490	10103091SH118	No KO
TH3325R	49.5	23.0	24.1	8.5	13.9	127	10103091SH140	18
TH3326R	53.5	23.0	24.1	8.5	13.9	139	10103091SH140	18
TH3361R	13.1	8.2	8.9	4.0	7.9	11	10103091SH101	19
TH3361RF	14.9	10.3	10.9	3.9	8.0	11	10103091SH133	No KO
TH3361RF2	22.4	13.3	14.0	4.8	9.9	23	10103091SH134	No KO
TH3362R	22.0	9.2	9.7	4.8	7.9	18	10103091SH101	10
TH3362RF	22.4	13.3	14.0	4.8	9.9	18	10103091SH134	No KO
TH3363R	22.1	9.3	10.2	4.9	9.8	19	10103091SH106	10
TH3364R	31.7	13.4	14.3	5.4	9.5	33	10103091SH182	11
TH3365R	53.5	23.0	24.1	8.5	13.9	132	10103091SH140	18
TH3366R	53.5	23.0	24.1	8.5	13.9	136	10103091SH140	18
TH4321R	10.5	6.2	6.6	3.1	7.7	7	10103091SH101	8
TH4322R	17.2	9.2	9.7	4.8	7.9	16	10103091SH101	10
TH4323R	22.1	9.3	10.2	4.9	9.8	18	10103091SH106	10
TH4324R	31.7	13.4	14.3	5.4	9.5	34	10103091SH182	11
TH4324RC	31.7	13.4	14.3	5.4	9.5	34	10103091SH182	11
TH4325RC	49.5	23.0	24.1	8.5	13.9	125	10103091SH140	No KO
TH4326RC	53.5	23.0	24.1	8.5	13.9	130	10103091SH140	No KO
TH4364RC	31.7	13.4	14.3	5.4	9.5	32	10103091SH182	No KO
TH4365RC	49.5	23.0	24.1	8.5	13.9	130	10103091SH140	No KO
TH4366RC	53.5	23.0	24.1	8.5	13.9	132	10103091SH140	No KO
TH4367RC	61.5	40.8	44.0	11.9	18.5	510	10103091SH118	No KO
TH4368RC	76.6	46.6	45.8	12.9	18.9	750	10103091SH118	No KO
THN2261RDC	13.1	8.2	8.9	4.0	7.9	11	10103091SH101	19
THN2262RDC	17.2	9.2	9.7	4.8	7.9	16	10103091SH101	10
THN2263RDC	17.3	9.3	10.2	4.9	9.8	16	10103091SH106	10
THN3361R	13.1	8.2	8.9	4.0	7.9	11	10103091SH101	19
THN3361RF	14.9	10.3	10.9	3.9	8.0	13	10103091SH133	19
THN3361RF2	22.4	13.3	14.0	4.8	9.9	22	10103091SH134	17
THN3362R	17.2	9.2	9.7	4.8	7.9	15	10103091SH101	10
THN3362RF	22.4	13.3	14.0	4.8	9.9	22	10103091SH134	17
THN3363R	17.3	9.3	10.2	4.9	9.8	15	10103091SH106	10
THN3364R	31.7	13.4	14.3	5.4	9.5	33	10103091SH182	11
THN3365R	49.5	23.0	24.1	8.5	13.9	122	10103091SH140	18
THN3366R	53.5	23.0	24.1	8.5	13.9	130	10103091SH140	18



Heavy Duty NEMA Type 3R



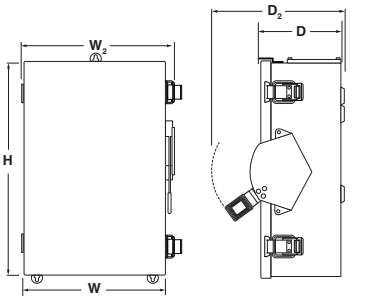
Heavy Duty NEMA Type 3R
200-600A Side Swing

800-1200A NEMA Type 1 and 3R Approximate Dimensions in inches

Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TC36367	52.0	31.3	34.5	10.5	18.5	317	10103091SH118	No KO
TC36368	65.0	36.5	39.7	11.8	18.9	331	10103091SH118	
TC72267	61.5	40.8	44.0	11.9	18.5	377	10103091SH118	
TC72267R	61.5	40.8	44.0	11.9	18.5	480	10103091SH118	
TC72268	76.6	46.6	45.8	12.9	18.9	391	10103091SH118	
TC72268R	76.6	46.6	45.8	12.9	18.9	575	10103091SH118	
TC72367	61.5	40.8	44.0	11.9	18.5	377	10103091SH118	
TC72367R	61.5	40.8	44.0	11.9	18.5	480	10103091SH118	
TC72368	76.6	46.6	45.8	12.9	18.9	480	10103091SH118	
TC72368R	76.6	46.6	45.8	12.9	18.9	490	10103091SH118	

Heavy Duty, NEMA Type 4/4X (316 Stainless) Approximate Dimensions in inches

Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TH3361SS316	13.3	9.4	10.1	4.9	9.4	18	10103091SH109	
TH3361SS316-BA	13.3	9.4	10.1	4.9	9.4	18	10103091SH109	
TH3362SS316	19.3	9.4	10.1	5.2	9.6	23	10103091SH109	
TH3362SS316-BA	19.3	9.4	10.1	5.2	9.6	23	10103091SH109	
TH3363SS316	25.4	13.4	14.3	5.2	9.6	36	10103091SH113	
TH3363SS316-BA	25.4	13.4	14.3	5.2	9.6	36	10103091SH113	
TH3364SS316	35.1	14.5	15.5	5.2	9.6	49	10103091SH113	
TH3364SS316-BA	35.1	14.5	15.5	5.2	9.6	49	10103091SH113	
THN3361SS316	11.3	9.4	10.1	4.9	9.4	16	10103091SH109	No KO
THN3361SS316-BA	11.3	9.4	10.1	4.9	9.4	9	10103091SH109	
THN3362SS316	13.3	9.4	10.1	5.2	9.6	22	10103091SH109	
THN3362SS316-BA	13.3	9.4	10.1	5.2	9.6	22	10103091SH109	
THN3363SS316	25.4	13.4	14.3	5.2	9.6	36	10103091SH113	
THN3363SS316-BA	25.4	13.4	14.3	5.2	9.6	36	10103091SH113	
THN3364SS316	35.1	14.5	15.5	5.2	9.6	50	10103091SH113	
THN3364SS316-BA	35.1	14.5	15.5	5.2	9.6	50	10103091SH113	
THN3365SS316	59.5	24.6	25.6	8.4	13.8	239	10103091SH119	
THN3366SS316	59.5	24.6	25.6	8.4	13.8	239	10103091SH119	

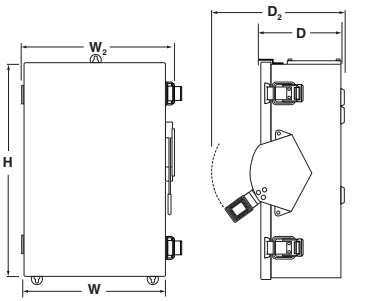


Heavy Duty NEMA Type 4/4X

Heavy Duty, NEMA Type 4/4X Water/Dust-tight Approximate Dimensions in inches

Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TH2221MSS	11.2	7.4	8.1	4.7	9.8	14	10103091SH123	
TH2221SS	11.3	7.4	8.1	5.4	10.0	12	10103091SH110	
TH2221SS-BA	11.3	7.4	8.1	4.9	9.4	12	10103091SH109	
TH2221SSW	11.3	7.4	8.1	5.4	10.0	12	10103091SH110	
TH2222MSS	19.3	9.4	14.1	5.0	10.1	20	10103091SH123	
TH2222SS	19.3	9.4	10.1	5.2	9.6	21	10103091SH109	
TH2222SS-BA	19.3	9.4	10.1	5.2	9.6	21	10103091SH109	
TH2222SSW	19.3	9.4	10.1	5.2	9.6	21	10103091SH109	
TH2223MSS	25.4	13.4	15.3	5.0	10.4	24	10103091SH128	
TH2224MSS	35.1	14.4	16.3	5.0	10.4	25	10103091SH128	
TH2261SSDC	13.3	9.4	10.1	4.9	9.4	18	10103091SH109	
TH2262SSDC	19.3	9.4	10.1	5.2	9.6	19	10103091SH109	
TH2263SSDC	25.4	13.4	14.3	5.2	9.6	30	10103091SH113	
TH3221SS	11.3	7.4	8.1	4.9	9.4	12	10103091SH109	
TH3221SS-BA	11.3	7.4	8.1	4.9	9.4	12	10103091SH109	
TH3221SSW	11.3	7.4	8.1	4.9	9.4	12	10103091SH109	
TH3222SS	19.3	9.4	10.1	5.2	9.6	15	10103091SH109	
TH3222SS-BA	19.3	9.4	10.1	5.2	9.6	15	10103091SH109	
TH3223SS	25.4	13.4	14.3	5.2	9.6	30	10103091SH113	
TH3223SS-BA	25.4	13.4	14.3	5.2	9.6	30	10103091SH113	No KO
TH3223SSW	25.4	13.5	14.2	5.2	9.6	30	10103091SH113	
TH3224SS	35.1	14.5	15.5	5.2	9.6	33	10103091SH113	
TH3224SS-BA	35.1	14.5	15.5	5.2	9.6	33	10103091SH113	
TH3224SSW	35.2	14.5	15.5	5.2	9.6	33	10103091SH113	
TH3225SS	59.5	24.6	25.6	8.4	13.8	128	10103091SH119	
TH3226SS	59.5	24.6	25.6	8.4	13.8	140	10103091SH119	
TH3321MSS	11.2	7.4	8.1	4.7	9.8	14	10103091SH123	
TH3321SS	11.3	7.4	8.1	4.9	9.4	12	10103091SH109	
TH3321SS-BA	11.3	7.4	8.1	4.9	9.4	12	10103091SH109	
TH3322MSS	19.3	9.4	14.1	5.0	10.1	23	10103091SH123	
TH3322SS	19.3	9.4	10.1	5.2	9.6	22	10103091SH109	
TH3322SS-BA	19.3	9.4	10.1	5.2	9.6	22	10103091SH109	
TH3322SSW	19.3	9.4	10.1	5.2	9.6	22	10103091SH109	
TH3323MSS	25.4	13.4	15.3	5.0	10.4	23	10103091SH128	
TH3324MSS	35.1	14.4	16.3	5.0	10.4	27	10103091SH128	
TH3325MSS	59.4	24.5	25.6	7.9	14.4	193	10103091SH130	
TH3326MSS	59.4	24.5	25.6	7.9	14.4	200	10103091SH130	
TH3361MSS	19.3	9.4	14.1	5.0	10.1	21	10103091SH123	
TH3361SS	13.3	9.4	10.1	4.9	9.4	17	10103091SH109	
TH3361SS-BA	13.3	9.4	10.1	4.9	9.4	17	10103091SH109	

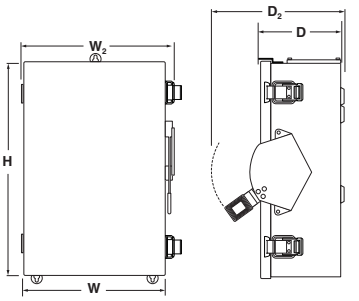
(table continued on next page)



Heavy Duty NEMA Type 4/4X

Heavy Duty, NEMA Type 4/4X Water/Dust-tight (Cont.) Approximate Dimensions in inches

Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TH3361SSW	13.3	9.4	10.1	4.9	9.4	18	10103091SH109	
TH3362MSS	19.3	9.4	14.1	5.0	10.1	23	10103091SH123	
TH3362MSSW	19.3	9.4	14.1	5.0	10.1	23	10103091SH123	
TH3362SS	19.3	9.4	10.1	5.2	9.6	23	10103091SH109	
TH3362SS-BA	19.3	9.4	10.1	5.2	9.6	23	10103091SH109	
TH3362SSW	19.3	9.4	10.1	5.2	9.6	22	10103091SH109	
TH3363MSS	25.4	13.4	15.3	5.0	10.4	23	10103091SH128	
TH3363SS	25.4	13.4	14.3	5.2	9.6	36	10103091SH113	
TH3363SS-BA	25.4	13.4	14.3	5.2	9.6	36	10103091SH113	
TH3363SSW	25.4	13.5	14.2	5.2	9.6	35	10103091SH113	
TH3364MSS	35.1	14.4	16.3	5.0	10.4	45	10103091SH128	
TH3364SS	35.1	14.5	15.5	5.2	9.6	49	10103091SH113	
TH3364SS-BA	35.1	14.5	15.5	5.2	9.6	49	10103091SH113	
TH3364SSW	35.2	14.5	15.5	5.2	9.6	33	10103091SH113	
TH3365MSS	59.4	24.5	25.6	7.9	14.4	206	10103091SH130	
TH3365SS	59.5	24.6	25.6	8.4	13.8	131	10103091SH119	
TH3366MSS	59.4	24.5	25.6	7.9	14.4	211	10103091SH130	
TH3366SS	59.5	24.6	25.6	8.4	13.8	139	10103091SH119	
TH4321SS	11.3	7.4	8.1	4.9	9.4	12	10103091SH109	
TH4321SS-BA	11.3	7.4	8.1	4.9	9.4	12	10103091SH109	
TH4321SSW	11.3	7.4	8.1	4.9	9.4	12	10103091SH109	
TH4322SS	19.3	9.4	10.1	5.2	9.6	23	10103091SH109	
TH4322SS-BA	19.3	9.4	10.1	5.2	9.6	23	10103091SH109	
TH4322SSW	19.3	9.4	10.1	5.2	9.6	23	10103091SH109	
TH4323SS	25.4	13.4	14.3	5.2	9.6	36	10103091SH113	
TH4323SS-BA	25.4	13.4	14.3	5.2	9.6	36	10103091SH113	
TH4323SSW	25.4	13.5	14.2	5.2	9.6	36	10103091SH113	
TH4324SS	35.1	14.5	15.5	5.2	9.6	47	10103091SH113	
TH4324SS-BA	35.1	14.5	15.5	5.2	9.6	47	10103091SH113	
TH4324SSW	35.2	14.5	15.5	5.2	9.6	47	10103091SH113	No KO
TH4325SS	59.5	24.6	25.6	8.4	13.8	135	10103091SH119	
TH4326SS	59.5	24.6	25.6	8.4	13.8	139	10103091SH119	
THN2261SSDC	11.3	9.4	10.1	4.9	9.4	16	10103091SH109	
THN2262SSDC	13.3	9.4	10.1	5.2	9.6	16	10103091SH109	
THN2263SSDC	25.4	13.4	14.3	5.2	9.6	30	10103091SH113	
THN3361MSS	19.3	9.4	14.1	5.0	10.1	22	10103091SH123	
THN3361MSSW	19.3	9.4	14.1	5.0	10.1	22	10103091SH123	
THN3361SS	11.3	9.4	10.1	4.9	9.4	16	10103091SH109	
THN3361SS-BA	11.3	9.4	10.1	4.9	9.4	16	10103091SH109	
THN3361SSCL	13.3	9.4	10.1	5.2	9.6	9	10103091SH109	
THN3361SSW	11.3	9.4	10.1	4.9	9.4	19	10103091SH109	
THN3362MSS	19.3	9.4	14.1	5.0	10.1	15	10103091SH123	
THN3362SS	13.3	9.4	10.1	5.2	9.6	21	10103091SH109	
THN3362SS-BA	13.3	9.4	10.1	5.2	9.6	21	10103091SH109	
THN3362SSCL	13.3	9.4	10.1	5.2	9.6	21	10103091SH109	
THN3362SSW	13.3	9.4	10.1	5.2	9.6	22	10103091SH109	
THN3363MSS	25.4	13.4	15.3	5.0	10.4	20	10103091SH128	
THN3363SS	25.4	13.4	14.3	5.2	9.6	36	10103091SH113	
THN3363SS-BA	25.4	13.4	14.3	5.2	9.6	36	10103091SH113	
THN3363SSW	25.4	13.5	14.2	5.2	9.6	36	10103091SH113	
THN3364MSS	35.1	14.4	16.3	5.0	10.4	32	10103091SH128	
THN3364SS	35.1	14.5	15.5	5.2	9.6	50	10103091SH113	
THN3364SS-BA	35.1	14.5	15.5	5.2	9.6	50	10103091SH113	
THN3364SSCL	35.1	14.5	15.5	5.2	9.6	32	10103091SH113	
THN3364SSW	35.2	14.5	15.5	5.2	9.6	32	10103091SH113	
THN3365MSS	47.9	24.5	25.6	7.9	14.4	110	10103091SH130	
THN3365SS	48.0	24.6	25.6	8.4	13.7	239	10103091SH119	
THN3366MSS	47.9	24.5	25.6	7.9	14.4	110	10103091SH130	
THN3366SS	48.0	24.6	25.6	8.4	13.7	139	10103091SH119	

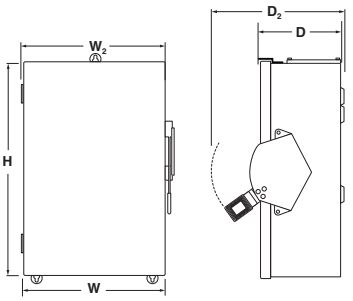


Heavy Duty NEMA Type 4/4X

Safety Switches
Enclosure Dimensions
Spec-Setter™ Safety Switches
TH and THN, NEMA Type 5/12 Enclosures

Heavy Duty, NEMA Type 5, 12 Drip/Dust-tight Approximate Dimensions in inches

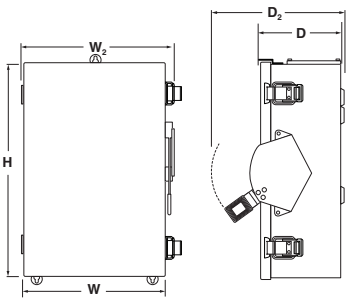
Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TH2221J	11.3	7.4	8.1	5.4	10.0	12	10103091SH110	
TH2221JW	11.3	7.4	8.1	5.4	10.0	12	10103091SH110	
TH2222J	19.3	9.4	10.1	5.7	10.2	21	10103091SH110	
TH2222JW	19.3	9.4	10.1	5.7	10.2	21	10103091SH110	
TH2261JDC	13.3	9.4	10.1	5.4	10.0	16	10103091SH109	
TH2262JDC	19.3	9.4	10.1	5.7	10.2	22	10103091SH109	
TH2263JDC	25.4	13.4	14.0	5.0	10.1	35	10103091SH113	
TH3221J	11.3	7.4	8.1	5.4	10.0	12	10103091SH110	
TH3221JW	11.3	7.4	8.1	5.4	10.0	12	10103091SH110	
TH3222J	19.3	9.4	10.1	5.7	10.2	15	10103091SH110	
TH3222JW	19.3	9.4	10.1	5.7	10.2	15	10103091SH110	
TH3223J	25.4	13.4	14.0	5.0	10.1	37	10103091SH120	
TH3223JW	25.4	13.4	14.0	5.0	10.1	37	10103091SH120	
TH3224J	35.1	14.5	15.1	5.0	10.1	33	10103091SH120	
TH3224JW	35.1	14.5	15.1	5.0	10.1	33	10103091SH120	
TH3225J	59.5	24.5	25.6	7.9	14.5	120	10103091SH124	
TH3226J	59.5	24.5	25.6	7.9	14.5	134	10103091SH124	
TH3321J	11.3	7.4	8.1	5.4	10.0	12	10103091SH110	
TH3321JW	11.3	7.4	8.1	5.4	10.0	12	10103091SH110	
TH3322J	19.3	9.4	10.1	5.7	10.2	21	10103091SH110	
TH3322JCH	19.3	9.4	9.8	5.7	10.3	28	10103091SH132	
TH3322JW	19.3	9.4	10.1	5.7	10.2	21	10103091SH110	
TH3361J	13.3	9.4	10.1	5.4	10.0	16	10103091SH110	
TH3361JW	13.3	9.4	10.1	5.4	10.0	16	10103091SH110	
TH3362J	19.3	9.4	10.1	5.7	10.2	22	10103091SH110	
TH3362JCH	19.3	9.4	9.8	5.7	10.3	31	10103091SH132	
TH3362JCHSS	19.3	9.4	9.8	5.7	10.3	32	10103091SH132	
TH3362JW	19.3	9.4	10.1	5.7	10.2	22	10103091SH110	
TH3363J	25.4	13.4	14.0	5.0	10.1	36	10103091SH120	
TH3363JW	25.4	13.4	14.0	5.0	10.1	35	10103091SH120	No KO
TH3364J	35.1	14.5	15.1	5.0	10.1	49	10103091SH120	
TH3364JW	35.1	14.5	15.1	5.0	10.1	33	10103091SH120	
TH3365J	59.5	24.5	25.6	7.9	14.5	206	10103091SH124	
TH3366J	59.5	24.5	25.6	7.9	14.5	215	10103091SH124	
TH4321J	11.3	7.4	8.1	5.4	10.0	12	10103091SH110	
TH4321JW	11.3	7.4	8.1	5.4	10.0	12	10103091SH110	
TH4322J	19.3	9.4	10.1	5.7	10.2	22	10103091SH110	
TH4322JW	19.3	9.4	10.1	5.7	10.2	22	10103091SH110	
TH4323J	25.4	13.4	14.0	5.0	10.1	36	10103091SH120	
TH4323JW	25.4	13.4	14.0	5.0	10.1	36	10103091SH120	
TH4324J	35.1	14.5	15.1	5.0	10.1	52	10103091SH120	
TH4324JW	35.1	14.5	15.1	5.0	10.1	52	10103091SH120	
TH4325J	59.5	24.5	25.6	7.9	14.5	128	10103091SH124	
TH4326J	59.5	24.5	25.6	7.9	14.5	139	10103091SH124	
THN2261JDC	13.3	9.4	10.1	5.4	10.0	16	10103091SH110	
THN2262JDC	19.3	9.4	10.1	5.7	10.2	15	10103091SH110	
THN2263JDC	25.4	13.4	14.0	5.0	10.1	34	10103091SH120	
THN3361J	13.3	9.4	10.1	5.4	10.0	16	10103091SH110	
THN3361JCL	13.3	9.4	10.1	5.4	10.0	22	10103091SH110	
THN3361JW	13.3	9.4	10.1	5.4	10.0	16	10103091SH110	
THN3362J	19.3	9.4	10.1	5.7	10.2	21	10103091SH110	
THN3362JCH	19.3	9.4	9.8	5.7	10.3	21	10103091SH132	
THN3362JW	19.3	9.4	10.1	5.7	10.2	21	10103091SH110	
THN3363J	25.4	13.4	14.0	5.0	10.1	34	10103091SH120	
THN3363JCL	25.4	13.4	14.0	5.0	10.1	33	10103091SH120	
THN3363JW	25.4	13.4	14.0	5.0	10.1	33	10103091SH120	
THN3364J	35.1	14.5	15.1	5.0	10.1	47	10103091SH120	
THN3364JW	35.1	14.5	15.1	5.0	10.1	47	10103091SH120	
THN3365J	48.0	24.5	25.6	7.9	14.5	164	10103091SH124	
THN3366J	48.0	24.5	25.6	7.9	14.5	109	10103091SH124	



Heavy Duty NEMA Type 5/12

Heavy Duty, NEMA Type 3R, 5, 12 Approximate Dimensions in inches

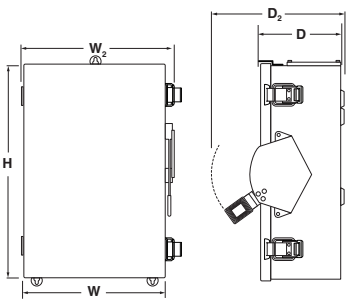
Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TH3361JR	13.3	9.4	10.1	5.4	10.0	17	10103091SH110	
TH3362JR	19.3	9.4	10.1	5.7	10.2	23	10103091SH132	
TH3363JR	25.4	13.4	14.0	5.0	10.1	38	10103091SH120	20
TH3364JR	35.1	14.5	15.1	5.0	10.1	49	10103091SH120	
TH3365JR	59.5	24.5	25.6	7.9	14.5	197	10103091SH124	
TH3366JR	59.5	24.5	25.6	7.9	14.5	212	10103091SH124	



Heavy Duty NEMA Type 3R/5/12

Heavy Duty, NEMA Type 12 Drip/Dust-tight Approximate Dimensions in inches

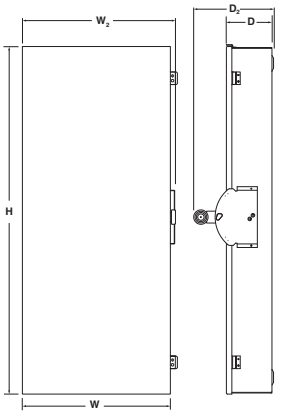
Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TH2221M	11.3	7.4	8.1	4.7	9.9	13	10103091SH123	
TH2222M	19.3	9.4	14.1	5.0	10.1	23	10103091SH123	
TH2223M	23.4	13.4	15.3	5.0	10.1	24	10103091SH128	
TH2224M	35.1	14.4	16.3	5.0	10.1	25	10103091SH128	
TH2261MDC	19.3	9.4	14.1	5.0	10.1	20	10103091SH123	
TH2262MDC	19.3	9.4	14.1	5.0	10.1	22	10103091SH123	
TH2263MDC	23.4	13.4	15.3	5.0	10.1	35	10103091SH128	
TH3321M	11.3	7.4	8.1	4.7	9.9	13	10103091SH123	
TH3322M	19.3	9.4	14.1	5.0	10.1	21	10103091SH123	
TH3322MW	19.3	9.4	14.1	5.0	10.1	21	10103091SH123	
TH3323M	23.4	13.4	15.3	5.0	10.1	24	10103091SH128	
TH3324M	35.1	14.4	16.3	5.0	10.1	30	10103091SH128	
TH3325M	59.4	24.5	25.6	7.9	14.4	193	10103091SH130	
TH3326M	59.4	24.5	25.6	7.9	14.4	200	10103091SH130	
TH3361M	19.3	9.4	14.1	5.0	10.1	22	10103091SH123	
TH3361MW	19.3	9.4	14.1	5.0	10.1	22	10103091SH123	No KO
TH3362M	19.3	9.4	14.1	5.0	10.1	22	10103091SH123	
TH3363M	23.4	13.4	15.3	5.0	10.1	35	10103091SH128	
TH3364M	35.1	14.4	16.3	5.0	10.1	45	10103091SH128	
TH3365M	59.4	24.5	25.6	7.9	14.4	206	10103091SH130	
TH3366M	59.4	24.5	25.6	7.9	14.4	211	10103091SH130	
THN2261MDC	19.3	9.4	14.1	5.0	10.1	20	10103091SH123	
THN2262MDC	19.3	9.4	14.1	5.0	10.1	20	10103091SH123	
THN2263MDC	23.4	13.4	15.3	5.0	10.1	35	10103091SH128	
THN3361M	19.3	9.4	14.1	5.0	10.1	21	10103091SH123	
THN3362M	19.3	9.4	14.1	5.0	10.1	15	10103091SH123	
THN3362MW	19.3	9.4	14.1	5.0	10.1	15	10103091SH123	
THN3363M	23.4	13.4	15.3	5.0	10.1	20	10103091SH128	
THN3364M	35.1	14.4	16.3	5.0	10.1	35	10103091SH128	
THN3365M	47.9	24.5	25.6	7.9	14.4	110	10103091SH130	
THN3366M	47.9	24.5	25.6	7.9	14.4	110	10103091SH130	



Heavy Duty NEMA Type 5/12

Double Throw, NEMA Type 1 TC Approximate Dimensions in inches

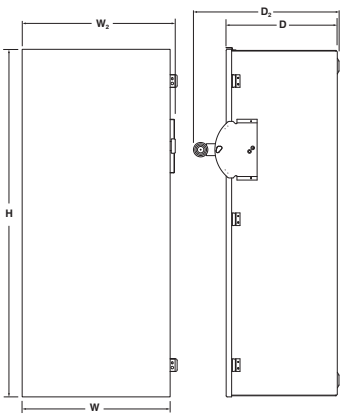
Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TC35321	15.8	10.4	12.0	5.2	8.7	14	10103091SH115	7
TC35322	18.8	11.4	13.0	6.3	9.3	19	10103091SH115	7
TC35323	22.4	14.5	16.0	7.9	14.5	34	10103091SH117	9
TC35324	30.2	17.9	19.5	8.9	11.9	54	10103091SH117	10
TC35325	34.3	24.5	26.7	10.3	17.1	83	10103091SH122	10
TC35326	44.4	23.5	25.6	11.3	17.5	140	10103091SH122	12
TC35327	63.8	27.0	27.8	8.9	14.1	175	10103091SH143	
TC35327N	63.8	27.0	27.8	8.9	14.1	175	10103091SH143	No KO
TC35328	78.1	42.6	43.8	20.5	29.6	471	10103091SH145	
TC35361	25.0	12.0	12.8	6.0	11.2	44	10103091SH185	
TC35362	18.8	11.4	13.0	6.3	9.3	21	10103091SH115	7
TC35363	22.4	14.5	16.0	7.9	14.5	38	10103091SH117	9
TC35364	30.2	17.9	19.5	8.9	11.9	62	10103091SH117	10
TC35365	34.3	20.4	22.6	10.3	17.1	89	10103091SH122	10
TC35366	44.4	23.5	25.6	11.3	17.5	140	10103091SH122	12
TC35367	63.8	27.0	27.8	8.9	14.1	175	10103091SH143	
TC35367N	63.8	27.0	27.8	8.9	14.1	175	10103091SH143	No KO
TC35368	78.1	42.6	43.8	20.5	29.6	471	10103091SH145	



Double Throw NEMA Type 1

Double Throw, NEMA Type 3R TC Approximate Dimensions in inches

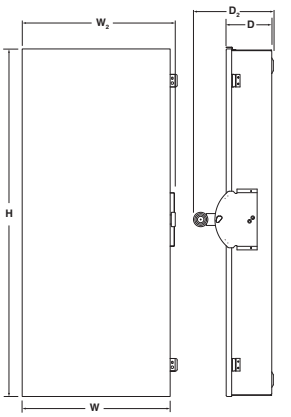
Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TC10323R	15.1	7.2	8.2	5.2	8.5	10	10103091SH131	15
TC10324R	30.2	13.3	16.8	8.5	12.1	38	10103091SH131	13
TC10424R	30.2	13.3	16.8	8.5	12.1	38	10103091SH131	13
TC35321R	19.8	10.4	12.3	5.2	10.3	14	10103091SH126	
TC35322R	20.8	11.4	13.3	6.3	11.4	19	10103091SH126	
TC35323R	22.9	14.4	16.6	7.9	14.5	35	10103091SH125	
TC35324R	30.6	17.9	19.6	8.9	1.9	54	10103091SH125	
TC35325R	34.8	24.4	27.3	10.3	17.3	98	10103091SH143	
TC35326R	63.8	23.7	24.5	8.9	14.1	175	10103091SH143	
TC35327R	63.8	27.0	27.8	8.9	14.1	175	10103091SH143	
TC35327RN	63.8	27.0	27.8	8.9	14.1	175	10103091SH143	
TC35328R	78.1	42.6	43.8	20.5	29.6	473	10103091SH145	No KO
TC35361R	25.0	12.0	12.8	6.0	11.2	44	10103091SH185	
TC35362R	20.8	11.4	13.3	6.3	11.4	21	10103091SH126	
TC35363R	22.9	14.4	16.6	7.9	14.5	39	10103091SH125	
TC35364R	30.6	17.9	19.6	8.9	1.9	62	10103091SH125	
TC35365R	54.3	22.7	23.5	7.3	12.5	140	10103091SH143	
TC35366R	63.8	23.7	24.5	8.9	14.1	175	10103091SH143	
TC35367R	63.8	27.0	27.8	8.9	14.1	175	10103091SH143	
TC35367RN	63.8	27.0	27.8	8.9	14.1	175	10103091SH143	
TC35368R	78.1	42.6	43.8	20.5	29.6	473	10103091SH145	



Double Throw NEMA Type 3R

Double Throw, NEMA Type 1 TDT Approximate Dimensions in inches

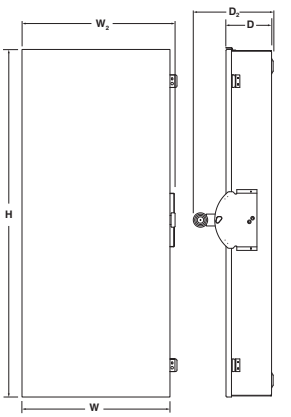
Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TDT3321	37.0	12.0	12.8	8.3	11.2	47	10103091SH137	No KO
TDT3322	37.0	12.0	12.8	8.3	11.2	43	10103091SH137	
TDT3323	37.0	12.0	12.8	8.3	11.2	48	10103091SH137	
TDT3324	51.4	19.2	19.9	6.1	11.3	159	10103091SH138	
TDT3325	74.7	25.3	26.2	8.9	14.1	163	10103091SH139	
TDT3326	86.1	27.4	28.3	8.9	14.1	341	10103091SH139	
TDT3327	58.9	28.1	29.3	20.5	25.6	275	10103091SH147	
TDT3328	78.1	42.6	43.8	20.5	29.6	501	10103091SH146	
TDT3361	37.0	12.0	12.8	8.3	11.2	42	10103091SH137	
TDT3362	37.0	12.0	12.8	8.3	11.2	43	10103091SH137	
TDT3363	37.0	12.0	12.8	8.3	11.2	62	10103091SH137	
TDT3364	51.4	27.6	28.6	8.8	16.2	102	10103091SH138	
TDT3365	74.7	25.3	26.2	8.9	14.1	274	10103091SH139	
TDT3366	58.9	28.1	29.3	20.5	25.6	278	10103091SH144	
TDT3367	58.9	28.1	29.3	20.5	25.6	278	10103091SH145	
TDT3368	78.1	42.6	43.8	20.5	29.6	501	10103091SH146	



Double Throw NEMA Type 1

Double Throw, NEMA Type 3R TDT Approximate Dimensions in inches

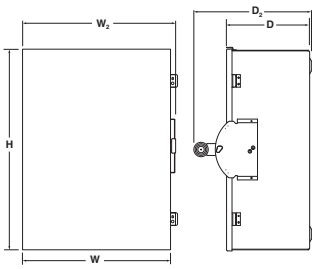
Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TDT3321R	37.0	12.0	12.8	8.3	11.2	47	10103091SH137	No KO
TDT3322R	37.0	12.0	12.8	8.3	11.2	47	10103091SH137	
TDT3323R	37.0	12.0	12.8	8.3	11.2	62	10103091SH137	
TDT3324R	51.4	27.6	28.6	8.8	16.2	159	10103091SH138	
TDT3325R	74.8	26.3	24.5	8.8	14.1	230	10103091SH143	
TDT3326R	58.9	28.1	29.3	20.5	25.6	320	10103091SH144	
TDT3327R	58.9	28.1	29.3	20.5	25.6	276	10103091SH147	
TDT3328R	78.1	42.6	43.8	20.5	29.6	503	10103091SH146	
TDT3361R	37.0	12.0	12.8	6.0	11.9	44	10103091SH185	
TDT3362R	37.0	12.0	12.8	6.0	11.9	44	10103091SH185	
TDT3363R	37.0	12.0	12.8	8.3	11.2	49	10103091SH137	
TDT3364R	51.4	27.6	28.6	8.8	16.2	160	10103091SH138	
TDT3365R	74.8	26.3	24.5	8.8	14.1	230	10103091SH143	
TDT3366R	58.9	28.1	29.3	20.5	25.6	278	10103091SH144	
TDT3367R	58.9	28.1	29.3	20.5	25.6	278	10103091SH147	
TDT3368R	78.1	42.6	43.8	20.5	29.6	503	10103091SH146	



Double Throw NEMA Type 3R

Double Throw, NEMA Type 4X (304 Stainless) TC Approximate Dimensions in inches

Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TC35361SS	25.7	11.9	12.7	5.5	11.4	60	10103091SH150	No KO
TC35362SS	25.7	11.9	12.7	5.5	11.4	60	10103091SH150	
TC35363SS	25.7	11.9	12.7	5.5	11.4	60	10103091SH150	
TC35364SS	39.8	19.6	20.3	6.5	11.7	105	10103091SH186	
TC35365SS	37.9	19.6	20.3	6.5	14.1	185	10103091SH149	
TC35366SS	67.0	24.1	25.3	9.0	14.0	195	10103091SH188	
TC35367SS	63.3	27.4	28.4	8.9	14.1	230	10103091SH187	



Double Throw NEMA Type 4X

Double Throw, NEMA Type 4X (304 Stainless) TDT Approximate Dimensions in inches

Product Number	Dimension H	Dimension W (Box)	Dimension W_2 (W/ Handle)	Dimension D (Box)	Dimension D_2 (W/ Handle)	Weight (lbs)	Drawing #	KO Figure Number
TDT3361SS	38.8	12.0	12.8	5.5	11.4	45	10103091SH148	No KO
TDT3362SS	38.8	12.0	12.8	5.5	11.4	45	10103091SH148	
TDT3363SS	38.8	12.0	12.8	5.5	11.4	45	10103091SH148	
TDT3364SS	53.3	19.6	20.3	6.5	11.6	100	10103091SH142	
TDT3365SS	37.9	19.6	20.3	6.5	14.1	260	10103091SH149	

Accessories and Lug Sizes: See pages 2-25 to 2-30
Outlines, Dimensions and Knockouts: See pages 2-31 to 2-39

Dimensions-Knockouts

Symbol	A	B	C	D	E	F	G	H	J	K	L	M	N
Conduit Size (Inches)	9/32	1/2	1/2	1/2	1/2	1/2	3/4	3/4	1	1	2	2	2 1/2
	–	–	3/4	3/4	3/4	3/4	1	1	1 1/4	1 1/2	2 1/2	2 1/2	3
	–	–	–	1	1	1	–	1 1/4	1 1/2	2	3	3	–
	–	–	–	–	1 1/4	1 1/2	–	1 1/2	2	2 1/2	–	3 1/2	–

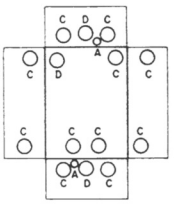


Figure 1

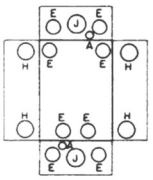


Figure 2

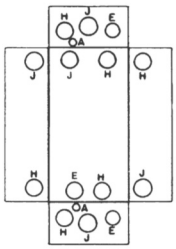


Figure 3

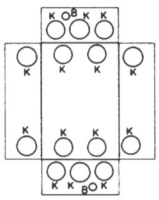


Figure 4

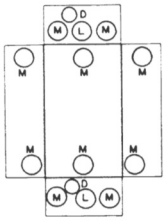


Figure 5

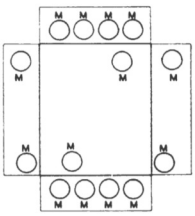


Figure 6

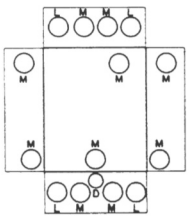


Figure 7

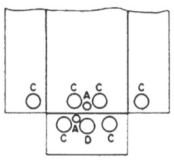
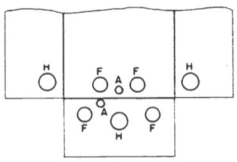


Figure 8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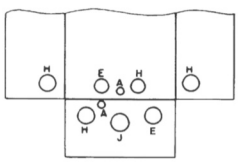
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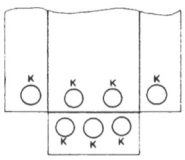
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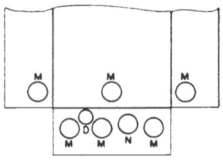
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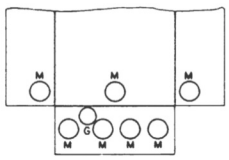
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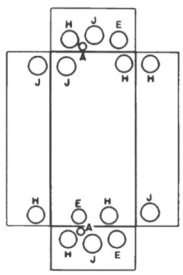
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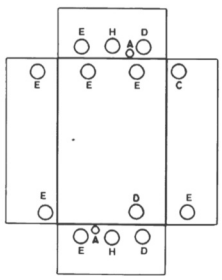
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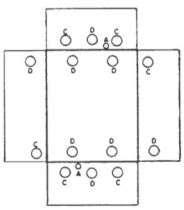
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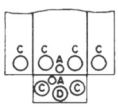
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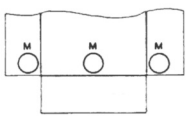
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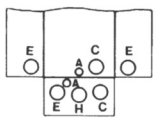
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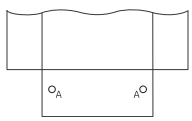
Figure 20

Safety Switches
Enclosure Dimensions

Spec-Setter™ Safety Switches
TG, TH and TS, NEMA Type 1 and 3R Enclosures

For additional information on GE safety switches, please visit the Publication Library at www.geindustrial.com to view and download the following resources:

Pub. Number	Title
GEA-12144	Spec Setter Safety Switches
DET-842	Stainless Steel Safety Switches Sealed Tight – Latch It!
DEE-576	General Duty Safety Switches
DEQ-219	GE's Side-Swing Safety Switches
DET-843	GE Residential Products and Solutions
DEA-464	Small Projects Same Day Flyer
DET-651	Small Projects Selection Guide

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FUSES

TRS 150R

American Power Fuses
TRI-ONIC®
TR and TRS (Class RK5 TD)

The industry's Most popular fuse for Motor circuit protection.

Tri-onic® SmartSpot® fuses now provide a visual open fuse indicator. With advanced material technology added to the existing product the TR and TRS current limiting time delay fuses are engineered for overcurrent protection of motors and transformers, service entrance equipment, feeder and branch circuits. Tri-onic proven time delay characteristic safely handles harmless starting currents and inrush currents associated with today's motors and transformers.

Features/Benefits

- *Solid State SmartSpot Indicator*
- *Time delay for motor start-ups and transformer inrush currents without nuisance opening*
- *Current limiting for low peak let-thru current*
- *Rejection-style design prevents replacement errors (when used with recommended fuse blocks)*
- *Easy-to-read label for quick recognition and replacement*
- *Metal-embossed date and catalog number for traceability and lasting identification*
- *Fiberglass body provides dimensional stability in harsh industrial settings*
- *Brass end-caps (blade-style) for cooler operation and superior performance*
- *High-grade silica filler ensures fast arc quenching and high current limitation*

Ratings

TR

AC: 1/10 to 600A 250VAC, 200kA I.R.

DC: 1/10 to 2 8/10A and 35 to 400A, 250VD, 20 A.I.R
3 to 30A & 450 to 600A,
160VDC, 20kA I.R.

TRS

AC: 1/10 to 600A, 600VAC, 200kA I.R.

DC: 1/10 to 12A, 600VDC, 20kA I.R.
70 to 600A, 600VDC, 100kA I.R.
15 to 60A, 300VDC, 20kA I.R.

Highlights

- *Time Delay*
- *Current Limiting*
- *AC & DC Rated*

Applications

- *Motor Circuits*
- *Mains*
- *Feeders*
- *Branch Circuits*
- *Transformers*
- *Service Entrance Equipment*
- *General-purpose Protection*

Approvals

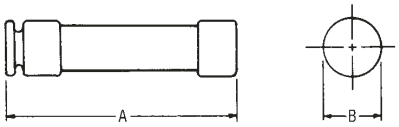
- *UL Listed to Standard 248-12*
- *CSA Certified to Standard C22.2 No. 248.12*
- *DC Listed to UL Standard 198L*

American Power Fuses
TRI-ONIC®
TR and TRS (Class RK5 TD)

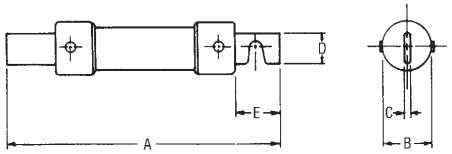
Standard Fuse Ampere Ratings

Ampere Rating	Catalog Number		Reference Number		Ampere Rating	Catalog Number		Reference Number	
	250V	600V	250V	600V		250V	600V	250V	600V
1/10	TR1/10R	TRS1/10R	F222530	W216748	10	TR10R	TRS10R	D200839	N218811
15/100	TR15/100R	TRS15/100R	E201898	F223059	12	TR12R	TRS12R	S201381	B219858
2/10	TR2/10R	TRS2/10R	Z214198	X216749	15	TR15R	TRS15R	D211120	B201389
3/10	TR3/10R	TRS3/10R	C217260	J212160	17-1/2	TR17-1/2R	TRS17-1/2R	S211639	K211126
4/10	TR4/10R	TRS4/10R	Z223053	Y216750	20	TR20R	TRS20R	D214708	P217777
1/2	TR1/2R	TRS1/2R	Y223052	N217776	25	TR25R	TRS25R	G215217	B219329
6/10	TR6/10R	TRS6/10R	R216238	L213197	30	TR30R	TRS30R	F217769	K213196
8/10	TR8/10R	TRS8/10R	T219322	R217779	35	TR35R	TRS35R	F218804	J214207
1	TR1R	TRS1R	Z212151	H212159	40	TR40R	TRS40R	E200840	Q217778
1-1/8	TR1-1/8R	TRS1-1/8R	Q218284	G212158	45	TR45R	TRS45R	F201899	Q218813
1-1/4	TR1-1/4R	TRS1-1/4R	E217768	J211125	50	TR50R	TRS50R	B213188	D201391
1-4/10	TR1-4/10R	TRS1-4/10R	E218803	H213194	60	TR60R	TRS60R	P216742	M214716
1-6/10	TR1-6/10R	TRS1-6/10R	R219320	G214205	70	TR70R	TRS70R	Q219848	Y213691
1-8/10	TR1-8/10R	TRS1-8/10R	S219850	R215732	75	TR75R	TRS75R	E222529	P215730
2	TR2R	TRS2R	J215725	Q222539	80	TR80R	TRS80R	W223050	W216242
2-1/4	TR2-1/4R	TRS2-1/4R	A213187	H214206	90	TR90R	TRS90R	B200837	L217774
2-1/2	TR2-1/2R	TRS2-1/2R	Q212672	J213195	100	TR100R	TRS100R	K216738	D214202
2-8/10	TR2-8/10R	TRS2-8/10R	S213686	S215733	110	TR110R	TRS110R	B218800	K215220
3	TR3R	TRS3R	T219851	P215224	125	TR125R	TRS125R	N219317	N215729
3-2/10	TR3-2/10R	TRS3-2/10R	N216741	N201906	150	TR150R	TRS150R	P219847	S216745
3-1/2	TR3-1/2R	TRS3-1/2R	Q216237	M200847	175	TR175R	TRS175R	D222528	K217773
4	TR4R	TRS4R	A212152	D219860	200	TR200R	TRS200R	V223049	K218808
4-1/2	TR4-1/2R	TRS4-1/2R	G222531	A216246	225	TR225R	TRS225R	A200836	Y219855
5	TR5R	TRS5R	E214709	M211128	250	TR250R	TRS250R	P201378	L222535
5-6/10	TR5-6/10R	TRS5-6/10R	R212673	H223061	300	TR300R	TRS300R	B201895	J200844
6	TR6R	TRS6R	S218286	V215735	350	TR350R	TRS350R	A211117	J201902
6-1/4	TR6-1/4R	TRS6-1/4R	S218286	K212161	400	TR400R	TRS400R	P211636	G211123
7	TR7R	TRS7R	G218805	Z216751	450	TR450R	TRS450R	N218282	E212156
8	TR8R	TRS8R	V219852	R218814	500	TR500R	TRS500R	C218801	W212677
9	TR9R	TRS9R	H222532	S222541	600	TR600R	TRS600R	P219318	F213192

Note: Indicator not available (1/10-7) Amps



0-60A



61-600A

Recommended Fuse Blocks With Box Connectors For Tri-onic® Class RK5 Fuses

Fuse Ampere Rating	Catalog Number 250V		Ref. Number 250V	
	1 Pole	3 pole	1 pole	3 pole
0-30	20306R	20308R	T213411	K215956
31-60	20606R	20608R	B212383	E214939
61-100	21036R	21038R	D201621	M212899
101-200	22001R	22003R	R213915	G214941
201-400	24001R	24003R	J219566	D222022
401-600	2631R	2633R	H214942	P215960

Fuse Ampere Rating	Catalog Number 600V		Ref. Number 600V	
	1 Pole	3 pole	1 pole	3 pole
0-30	60306R	60308R	H212389	K214438
31-60	60606R	60608R	K212391	M214440
61-100	61036R	61038R	W204788	Z211875
101-200	62001R	62003R	V212906	B213924
201-400	64001R	64003R	D219055	M222030
401-600	6631R	6633R	J216990	E218021

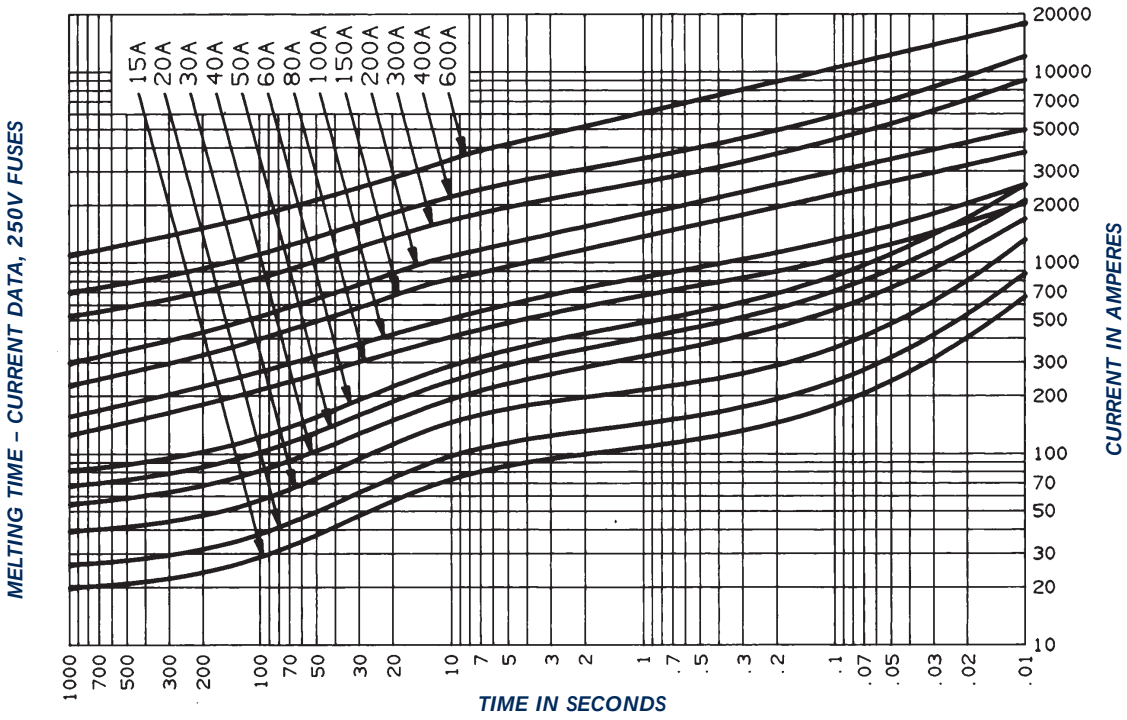
A variety of pole configurations and termination provisions is available.

Dimensions

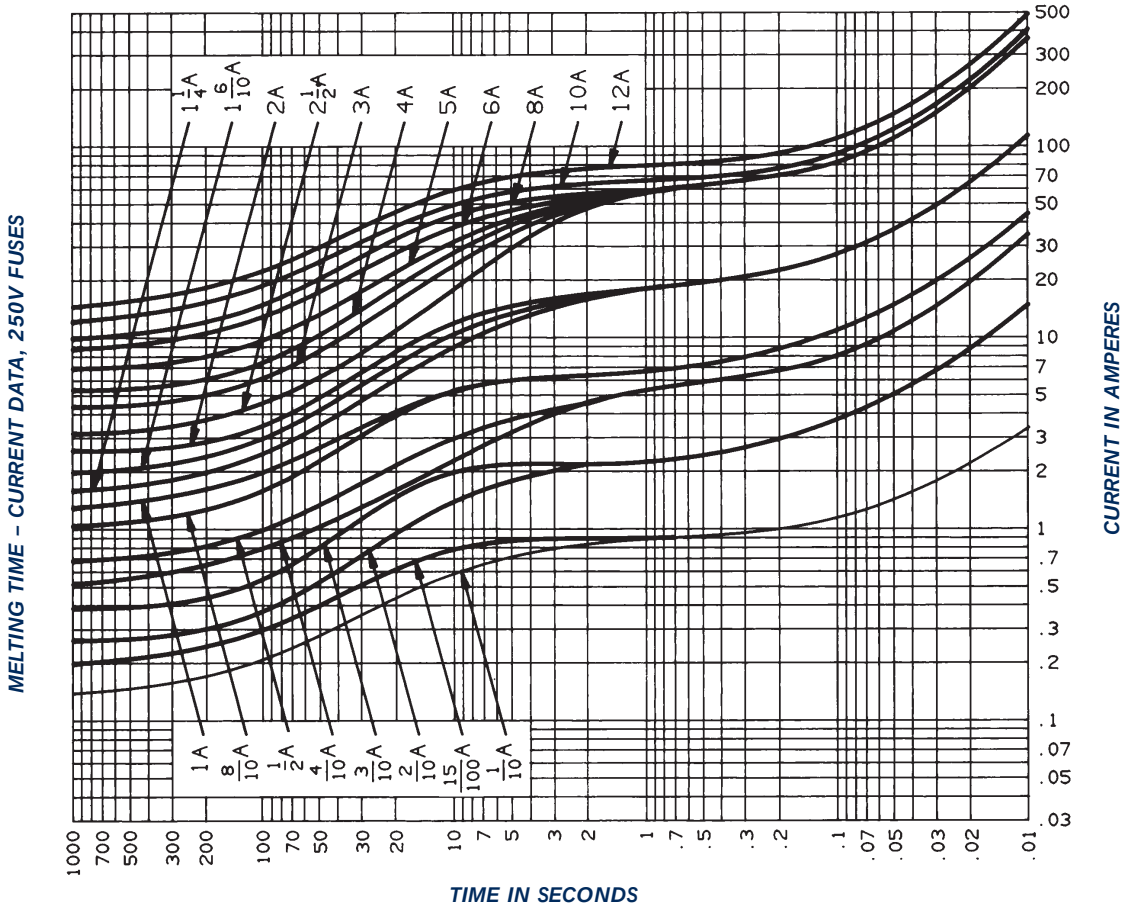
Ampere Rating	A		B		C		D		E	
	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
250V-TR Fuses										
0-30	2	51	9/16	14	-	-	-	-	-	-
31-60	3	76	13/16	21	-	-	-	-	-	-
61-100	5-7/8	149	1-1/16	27	1/8	3	3/4	19	1	25
101-200	7-1/8	181	1-9/16	40	3/16	5	1-1/8	28	1-3/8	35
201-400	8-5/8	219	2-1/16	53	1/4	6	1-5/8	41	1-7/8	48
401-600	10-3/8	264	2-9/16	66	1/4	6	2	51	2-1/4	57
600V-TRS Fuses										
0-30	5	127	13/16	21	-	-	-	-	-	-
31-60	5-1/2	139	1-1/16	27	-	-	-	-	-	-
61-100	7-7/8	200	1-5/16	34	1/8	3	3/4	19	1	25
101-200	9-5/8	244	1-13/16	46	3/16	5	1-1/8	28	1-3/8	35
201-400	11-5/8	295	2-9/16	66	1/4	6	1-5/8	41	1-7/8	48
401-600	13-3/8	340	3-1/8	80	1/4	6	2	51	2-1/4	57

American Power Fuses
TRI-ONIC®
TR and TRS (Class RK5 TD)

TR 15 to 600

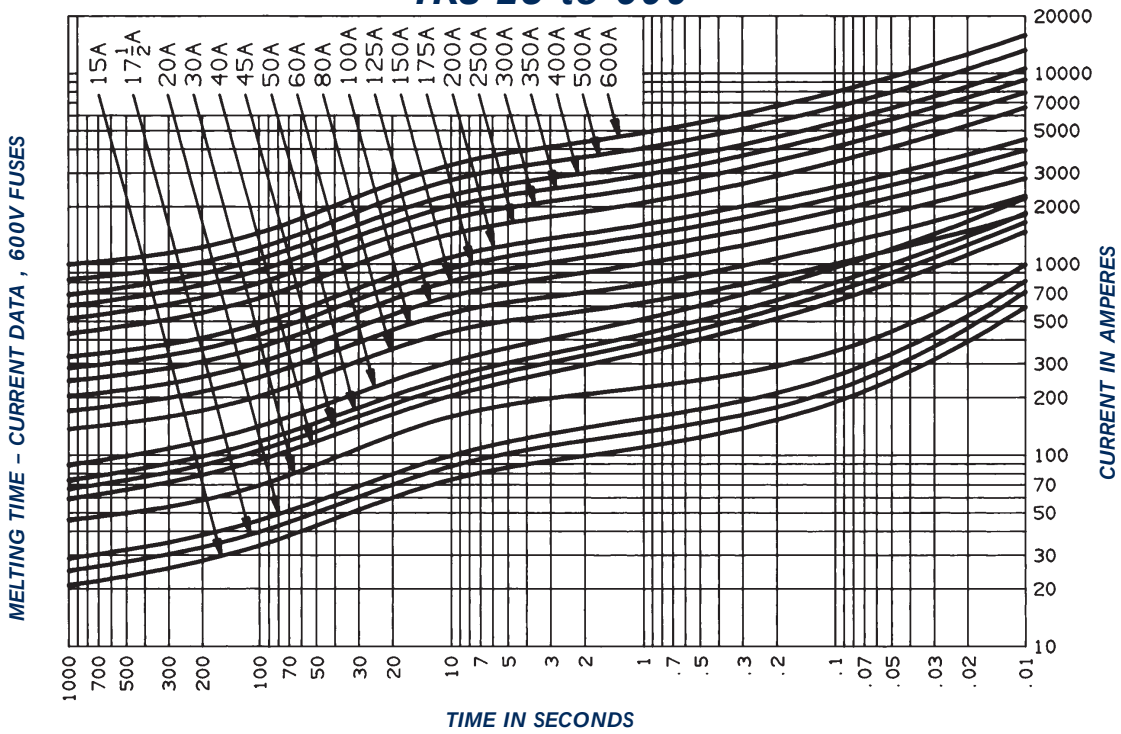


TR 1/10 to 12

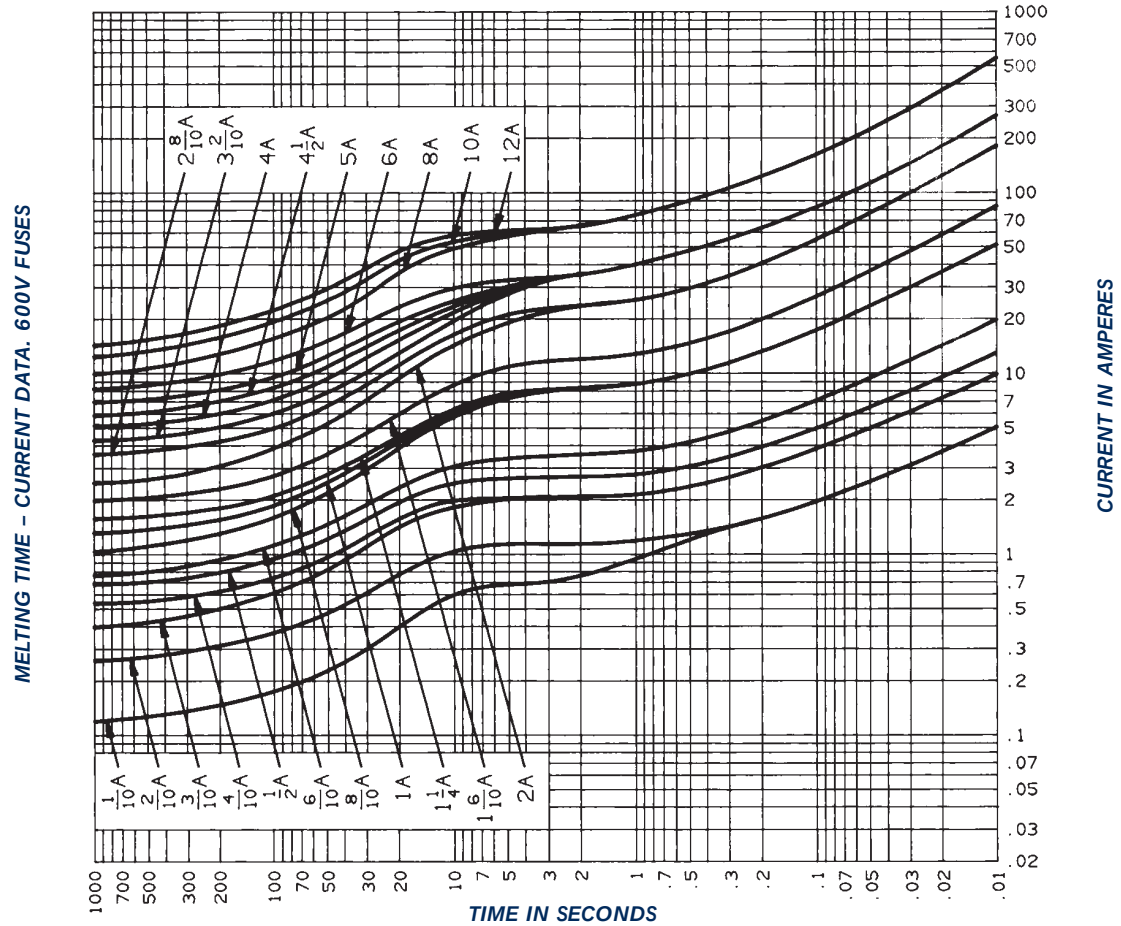


American Power Fuses
TRI-ONIC®
TR and TRS (Class RK5 TD)

TRS 15 to 600

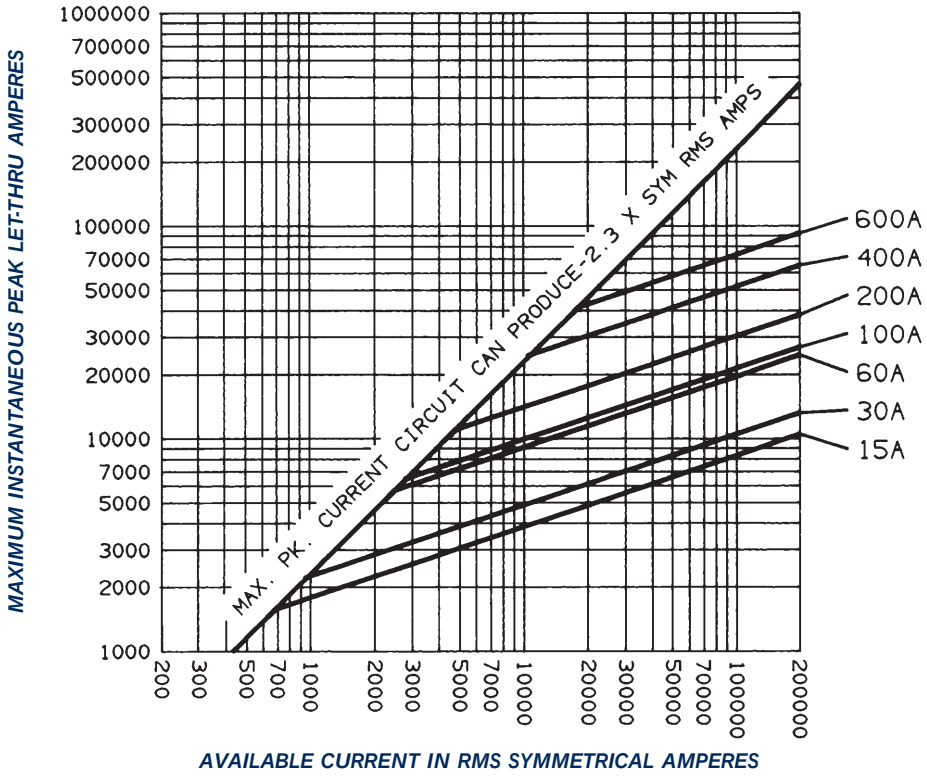


TRS 1/10 to 12

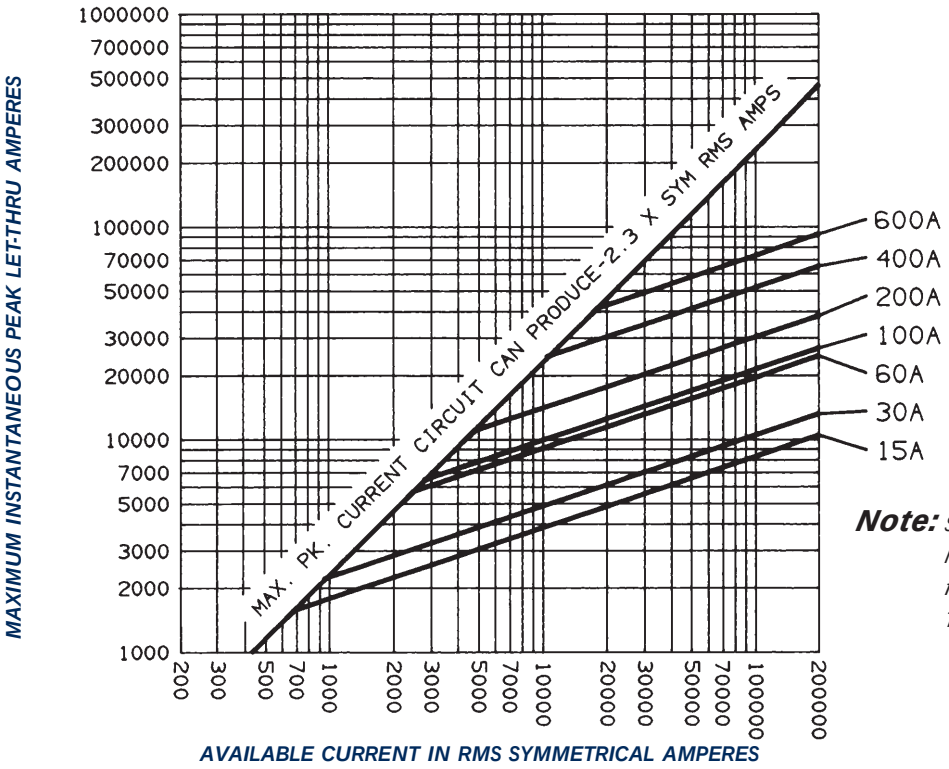


American Power Fuses
TRI-ONIC®
TR and TRS (Class RK5 TD)

Peak Let-Thru Current Data – TR 30 to 600, 250 Volts AC



Peak Let-Thru Current Data – TRS 15 to 600, 600 Volts AC



Note: *See Application Information page L9 for All Motor and Transformer Tables.*

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UL RATED PANEL BOARD ENCLOSURE

EZ BOX 36X42

Saginaw Control & Engineering
95 Midland Road
Saginaw, MI 48638-5770
Phone: (800)234-6871
Fax: (989)799-4524
http://www.saginawcontrol.com

Part Information - SCE-42EL3612LP

SCE-42EL3612LP

Application -
Designed to house electrical and electronic controls, instruments and components. Provides protection from dust, oil and water. For outdoor application a drip shield is recommended.

Construction -
- 0.075" carbon steel.
- Seams continuously welded and ground smooth.
- Flange trough collar around all sides of door opening.
- Oil-resistant gasket.
- Collar studs provided for mounting optional panels.
- Concealed hinge.
- Removable and interchangeable doors.
- Black quarter turn latches.
- Latches are opened or closed with a screwdriver.
- Mounting holes in back of enclosure.
- Mounting hardware, sealing washer and hole plug included.
- Removable print pocket furnished if height and width of enclosure is greater than 12 inches.
- Ground studs on door and body.

Options -
- Optional tamper-resistant inserts are available.
- Optional mounting feet available.
- Door hardware available.

Finish -
ANSI-61 gray powder coating inside and out. Optional sub-panels are powder coated white.

Industry Standards - (IS2)
NEMA Type 4, 12 and Type 13
UL Listed Type 4 and 12
CSA Type 4 and 12
IEC 60529 IP 66

Notes -
Interchangeable latches and handles available in the accessory section.

Product Specifications -
Part Number: SCE-42EL3612LP
Description: EL Enclosure
Height: 42.00"
Width: 36.00"
Depth: 12.00"
Price Code: E3
Catalog Page: 71
Est. Ship Weight: 123.00 lbs

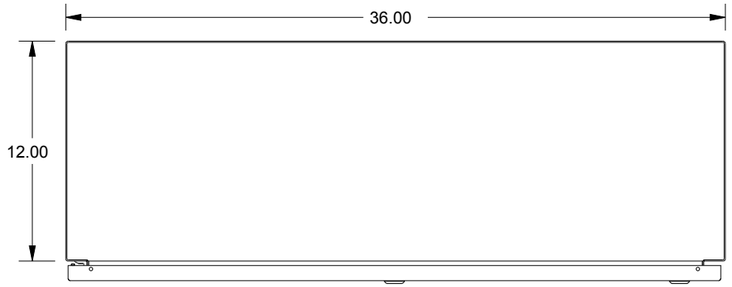
Download CAD Package
Add to Bill of Material

Optional Accessories -
SCE-42P36 - Subpanel, Bent
SCE-BV4XKIT - Kit, Breather Vent
SCE-DF42EL36LP - Panel, Dead Front (Wall Mount)
SCE-DS36N4 - Shield, Drip
SCE-DV4XKIT - Kit, Drain Vent
SCE-ELMFK4 - Foot Kit, EL Mounting (4pc.)
SCE-ELSP3 - KIT, Swing-Out Panel (20 High & Up)
SCE-PLWKB - Padlocking Wingknob Door Latch (Black)

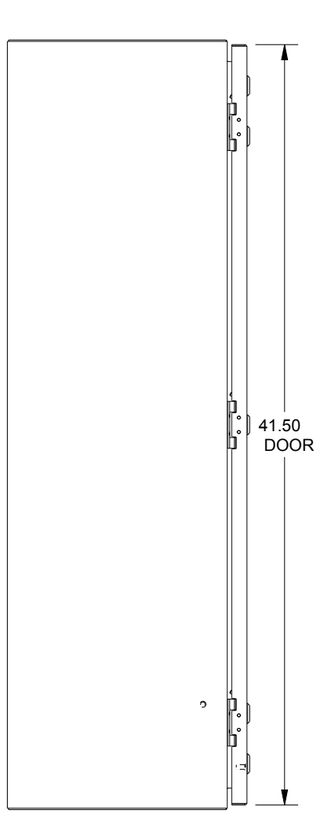
Similar Part Numbers -
SCE-30EL2406LP - EL Enclosure
SCE-30EL2408LP - EL Enclosure
SCE-30EL2410LP - EL Enclosure
SCE-30EL2412LP - EL Enclosure
SCE-30EL2416LP - EL Enclosure
SCE-30EL2420LP - EL Enclosure
SCE-30EL2424LP - EL Enclosure
SCE-30EL3008LP - EL Enclosure
SCE-30EL3010LP - EL Enclosure
SCE-30EL3012LP - EL Enclosure

Installation Information -
Mounting Foot Kit for Enviroline Enclosures
Sealing Washer Specifications
EL Flush Mount Frame
Drip Shield Kit Assembly
Drain/Vents
Dead Front Wall Mount Installation Instructions
Swing Panel Assembly for Enviroline Enclosures
Swing Panel ELSP for Encl. Height > 16
Dead Front Wall Mount < 20 In Height Installation Instructions
Swing Panel ELSP for Encl. Height <= 16

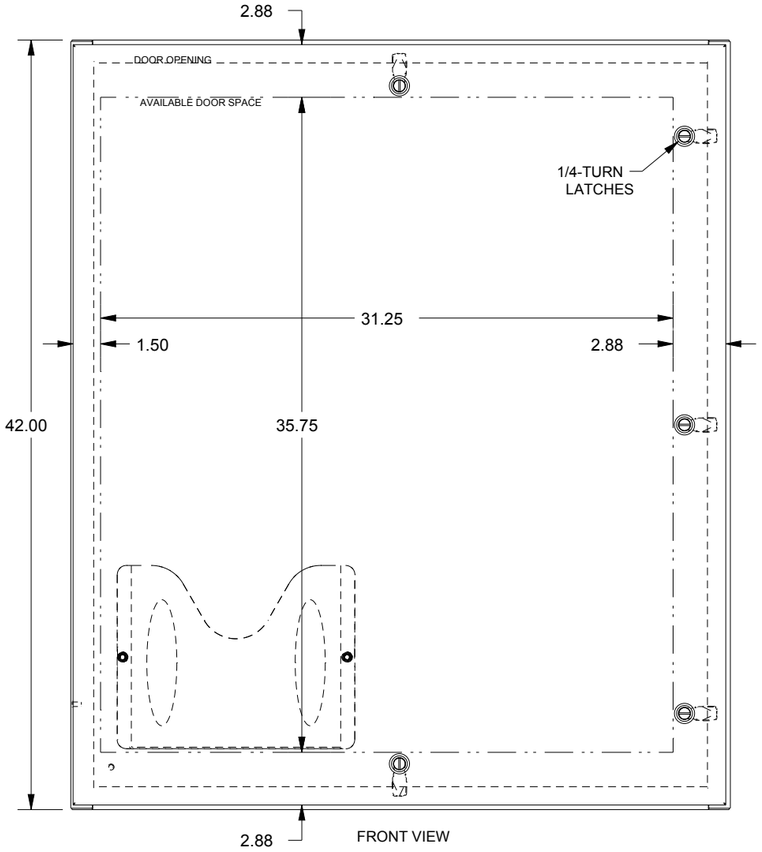
SAGINAW CONTROL & ENGINEERING
SCE-42EL3612LP



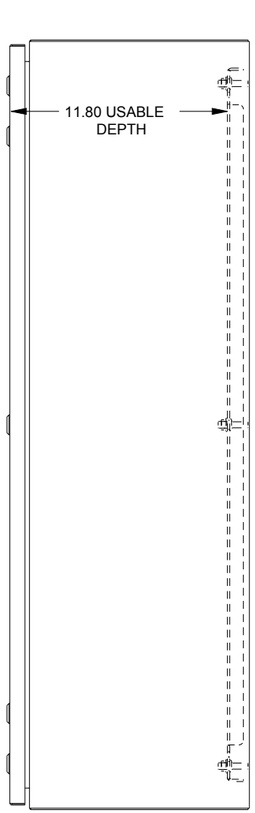
TOP VIEW



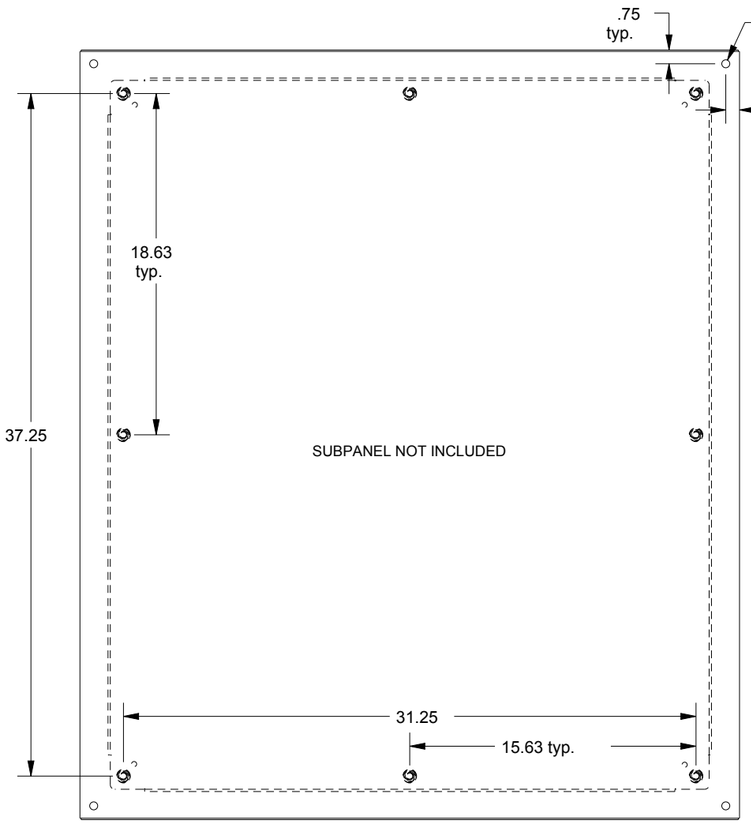
LEFT SIDE VIEW



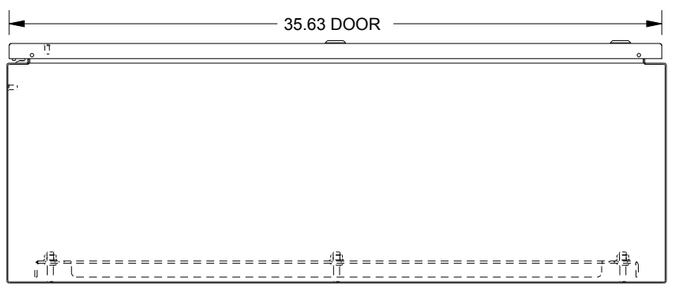
FRONT VIEW



RIGHT SIDE VIEW



EXTERNAL REAR VIEW



BOTTOM VIEW

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INFO@COMPRESSORDS.COM

C-MORE HMI

EA9-T15CL TOUCH PANEL

EA9 C-more Touch Panels

C-more EA9 series Touch Panels are fully programmable and provide power and flexibility through a vast set of features. Color TFT touch screen monitors are available in 6", 8", 10", 12" or 15" versions.

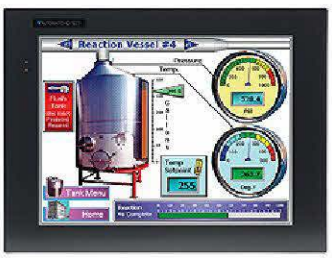
C-more EA9-T6CL-R Touch Screen Interface Panel
6-inch color TFT, 64k colors, 320 x 240 pixel QVGA screen resolution, no Ethernet support, one SD card slot

C-more EA9-T6CL Touch Screen Interface Panel
6-inch color TFT, 64k colors, 320 x 240 pixel QVGA screen resolution, Ethernet support, one SD card slot

C-more EA9-T8CL Touch Screen Interface Panel
8-inch color TFT, 64k colors, 800 x 600 pixel SVGA screen resolution, Ethernet support, one SD card slot

C-more EA9-T10CL Touch Screen Interface Panel
10-inch color TFT, 64k colors, 800 x 600 pixel SVGA screen resolution, Ethernet support, one SD card slot

C-more EA9-T12CL Touch Screen Interface Panel
12-inch color TFT, 64k colors, 800 x 600 pixel SVGA screen resolution, Ethernet support, HDMI port, two SD card slots



C-more EA9-T15CL Touch Screen Interface Panel
15-inch color TFT, 64k colors, 1024 x 768 pixel XGA screen resolution, Ethernet support, HDMI port, two SD card slots

The C-more programming software (EA9-PGMSW) is a user-friendly, Windows-based graphical editor for configuring all C-more EA9 operator interface touch panels

Exclusion of warranty:
Both the manufacturer and the supplier reserve the right to execute technical changes and updates as well as adaptations in pricing without prior notice. Errors and omissions excepted.

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EA9 C-more Touch Panels – Features

- Pre-built touch panel components for easy screen design
- Screen objects such as Toggle Switch, Slide Switch, Selector Switch, Throw Switch, Thumbwheel Switch, Meters, PID Faceplates, Analog/Digital Clock
- SD card for user program backup and logging (not all models)
- Field expandable user memory
- All models support 64K colors
- Multiple languages (up to 9)
- Serial PLC Interface RS-232C/422/485
- Ethernet Port 10/100 MB
- 2 USB ports, Type B (downloads and programming) and Type A (device options)
- Up to 9999 screens, depending on complexity
- Built-in clock and calendar
- Built-in soft keypad for numeric and alphanumeric entry
- Password protection for every touch object
- Passwords for up to eight user groups
- Unlimited levels of undo and 16 levels of redo
- Import bitmaps or bitmap objects, such as pushbuttons
- 40-character tag names
- Sound - Audio line out (full featured models)
- Animation Objects
- Project Simulation
- Object grouping
- Color gradation for objects
- Analog touch overlay (no predefined touch cells)
- Overlapping Objects
- Background Screens
- User Library, including: Objects, Screen, Graphic, Sound, Video
- Send e-mail
- Web Server
- FTP Server
- Remote Access and Control

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EA9 C-more Touch Panels – Selection Guide and Specification

C-*more* Panel Specification			
	EA9-T6CL-R	**EA9-T6CL**	**EA9-T8CL**
			
Model	6" TFT color w/ base features	6" TFT color w/ full features	8" TFT color w/ full features
Display Viewing Area	115.2 mm x 86.4 mm		170.4 mm x 127.8 mm
Weight	710 g	720 g	1330 g
Screen Pixels	320 x 240 (QVGA)		800 x 600 (SVGA)
Display Brightness	280 nits		310 nits
LCD Panel Dot Pitch	0.18 mm x 0.18 mm		0.213 mm x 0.213 mm
Color Scale	65,536 colors		
Backlight Average Lifetime *	50,000 hours @ 25 °C		
Touch Panel Type	Four-wire analog resistive		
Project Memory	26 MB		
Number of Screens	Up to 999 screens – limited by project memory		
Realtime Clock	Realtime Clock Built into panel, backed up for 30 days at 25 °C		
Calender – Month/Day/Year	Yes – monthly deviation 60 sec (Reference)		
Serial Port1	15-pin D-sub female – RS232C, RS-422/485		
Serial Port2	N/A	3-wire terminal block – RS-485	
Serial Port3	N/A	RJ12 modular jack – RS-232C	
USB Port – Type B	USB 2.0 High speed (480 Mbps) Type B – Download/Program		
USB Port – Type A	USB 2.0 High speed (480 Mbps) Type A – for USB device options		
Ethernet Port	N/A	Ethernet Port 10/100 Base-T, auto MDI/MDI-X	
Audio Line Out	N/A	3.5 mm mini jack – requires amplifier and speaker(s)	
Mic In	N/A	3.5 mm mini jack	
SD Card Slot	1 slot supports max. 2 GB (SD), max. 32 GB (SDHC)		
HDMI Out	N/A		
Supply Power	12-24 VDC, or use the AC/DC Power Adapter – EA-AC, Reverse Polarity Protected		
Power Consumption	16.0 W 1.30 A @ 12VDC 0.66 A @24VDC		18.0 W 1.50 A @ 12VDC 0.75 A @24VDC
Internal Fuse (non-replaceable)	4.0 A		6.3 A
Operating Temperature	0 to 50 °C Max. surrounding air temperature rating: 50°C IEC 60068-2-14		
Storage Temperature	–20 to +60°C – IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-14		
Humidity	5 – 95% RH (non-condensing)		
Environment	For use in Pollution Degree 2 environment, no corrosive gases permitted		
Noise Immunity	NEMA ICS3-304 (EN61131-2) RFI, (145MHz, 440Mhz 10W @ 10cm) Impulse 1000V @ 1mS pulse EN61000-4-2 (ESD), EN61000-4-3 (RFI) EN61000-4-4 (FTB) EN61000-4-5 (Serge) EN61000-4-6 (Conducted) EN61000-4-8 (Power frequency magnetic field immunity)		
Withstand Voltage	1000 VAC, 1 min. (FG to Power supply)		
Insulation Resistance	> 10M ohm @ 500VDC (FG to Power supply)		
Vibration	IEC60068-2-6 (Test Fc)		
Shock	IEC60068-2-27 (Test Ea)		
Emission	EN55011 Class A (Radiated RF emission)		
Enclosure	NEMA 250 type 4/4X indoor use only UL50 type 4X indoor use only IP-65 indoor use only (When mounted correctly)		
Agency Approvals	UL508, E157382 CE (EN61131-2), RoHS (2011/65/EU) CUL Canadian C22.2		

***NOTE:* The backlight average lifetime is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under low or high temperature usage.**

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C-*more* Panel Specification			
	EA9-T10CL	**EA9-T12CL**	**EA9-T15CL**
			
Model	10" TFT color w/ full features	12" TFT color w/ full features	15" TFT color w/ full features
Display Viewing Area	211.2 mm x 158.4 mm	246.0 mm x 184.5 mm	304.1 mm x 228.0 mm
Weight	1900 g	2200 g	2950 g
Screen Pixels	800 x 600 (SVGA)		1024 x 768 (XGA)
Display Brightness	280 nits		
LCD Panel Dot Pitch	0.264 mm x 0.264 mm	0.3075 mm x 0.3075 mm	0.297 mm x 0.297 mm
Color Scale	65,536 colors		
Backlight Average Lifetime *	50,000 hours @ 25 °C		
Touch Panel Type	Four-wire analog resistive		
Project Memory	26 MB	82 MB	
Number of Screens	Up to 999 screens – limited by project memory		
Realtime Clock	Realtime Clock Built into panel, backed up for 30 days at 25 °C		
Calender – Month/Day/Year	Yes – monthly deviation 60 sec (Reference)		
Serial Port1	15-pin D-sub female – RS232C, RS-422/485		
Serial Port2	3-wire terminal block – RS-485		
Serial Port3	RJ12 modular jack – RS-232C		
USB Port – Type B	USB 2.0 High speed (480 Mbps) Type B – Download/Program		
USB Port – Type A	USB 2.0 High speed (480 Mbps) Type A – for USB device options		
Ethernet Port	Ethernet Port 10/100 Base-T, auto MDI/MDI-X		
Audio Line Out	3.5 mm mini jack – requires amplifier and speaker(s)		
Mic In	3.5 mm mini jack		
SD Card Slot	1 slot supports max. 2 GB (SD), max. 32 GB (SDHC)	2 slots supports max. 2 GB (SD), max. 32 GB (SDHC)	
HDMI Out	N/A	Yes	
Supply Power	12-24 VDC, or use the AC/DC Power Adapter – EA-AC, Reverse Polarity Protected		
Power Consumption	18.0 W 1.50 A @ 12VDC 0.75 A @24VDC	21.0 W 1.75 A @ 12VDC 0.88 A @24VDC	29.0 W 2.40 A @ 12VDC 1.20 A @24VDC
Internal Fuse (non-replaceable)	6.3 A		
Operating Temperature	0 to 50 °C Max. surrounding air temperature rating: 50°C IEC 60068-2-14		
Storage Temperature	–20 to +60°C – IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-14		
Humidity	5 – 95% RH (non-condensing)		
Environment	For use in Pollution Degree 2 environment, no corrosive gases permitted		
Noise Immunity	NEMA ICS3-304 (EN61131-2) RFI, (145MHz, 440Mhz 10W @ 10cm) Impulse 1000V @ 1mS pulse EN61000-4-2 (ESD), EN61000-4-3 (RFI) EN61000-4-4 (FTB) EN61000-4-5 (Serge) EN61000-4-6 (Conducted) EN61000-4-8 (Power frequency magnetic field immunity)		
Withstand Voltage	1000 VAC, 1 min. (FG to Power supply)		
Insulation Resistance	> 10M ohm @ 500VDC (FG to Power supply)		
Vibration	IEC60068-2-6 (Test Fc)		
Shock	IEC60068-2-27 (Test Ea)		
Emission	EN55011 Class A (Radiated RF emission)		
Enclosure	NEMA 250 type 4/4X indoor use only UL50 type 4X indoor use only IP-65 indoor use only (When mounted correctly)		
Agency Approvals	UL508, E157382 CE (EN61131-2), RoHS (2011/65/EU) CUL Canadian C22.2		

***NOTE:* The backlight average lifetime is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under low or high temperature usage.**

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EA9 C-more Touch Panels – Communication Protocols

PLC Compatibility Table			
PLC/Network	**Model**		**Protocols**
DirectLOGIC	DL05 / DL06	all	K-Sequence
			DirectNET
			MODBUS (Koyo addressing)
		H0-ECOM/H0-ECOM100	***Direct***LOGIC Ethernet
	DL105	all	K-Sequence
	DL205	D2-230	K-Sequence
		D2-240	K-Sequence
			DirectNET
		D2-250 / D2-250-1 / D2-260	K-Sequence
			DirectNET
			MODBUS (Koyo addressing)
		D2-240 / D2-250-1 / D2-260 using D2-DCM	***Direct***NET
			MODBUS (Koyo addressing)
		H2-ECOM/ H2-ECOM100	***Direct***LOGIC Ethernet
	DL305	D3-330 / D3-330P (Requires the use of a Data Communications Unit)	***Direct***NET
		D3-340	***Direct***NET
		D3-350	K-Sequence
			DirectNET
			MODBUS (Koyo addressing)
		D3-350 using D3-DCM	***Direct***NET
			MODBUS (Koyo addressing)
	DL405	D4-430	K-Sequence
			DirectNET
		D4-440	K-Sequence
			DirectNET
		D4-450	K-Sequence
			DirectNET
			MODBUS (Koyo addressing)
		All with D4-DCM	***Direct***NET
			MODBUS (Koyo addressing)
		H4-ECOM/ H4-ECOM100	DirectLOGIC Ethernet

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EA9 C-more Touch Panels – Communication Protocols

PLC Compatibility Table		
PLC/Network	**Model**	**Protocols**
Productivity Series	Productivity3000 Serial (P3-550)	AutomationDirect P3000 Serial
	Productivity3000 Ethernet (P3-550)	AutomationDirect P3000 Ethernet
Do-more	all	Do-more Serial
		Do-more Ethernet
CLICK	all	AutomationDirect Modbus (CLICK)
Allen-Bradley	MicroLogix 1000/1100/1200/1400/1500, SLC 5-/01/02/03, PLC5	DH485/AIC/AIC+
	MicroLogix 1000, 1100, 1200 and 1500	DF1 Half Duplex; DF1 Full Duplex
	SLC 5-/03/04/05	
	ControlLogix, CompactLogix, FlexLogix	
	ControlLogix, CompactLogix, FlexLogix – Tag Based	
	PLC-5	DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix – Generic I/O Messaging	Ethernet/IP Server
	ControlLogix, CompactLogix, FlexLogix – Tag Based	Ethernet/IP Client
	MicroLogix 1100 & SLC5/05 via native Ethernet port	
	MicroLogix 1000, 1100, 1200, 1400, 1500 und SLC5-03/04/05 via ENI-Adapter	
	Micro 800 series	Modbus RTU
		Modbus TCP
MODBUS TCP/IP	MODBUS TCP/IP devices	MODBUS TCP/IP
GE	90/30, 90/70, Micro 90, VersaMax Micro	SNPX
Mitsubishi	FX Series	FX Direct
	Q02, Q02H, Q06H, Q12H, Q25H	Q CPU
	Q, QnA Serial	QnA Serial
	Q, QnA Ethernet	QnA Ethernet
Modicon	984 CPU, Quantum 113 CPU, AEG Modicon Micro Series 110 CPU: 311-xx, 411-xx, 512-xx, 612-xx	Modbus RTU
Omron	C200 Adapter, C500	Host Link
	CJ1/CS1 Serial, CJ1/CS1 Ethernet	FINS
Siemens	S7-200, S7-300, S7-400, S7-1200 CPU Ethernet	Ethernet ISO over TCP

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EA9 C-more Touch Panels – Configuration Software

C-more's mission is to make you feel like a touch panel configuration expert. So we put in many tools to make your job faster and more effective.

System requirements for running C-more Programming Software -EA9-PGMSW - on a PC:

- 300 MB free hard-disk space
- Super VGA color video adapter and monitor with 1024 x 768 pixel resolution 64K color minimum
- CD-ROM or DVD drive for installing software from the CD
- Keyboard and Mouse or compatible pointing device
- USB port or Ethernet 10/100 Mbps port for project transfer from software to touch panel
- Operating System – Windows XP Pro., Windows 7 (32 or 64 bit) or Windows 8 (32 or 64 bit)

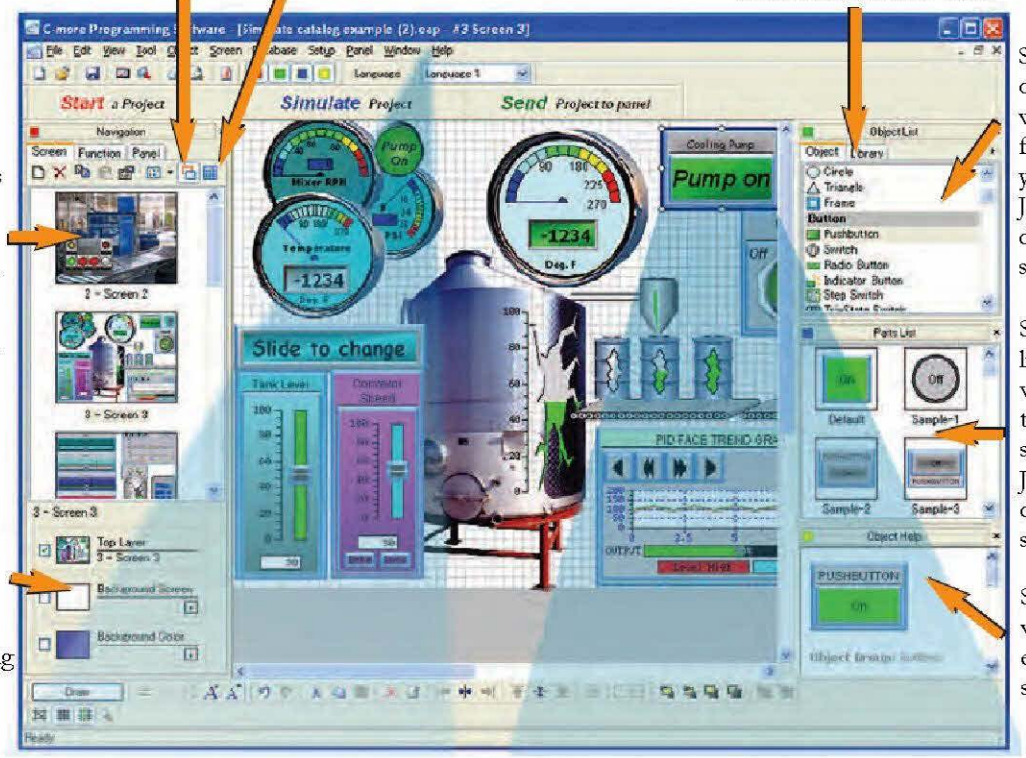
Save your screens in the Screen Library to use with other projects

Build your own keypads to use with numeric and text entry

Click on the Library tab to view libraries of personally stored objects, screens, sound bites, etc. This saves hours of work!

Thumbnail project preview window helps you organize multiscreen projects. And you can rearrange the screens using the screen library!

Select background screen, background color and screen layering with a click!



Scrolling object selection window lets you find the object you want fast. Just drag and drop it on the screen.

Scrolling parts list shows variations of the objects selected above. Just drag and drop on the screen.

Scrolling help window for each object type selected

C-more Programming Software

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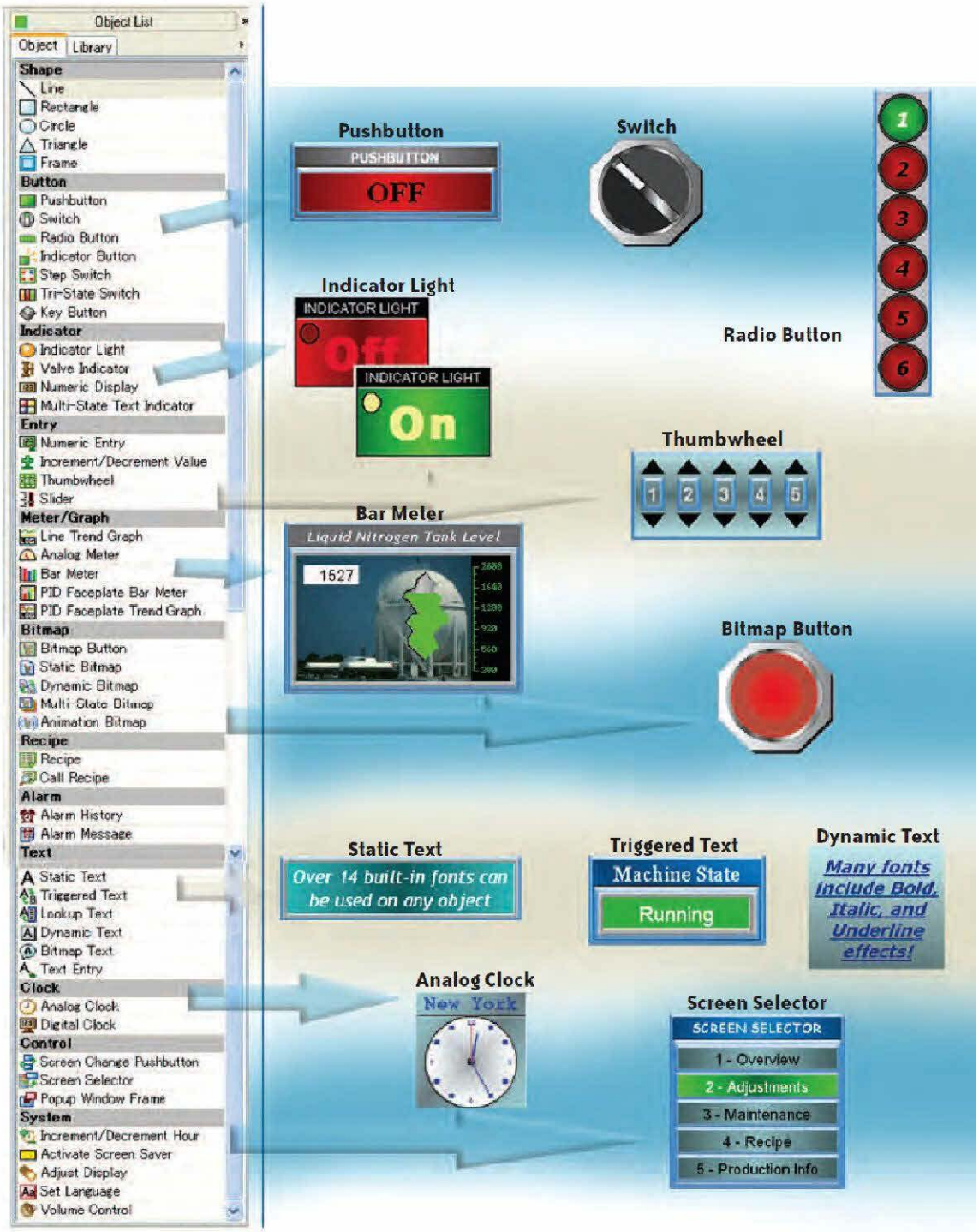
EA9 C-more Touch Panels – Configuration Software

A. Wide Array of Objects and Customized Parts

Here a few of the more than 50 types of objects in the standard Object List



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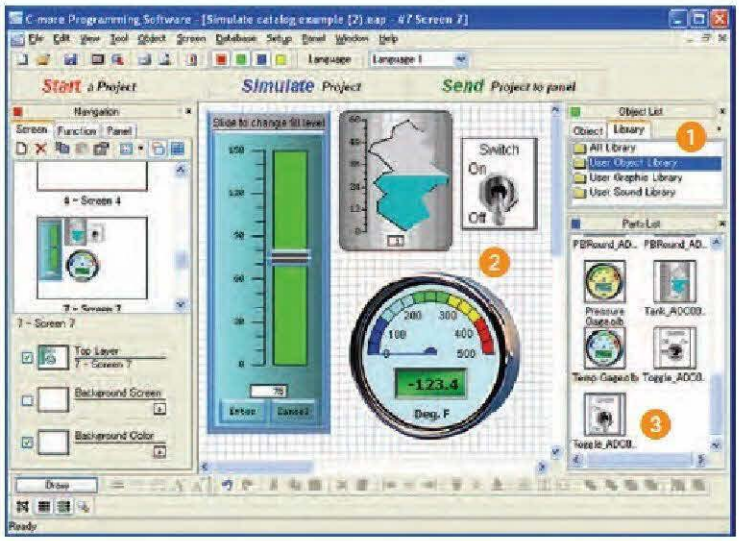
EA9 C-more Touch Panels – Configuration Software

B. User libraries allow you to re-use your work again and again

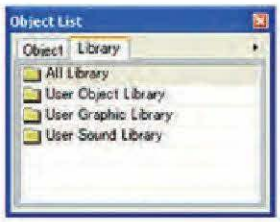
C-more provides three user libraries that allow you to efficiently re-use your work throughout your project or for other projects in the future. You can store a custom object, such as your company logo or a group of objects that compose a custom object. You can also store entire screens, graphics and sound bites. You can access your libraries at any time and reuse your work by merely clicking on the saved item and dragging it from the library into your project. You can even import and export library items to share with other designers.



❶ Object, graphic and sound Libraries

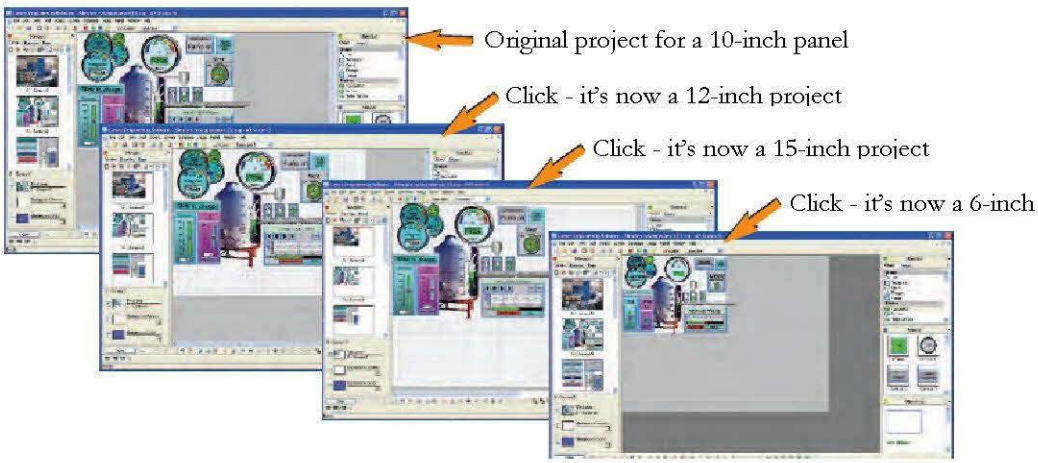
❷ Create, store and retrieve your:
- Custom objects
- Entire screens
- Sound bites

❸ Re-use your work on this project or future projects



C. Change your project screen size with a click of your mouse

Imagine developing your project on a 10-inch panel and then deciding to change the size to a 15-inch panel or an 8-inch panel. In the past, you most likely had to recreate your entire project and reconfigure every object, tag and screen. With C-more, your project can be automatically converted for a different size display with a click of the mouse. Of course, you may wish to move things around a little since you have a different screen size. This feature is great for OEMs or integrators that may be installing different configurations of the same machine or process.



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Guidelines for Warranty and Returns

30-day money-back returns

30-day return authorizations can now be obtained using your online account (also available for guest users).

We offer a 30-day money-back period on all products except Marathon Electric motors and refurbished products, beginning 10 days after the date of the invoice. This grace period provides ample time for you to receive the product. Products must be returned in the original boxes in like-new condition. See "Guidelines for Returns" for complete details on how to return a product under the 30-day money back guarantee. Products returned outside the 30-day policy will be subject to restocking fees. AutomationDirect's standard policy is that all customers are responsible for freight charges to AutomationDirect when returning products under the 30-day return policy.

Warranty

Warranty return authorizations can now be obtained using your online account (also available for guest users).

All AutomationDirect products carry a minimum one-year warranty against defects in materials and workmanship. If a product proves defective in materials or workmanship within one year from the date of purchase, we will replace or repair it. *(See page TC-24 for information regarding IronHorse and Marathon Electric motors)*. The replacement is your exclusive remedy and our sole obligation for any breach of warranty, except that, if, after a reasonable number of attempts, we are unable to provide you a product that meets the above warranty, we will refund the purchase price for that product, as our sole obligation and your sole remedy. **Products returned under warranty (after 30 days) may be replaced with refurbished or remanufactured goods.** AutomationDirect's standard policy is that all customers are responsible for freight charges to AutomationDirect when returning products under the warranty return policy.

Some products may carry a longer warranty term as specified in this catalog and in our online store. Except for the longer term, these same provisions apply to such warranties. EXCEPT AS EXPRESSLY PROVIDED IN THIS WARRANTY SECTION, WE MAKE NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH RESPECT TO ANY PRODUCT, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, NON-INFRINGEMENT OR FITNESS FOR ANY PARTICULAR PURPOSE, AND WE HEREBY DISCLAIM SAME.

In no event will we be liable, whether in contract, tort or under any other legal theory, for lost profits or revenues, loss of use or similar economic loss, for any indirect, special, incidental, consequential, punitive or similar damages arising out of or in connection with any products (including non-conforming products), or for any third-party claims against you relating to the products, even if we have been advised of the possibility of such claim. In no event will our monetary liability (whether in contract, tort or under any other legal theory) in respect of any product exceed the purchase price that you paid to us for it.

This warranty will be void if product date codes or serial numbers are removed or defaced. Of course, warranties also do not apply to products that have been subject to abnormal use, abnormal conditions, improper storage, exposure to moisture or dampness, unauthorized modifications, unauthorized repair, misuse, neglect, accident, alteration, improper installation or other acts which are not our fault, including damage caused in shipping. Our warranty also does not apply to any product that has been damaged by external causes such as fire, flood, sand, dirt, lightning, exposure to weather, acts of God, battery leakage. theft, blown fuses, improper use of any electrical source or connection to product not recommended in writing for interconnection by us.

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and usually change with time. It is your responsibility to determine which codes should be followed, and to verify that the equipment, installation and operation is in compliance with the latest revision of these codes.

At a minimum, you should follow all applicable sections of the National Fire Code, National Electrical Code, and the codes of the National Electrical Manufacturers Association (NEMA). There may be local regulatory or government offices that can also help determine which codes and standards are necessary for safe installation and operation.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not assume any responsibility for your product design, installation or operation.

Our products are not fault-tolerant and are not designed, manufactured or intended for use or resale as on-line control equipment in hazardous environments requiring fail-sale performance, such as in the operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, direct life support machines, or weapons systems, in which the failure of the product could lead directly to death, personal injury or severe physical or environmental damage.

The full catalog desk reference contains many specifications, wiring diagrams and other types of information related to the various product offerings. However, under no circumstances should you use this document for installation, operation or troubleshooting of any equipment. Always consult the appropriate product documentation prior to using the equipment. If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call for assistance.

For complete guidelines on returning products, see page TC-23.

Re-manufactured Products

Re-manufactured products

If you are looking to save some money on your next purchase with AutomationDirect, you may be interested in our re-manufactured parts. Inventory is available for many of our standard products, and is offered at substantial savings. The select re-manufactured parts are available to U.S. and Canadian customers. You will receive a 20% discount off the catalog price of any available items, and we will give you a full 1-year warranty from the date of purchase against defects and workmanship.

(Our 30-day money-back return policy DOES NOT apply for this offer.)

The products are offered on a "first come, first serve" basis while supplies last. You will need Web access to view product availability and to order.

Products with available inventory will be listed under our "Re-manufactured Products" category at www.automationdirect.com. The items in the category will change based on inventory status at the time the product listing page is generated. Re-manufactured products are also available from our detailed item pages. You will be given a choice to purchase A-stock or Re-manufactured items, where applicable. The re-manufactured items are listed as B-*** (where *** is the A-stock part number without any dashes). For example, the re-manufactured part number for a D2-260 would be B-D2260.

Operator interface repair

C-more Core Exchange

We now offer "Core Exchanges" for all C-more HMI models that are out of warranty and not functioning properly or need repair due to customer damage. Due to hardware compatibility issues, panels that are older than four years from the date of manufacture are not eligible for this program. Please contact Returns Authorizations at 1-800-633-0405 or 770-889-2858. If the same B-stock model is available we will offer it to you at 20% off the regular catalog price. We will then issue you a Return Authorization to send us your non-functioning panel. When we receive the panel, we will then credit your account an additional 20% of the regular catalog price. This will give you a 40% total savings and a full one-year warranty on the replacement panel.

Automationdirect.com (ADC)
3505 Hutchinson Road, Cumming, GA 30040
Phone: (800) 633-0405 or (770) 889-2858, Fax: (770) 889-8672
e-mail ragroup@automationdirect.com

Guidelines for Returning Products

See Page TC-21 for our Warranty Terms. These guidelines are intended to facilitate and expedite returns and do not alter or modify our Warranty Terms.

It is AutomationDirect's belief that in most cases, although not all, we may be able to provide you a solution so that you may not have to return products to us. Please call one of our Return Authorization (RA) representatives for an RA number before returning any products to us. ALL RAs can also be issued under your account via the Web. Our Pre Return Authorization form also goes out with all shipments and is posted on the Web site, www.automationdirect.com. The RA representative may request return approval for your product by our Technical Services department before an RA can be issued.

Please note that we cannot accept products that you purchased from one of our Value Added Resellers (VARs) or any other third party. Please contact the VAR from whom you purchased when seeking potential replacement, repair or credit. For Marathon Electric products, please contact Marathon directly at 1-800-254-4207 or at www.marathonelectric.com.

Warranty Returns/Repairs

Standard policy is that all customers are responsible for freight charges when returning product. The following guidelines apply to authorized returns for products under warranty (our warranty information is fully described in the previous pages):

1. An RA can be obtained under your account via the Web (see "Online Return" instructions in box below). All date codes and/or serial numbers must be supplied before the RA can be issued. If date codes and/or serial number labels have been defaced or altered in any way, the warranty will be void. No exceptions.

2. Failure symptoms must be reported for each product returned for Quality Control purposes. If this information is not available at the time the return authorization is issued, please specify each failure symptom on the RA form before returning the product.

3. Once you have contacted AutomationDirect to request your RA, it will be faxed/e-mailed to you. Fold the form, then insert it inside a clear packing list envelope so that the return address is visible.

4. In the return box, include all documentation, cables and other components included with the original parts shipment. Write the RA number on the outside of the shipping box, not the product box.

5. Please return the parts to the appropriate address shown at the top of the RA form within two weeks of issuance.

6. If you are issued an RA for a potentially defective product, you, the customer, are responsible for freight charges, and that the shipment arrives safely and undamaged. We highly recommend that you insure the shipment for the full cost of replacing the product. See "Limits of Liability".

30-Day Money Back

Standard policy is that all customers are responsible for freight charges when returning product. These guidelines apply to returns subject to our 30-day money back policy, found in the previous pages. The following does not apply to Marathon Electric products. There are no 30-day returns on those parts.

1. Once you have called to request your RA, it will be faxed/e-mailed to you. (You can also request your RA from our Web site, under "My Account"; see "Online Return" instructions in box below.) Fold the form, then insert it inside a clear packing list envelope so that the return address is visible.

2. Do not mark or write on the original product boxes to avoid refurbishing fees.

3. Products must be returned in the original boxes in like new condition. Include all documentation, cables and other components included with the original parts shipment.

4. Shipments should be in an appropriate shipping container to avoid product damage. See "Limits of Liability".

5. Return only products that are specified on that RA. Additional products sent without approval will be returned to you.

6. Please return the parts to the appropriate address shown at the top of the RA from within two weeks of issuance. Note: The address may not be AutomationDirect's Georgia location, please check carefully for the correct return address.

7. You, the customer, are responsible for freight charges and the shipment arriving safely and undamaged. We highly recommend that you insure the shipment for the full cost of replacing the product. See "Limits of Liability" below.

Shipments that do not follow the above procedures may be returned to sender or restocking and refurbishing charges may be incurred at the current cost of AutomationDirect's parts and labor.

Limits of Liability

A return authorization number does not guarantee a refund or replacement. If a refund is initially issued and the manufacturer of the product finds the problem to be due to "customer abuse," credit will be reversed and you will be notified of such action.

AutomationDirect will accept no responsibility nor issue credit for packages damaged in transit for any reason. It is your responsibility to assure that the product is properly packaged for shipment. Freight charges are your responsibility and we highly recommend that you insure the item, at your expense, for the amount of the potential credit that you are seeking.

Online Return Request Instructions

1. After you have logged in to your AutomationDirect account, visit our Returns page and choose appropriate return reason. Guest users can make the request using the "Request an RMA" link under the "My Account" menu.
2. You'll see a list of your orders which fall within the selected return window. Choose the order that contains the items to return.
3. Verify your contact information, scan the list of items from your order, and enter the quantities you need to return. Then "Submit" the return. The Returns Team will look over your return request, and if everything checks out, the necessary paperwork and instructions will be sent to you immediately.

Marathon Service

AUTOMATIONDIRECT DOES NOT PROVIDE A 30-DAY MONEY-BACK PERIOD OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, ON MARATHON ELECTRIC PRODUCTS, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, NON-INFRINGEMENT OR FITNESS FOR ANY PARTICULAR PURPOSE, AND WE HEREBY DISCLAIM SAME.

Warranty, Returns and Service Information for Marathon Electric Products

If you have purchased Marathon Electric motors, this information applies to those products. Marathon Electric may provide a limited warranty on its products; see catalog technical pages for stated warranty periods. For more information, contact Marathon Electric at the Web site and phone numbers below. AutomationDirect will assist you with your technical support issues, however, all repair services are performed directly through an authorized Marathon Electric service center.

Marathon Service Center and Support Information

For the nearest Marathon service center near you please contact:

- www.marathonelectric.com
- Marathon Electric at (800) 254-4207 or (715) 675-3311.
- www.automationdirect.com - Tech Support
- For AutomationDirect Technical Services please call (770) 844-4200 or 1-800-633-0405.

IronHorse Service

EXCEPT AS EXPRESSLY PROVIDED BELOW, AUTOMATIONDIRECT DOES NOT MAKE ANY REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, ON IRONHORSE MOTOR OR STABLE MOTOR BASE PRODUCTS, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, NON-INFRINGEMENT OR FITNESS FOR ANY PARTICULAR PURPOSE, AND WE HEREBY DISCLAIM SAME.

Warranty, Returns and Service Information for IronHorse Motors and Stable Bases

AutomationDirect offers a 2-year warranty against defects in materials and workmanship on all Ironhorse rolled steel and cast iron motors, and a 1-year warranty on Ironhorse stainless steel motors and Stable bases. AutomationDirect will replace motors 40 hp and smaller that prove to be defective. For all motors 50 hp and larger, we require that IronHorse motors be inspected by an authorized EASA repair center. The EASA repair center will provide us with a disposition on the warranty claim and, if deemed to be under warranty, we will cover 100% of the cost of the repair. (excluding shipping and/or freight carrier insurance charges). In cases where it is not economical to repair the motor, we will replace it at no charge to you. (We will pay an evaluation fee of up to $100 U.S. per motor.) We will not cover any cost where a motor was subject to any improper installation, abuse, modifications, neglect, misuse, exposure to moisture or dampness or any unauthorized repair. We will not reimburse the customer for any repair performed by themselves or by anyone not authorized by AutomationDirect. A purchase order may be required to start the repair process. Please call AutomationDirect to start the process.

Please Note: We cannot accept or file warranty claims on IronHorse motors that you did not purchase directly from us. If you purchased an IronHorse motor from one of our Value Added Resellers (VARS) or from anyone other than AutomationDirect, you must go directly through their return and repair channels.

Service Centers and Support Information

AutomationDirect Technical Support Services: please call (770) 844-4200 or 1-800-633-0405

www.automationdirect.com - Tech Support

www.EASA.com – for qualified EASA repair shops near you

We sell good proximity sensors at great prices – and we back them up!

AutomationDirect Lifetime Warranty

Registration required

For inductive proximity sensors sold to the Original User for the lifetime of the original application.

The following terms apply to the LIFETIME WARRANTY in addition to the General Terms:

1. This warranty is available only to AutomationDirect's authorized Value Added Resellers and to the Original User. In the event the ownership of the product is transferred to a person, firm, or corporation other than the Original User, this WARRANTY shall terminate.

2. This WARRANTY is applicable only to the original installation of the product. In the event the machinery, equipment, or production line to which the product is connected, or on which it is installed, is substituted, changed, moved or replaced, the WARRANTY shall terminate.

3. This WARRANTY shall be valid only if the product was purchased by the Original User from AutomationDirect, or from an authorized AutomationDirect Value Added Reseller, or was an integral part of a piece of machinery and equipment obtained by the Original User from an original equipment manufacturer, where the part was purchased by the original equipment manufacturer directly from AutomationDirect or from an authorized AutomationDirect Value Added Reseller.

Purchaser's remedies

This remedy shall apply to all WARRANTIES. If an AutomationDirect Value Added Reseller desires to make a WARRANTY claim, the Value Added Reseller shall, if requested by AutomationDirect, ship the product to AutomationDirect's facility in Cumming, GA postage or freight prepaid. If the Original User desires to make a WARRANTY Claim, they shall notify the authorized Value Added Reseller from whom it was purchased or, if purchased directly from AutomationDirect, shall notify AutomationDirect and, if requested by AutomationDirect, ship the Product to AutomationDirect's facility in Cumming, GA postage or freight prepaid. AutomationDirect shall, at its option, take any of the following two courses of action for any products which AutomationDirect determines are defective in materials or workmanship.

1. Repair or replace the product and ship the product to the Original User or to the authorized AutomationDirect Value Added Reseller, postage or freight prepaid; or

2.-Repay to the Original User that price paid by the Original User; provided that if the claim is made under the lifetime warranty, and such product is not then being supplied by AutomationDirect, then the amount to be repaid by AutomationDirect to the Original User shall be reduced according to the following schedule:

Number of Years Since Date of Purchase by Original User	Percent of Original Purchase Price To Be Paid by AutomationDirect
10	50 percent
15	25 percent
20	10 percent
More than 20	5 percent

REMEDIES OF PURCHASER'S AND VALUE ADDED RESELLERS SHALL BE LIMITED EXCLUSIVELY TO THE RIGHT OF REPLACEMENT, REPAIR OR REPAYMENT AS PROVIDED ABOVE AND DOES NOT INCLUDE ANY LABOR COST OR REPLACEMENT AT ORIGINAL USER'S SITE. AUTOMATIONDIRECT.COM SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES RESULTING FROM ANY BREACH OF ANY WARRANTY, EXPRESSED OR IMPLIED, APPLICABLE TO THE PRODUCT, INCLUDING WITHOUT LIMITATION, ANY DAMAGES RESULTING FROM PROPERTY DAMAGE, PERSONAL INJURY OR BUSINESS INTERRUPTION, EVEN IF NOTIFIED OF THE POSSIBILITY OF SUCH DAMAGES.

Inductive proximity sensors warranty form may be obtained online at:

http://www.automationdirect.com/static/specs/proxwarranty.pdf

OMPRESSOR
DESIGN AND
SERVICES, INC.

74885 JONI DRIVE, SUITE 3
PALM DESERT, CA 92260
(442) 600-2444
INFO@COMPRESSORDS.COM

DO-MORE PLC

H2 MICRO MODULAR PLC WITH H2-DM1E CPU

Do-more H2 Series PLC Overview

Do-more H2 Series PLC Modules

The Do-more H2 Series PLC is the newest technology available that makes control applications easier to implement. It uses proven DirectLOGIC hardware as a platform for a powerful, flexible instruction set, with a user-friendly programming environment. The Do-more H2 Series PLC utilizes most of the modules that are part of the DL205 PLC family. You simply install a Do-more H2 Series CPU module into a DL205 base unit. However, the specifications of the Do-more H2 Series PLC are very different from the DL205 PLC. This overview covers the key features of the Do-more H2 Series PLC.

Do-more H2 CPU Module

DL205 PLC base unit and I/O modules

CPU modules

The Do-more H2 Series PLC offers two CPU modules available, H2-DM1 and H2-DM1E, both of which must be programmed using the Do-more Designer programming software. You cannot use the existing DL205 CPU modules (D2-230, D2-240, D2-250(-1) and D2-260) with Do-more Designer.

H2-DM1

H2-DM1E (with Ethernet)

Base units

The Do-more H2 Series PLC supports all of the base units available for the DL205 PLC.

Do-more H2 Series PLC Overview

Discrete I/O modules

The Do-more H2 Series PLC supports all of the discrete I/O modules available for the DL205 PLC.

Analog I/O modules

The Do-more H2 Series PLC supports all of the analog I/O modules available for the DL205 PLC.

Do-more H2 Series PLC Overview

Specialty modules

The Do-more H2 Series PLC supports many of the specialty modules available for the DL205 PLC. The following modules are supported:


H2-ECOM100


H2-SERIO


H2-SERIO-4


H2-ERM


H2-ERM100


H2-CTRIO


H2-CTRIO2


F2-08SIM

Specialty modules NOT supported

The following modules are NOT supported by the Do-more H2 Series PLC.


D2-DCM


D2-RMSM


D2-CTRINT


F2-CP128


D2-EM


D2-CM


D2-RSSS


DV-1000


D2-HPP

Programming Software

The Do-more H2 Series PLC can only be programmed by Do-more Designer. (**DirectSOFT programming software is not compatible with Do-more PLCs**)

Do-more H2 Series PLC Overview

Module Compatibility

The following table shows which DL205 components are supported by the H2-DM1 and H2-DM1E Do-more CPUs.

Module Compatibility Table					
Module	**Part Number**	**Status**	**Module**	**Part Number**	**Status**
Base Units	D2-03B-1	✓	*Analog I/O Modules*	F2-04AD-1	✓
	D2-04B-1	✓		F2-04AD-2	✓
	D2-06B-1	✓		F2-08AD-1	✓
	D2-09B-1	✓		F2-08AD-2	✓
	D2-03BDC1-1	✓		F2-04RTD	✓
	D2-04BDC1-1	✓		F2-04THM	✓
	D2-06BDC1-1	✓		F2-02DA-1(L)	✓
	D2-09BDC1-1	✓		F2-02DA-2(L)	✓
	D2-06BDC2-1	✓		F2-02DAS-1	✓
	D2-09BDC2-1	✓		F2-02DAS-2	✓
Discrete I/O Modules	D2-08ND3	✓		F2-08DA-1	✓
	D2-16ND3-2	✓		F2-08DA-2	✓
	D2-32ND3	✓		F2-4AD2DA	✓
	D2-32ND3-2	✓		F2-8AD4DA-1	✓
	D2-08NA-1	✓		F2-8AD4DA-2	✓
	D2-08NA-2	✓	*Local Expansion Modules*	D2-CM	No
	D2-16NA	✓		D2-EM	No
	D2-04TD1	✓	*Specialty Modules*	H2-ERM(100)	✓
	D2-08TD1	✓		H2-ERM-F	✓
	D2-08TD2	✓		D2-RMSM	No
	D2-16TD1-2	✓		D2-RSSS	No
	D2-16TD2-2	✓		H2-ECOM100	✓
	F2-16TD1P	✓		H2-ECOM-F	✓
	F2-16TD2P	✓		D2-DCM	No
	D2-32TD1	✓		H2-EBC100	✓
	D2-32TD2	✓		H2-EBC-F	✓
	D2-08TA	✓		H2-SERIO	✓
	F2-08TA	✓		H2-SERIO-4	✓
	D2-12TA	✓		F2-CP128	No
	D2-04TRS	✓		H2-CTRIO	✓
	D2-08TR	✓		H2-CTRIO2	✓
	F2-08TR	✓		D2-CTRINT	No
	F2-08TRS	✓		F2-08SIM	✓
	D2-12TR	✓	*Programmer*	D2-HPP	No
	D2-08CDR	✓	*Operator Interface*	DV-1000	No

✓ = Supported No = Not Supported

Do-more H2 Series PLC Overview

Communications

The Do-more H2 Series PLC supports many communication protocols. The following table shows which CPU module communications port or specialty module supports each protocol.

Protocols	CPU Modules			Specialty Modules			
	H2-DM1 / H2-DM1E		H2-DM1E	H2-ECOM100	H2-ECOM H2-ECOM-F	H2-SERIO H2-SERIO-4	H2-ERM (100) H2-ERM-F
	USB Port	RS-232 Serial Port	Ethernet Port				
Do-more Designer Programming	Yes	Yes	Yes	Yes		Yes	
Modbus/RTU Client (Master)		Yes				Yes	
Modbus/RTU Server (Slave)		Yes				Yes	
Modbus/TCP Client (Master)			Yes	Yes			
Modbus/TCP Server (Slave)			Yes	Yes			
DirectLOGIC RX/WX Client (Master)			Yes	Yes	Yes		
DirectLOGIC RX/WX Server (Slave)			Yes	Yes	Yes		
K-Sequence Server (Slave)		Yes		Yes	Yes	Yes	
DirectNET Server (Slave)				Yes	Yes		
HEI Ethernet Remote I/O Master			Yes				Yes
SMTP (EMail) Client w/Authentication			Yes				
Simple Network Time Protocol (SNTP) Client			Yes				
Do-more/PEERLINK			Yes				
Do-more Time Synchronization Protocol (Client, Server, Alternate Client)			Yes				
Do-more Logger/UDP			Yes				
Serial ad-hoc ASCII/Binary Programatic Control		Yes				Yes	
UDP ad-hoc Programmatic Control			Yes				
TCP Client Programmatic Control			Yes				
TCP Server Programmatic Control			Yes				

Blank = Not Supported

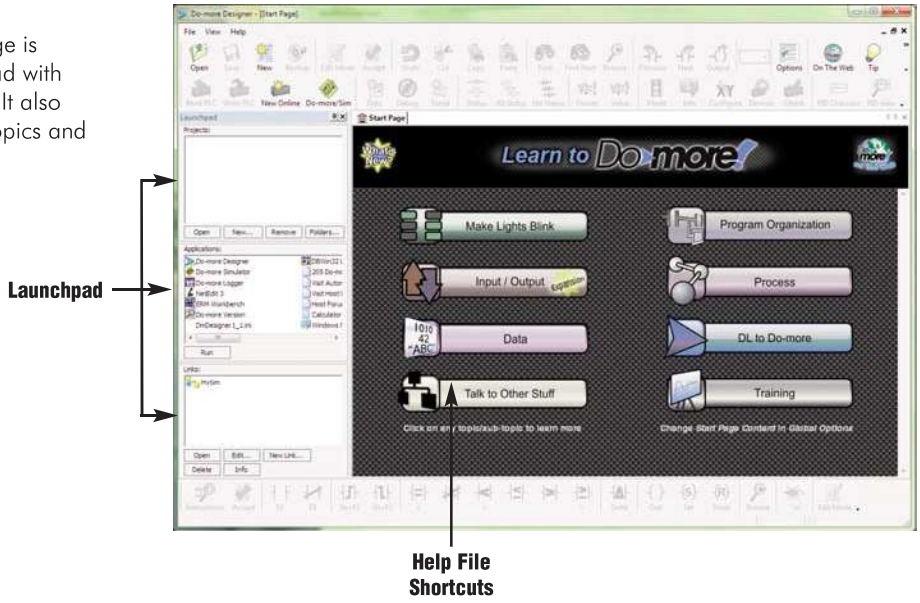
Do-more H2 Series PLC Overview

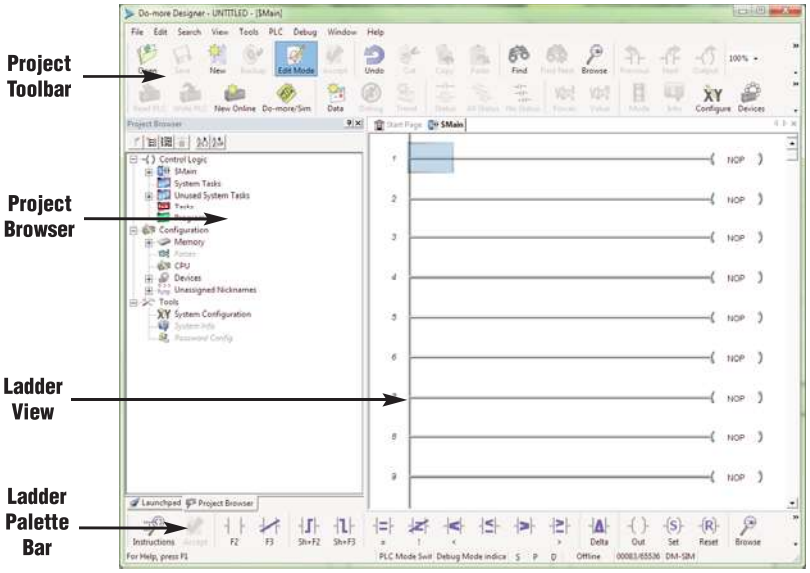
Do-more Designer (Part No. DM-PGMSW)

Do-more Designer is the full-featured programming software for the Do-more PLC series. Do-more Designer is a free download from Automationdirect.com. A CD-ROM version is also available for purchase for $10.00.

Start Page

When the software is started, the Start Page is displayed. This page contains a Launchpad with Projects, Applications and Links windows. It also contains shortcuts to important help file topics and the Do-more Simulator.





Main Programming Window

The Main Programming Window is displayed when a new program is started or an existing program is opened. It is divided into Menus, Toolbars, and Windows that work together to make project development as simple as possible.

Do-more H2 Series PLC Overview

Do-more Designer Features

Do-more Designer has the following main features:

- Supports the Do-more PLC instruction set
- Project Browser (Window to organize the user project)
- Data View (Interface to monitor PLC data in a list)
- Trend View (Interface to monitor PLC data with trend graphs)
- PID View (Interface to monitor and tune the individual PID control loop)
- PID Overview (Interface to monitor multiple PID control loops)
- Debug View (Interface to debug the ladder programs)

When Do-more Designer is installed on your PC, the following tools are also installed:

- Do-more Simulator (Offline simulator of ladder program execution and PID control)
- Do-more Logger (Software tool to log PLC data)
- ERM Workbench (Configuration tool for the ERM modules)
- NetEdit 3 (Configuration tool for the ECOM/EBC Ethernet modules)

PC Requirements

The Do-more Designer Windows-based programming software works with Windows® XP (Home or Professional, 32-bit), Vista (Home, Basic, Premium, 32 or 64-bit), Windows 7 (Home, Professional, Ultimate, 32 or 64-bit) or Windows 8 (Home, Professional, Enterprise 32 or 64-bit; Windows 8 RT edition is NOT supported). Please check the following requirements when choosing your PC configuration:

- Minimum PC to PLC Connectivity, at least one of the following:
  - USB Port: connects to the CPU with USB-A connector (USB-A to USB-B cable)
  - RS-232 Serial Port: connects to the CPU with RJ-12 connector (RJ-12 to DB9 or RJ-12 to USB-B serial converter cable)
  - Ethernet Port: connects to the CPU (H2-DM1E) with RJ-45 10Base-T or 100Base-T (Cat5 Patch Cable)
- Hard Disk: 100MB free disk space
- Video Display: 1024x768, 256 colors resolution (1280x720, true color recommended)
- Windows XP, 32-bit:
  - 800MHz, single core CPU (2GHz, multi-core or hyperthreaded recommended)
  - 512MB RAM (2GB recommended)
- Vista or Windows 7 or Windows 8, 32 or 64-bit:
  - 1GHz, single core CPU (2GHz, multi-core recommended)
  - 1GB RAM (3GB recommended)

Programming Cables

The Do-more H2 Series CPU module H2-DM1 has two communication ports (USB and RS-232 serial) and the H2-DM1E has three communication ports (USB, RS-232 serial and Ethernet). You can use any of those ports for programming and monitoring. Needed cables for these ports are listed below and can be purchased at Automationdirect.com.

USB Cables (USB 2.0, Type A-B connectors) available:

- USB-CBL-AB3 (3 ft.)
- USB-CBL-AB6 (6 ft.)
- USB-CBL-AB10 (10 ft.)
- USB-CBL-AB15 (15 ft.)

RS232 Serial Cable

- D2-DSCBL (12 ft. 9-pin D-sub to RJ12 connector)

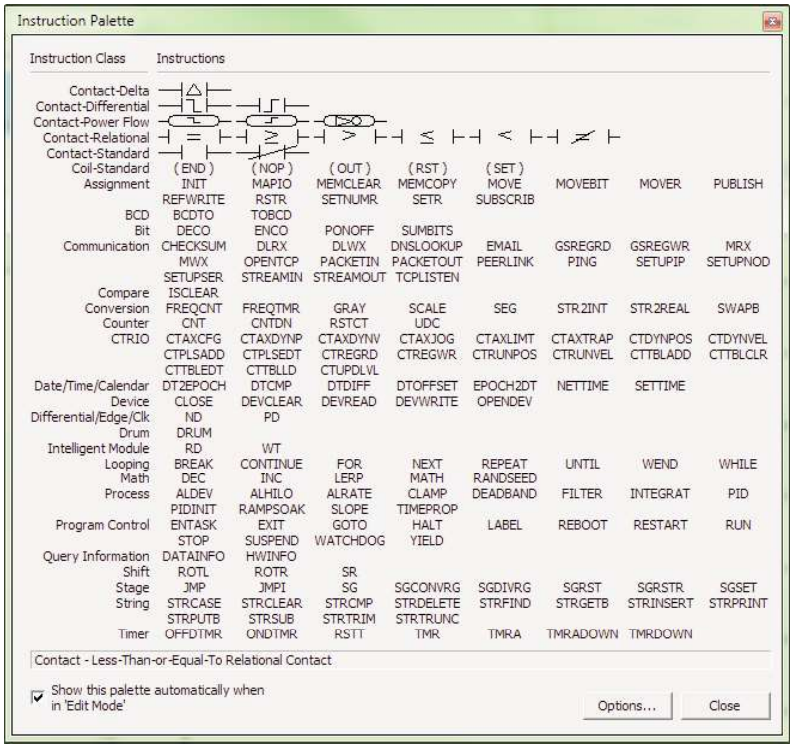
Ethernet Cables (Cat5e)

Automationdirect.com sells many Ethernet patch cables in various colors and lengths. Please check the Cables section in this catalog for further details.

Do-more H2 Series PLC Overview

Do-more PLC Instruction Set

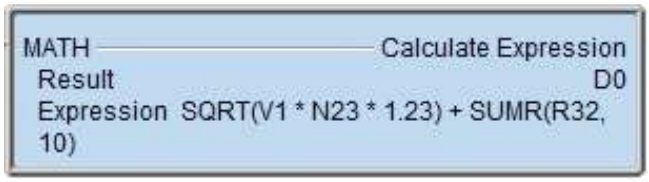
This Instruction Set was developed specifically for the new Do-more PLC; the 'Instruction Palette' displays all available instructions.



You may see some similarities to the DirectLOGIC PLC instruction set. However, the instruction set for the Do-more PLC is more advanced and intuitive. A good example is the MATH instruction. Now, just one MATH instruction covers all math operations and also allows you to mix different data types in one expression.

There are over 60 operators and functions available with the MATH instruction.

Note: To learn more about the MATH instruction, please refer to the Do-more Designer help topic 'MATH – Math Expression'.



Operators

+, -, *, /, %, **, <, <=, ==, !=, >=, >, &&, ||, &, |, ^, <<, >>, >>>, -, ~, !

Functions

ABS, ACOS, ASIN, ATAN, AVGR, COS, COUNTIFEQ, COUNTIFNE, COUNTIFGE, COUNTIFGT, COUNTIFLE, COUNTIFLT, DEG, E, FRAC, IF, LN, LOG, MAXR, MAX, MINR, MIN, NOW, PI, RAD, RANDINT, RANDREAL, REF, ROUND, SIN, SQRT, STDEVR, STDEVPR, SUMIFEQ, SUMIFNE, SUMIFGE, SUMIFGT, SUMIFLE, SUMIFLT, SUMR, TAN, TICKms, TICKus, TOINT, TOREAL, TRUNC

Do-more H2 Series PLC Overview

Data Types

The Do-more PLC supports the following seven primary data types:

- Bit (0 or 1)
- Unsigned Byte (0 to 255)
- Signed Byte (-128 to 127)
- Unsigned Word (0 to 65,535)
- Signed Word (-32,768 to 32,767)
- Signed DWord (-2,147,483,648 to 2,147,483,647)
- Real (-3.4028235E+038 to 3.4028235E+038)

Note: As you can see, the BCD data type that is popular for the DirectLOGIC PLC is not included in this list. However, you can use the BCDTO and TOBCD instructions if you need to use the BCD data type with your application. Those instructions convert the data between the BCD data type and the integer/real data types.

Data Structure

The Do-more PLC supports data structures as additional data types. Structures use the familiar PC programming organization of "dot notation". All available elements of a structure are shown in this format. The following data structures are currently available:

- Timer Structure
- Counter Structure
- String Structure
- PID Structure
- Date/Time Structure
- Task Structure
- Rampsoak Structure
- Program Structure
- DeviceRef Structure
- Drum Structure

The data structure is a set of data. For instance, a Timer structure (Timer Struct) has the following set of data:

- Acc (Accumulated Time, Signed DWord)
- Done (Bit)
- Zero (Bit)
- Timing (Bit)
- Reset (Bit)

When you use a timer instruction (TMR), a Timer structure is assigned to the instruction. If you select 'T0', you can access the above data with dot notation. For instance, to access the accumulated time (Acc), enter 'T0.Acc'. To access the Done bit, enter 'T0.Done'.

Memory Addressing

With the Do-more PLC, each memory address type has its own specific data type. Here are some examples:

- V (Unsigned Word)
- N (Signed Word)
- D (Signed DWord)
- R (Real)

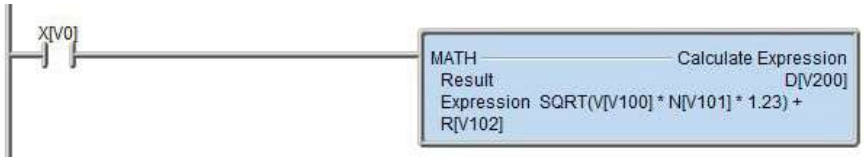
If you see address 'V123' in the ladder program, the memory address always stores an Unsigned Word value. With this memory addressing method, it becomes easier to read and write the ladder programs.

Although most of the memory addressing is decimal, the memory addresses DLX, DLY, DLC and DLV use octal. These four memory addresses can be used to exchange data with DirectLOGIC PLCs, which use octal memory addressing.

Do-more H2 Series PLC Overview

Array Addressing

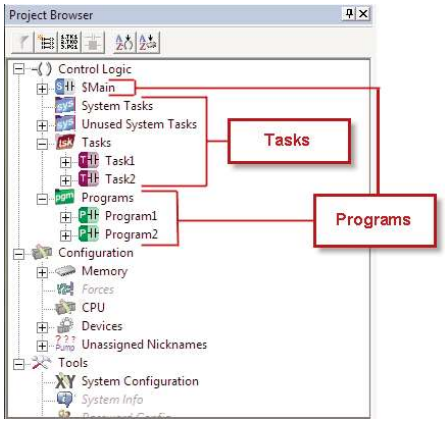
The Do-more PLC supports array addressing with all memory addresses. V-memory address must be used as the index for an array. With the Do-more PLC, the following ladder program is valid.



Note: In this example, V0, V100, V101, V102 and V200 are indices.

Code-block, Program and Task

One Do-more project can consist of more than one ladder program. Each ladder program is called a 'Code-block'. The Do-more PLC supports two types of code-blocks, Program and Task. Here are their definitions.



Program

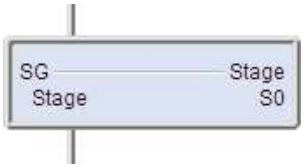
Programs are code-blocks that run based on an event using the RUN instruction. They can be self-terminating or never terminate. Stage programming is only supported inside Program code-blocks.

Task

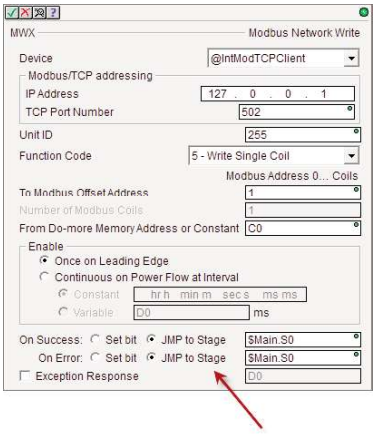
Tasks are code-blocks that are enabled and disabled using the ENTASK instruction. The ENTASK instruction allows you to specify an interval to execute the task's logic with a millisecond resolution or to execute a single time on a leading edge input.

Stages

The Do-more PLC supports Stages. You can use Stages only in the Program code-blocks. (They are not available in the Task code-blocks.) The Do-more PLC supports the following instructions for Stage Programming[1]:



- SG (SG)
- JMP (Jump To Stage)[2]
- JMPI (Index Jump)
- SGSET (Enable Stage)
- SGRST (Disable Stage)
- SGRSTR (Disable Range of Stages)
- SGCONVRG (Converge Multiple Stages to SG)
- SGDIVRG (Jump to Multiple Stages)



[1] There is no ISG (Initial Stage) instruction for the Do-more PLC; the first stage in the Program code-block becomes the initial stage automatically.

[2] Many asynchronous instructions can directly initiate a Jump to Stage.

Do-more H2 Series PLC Overview

Comparison with the DL205 PLC

The following spec table shows the major differences between the Do-more H2 Series PLC and the DL205 PLC.

	Do-more H2 Series PLC	DL205 PLC
Instruction Set	Do-more PLC instruction set	DirectLOGIC PLC instruction set
Total Memory Bytes	262.1K	30.4K
Default Data Type	Decimal and Real (Data can be referred in different data types with the 'Casting' feature.)	BCD, HEX and Real
Memory Addressing	Decimal mainly (There are some octal memory addresses to exchange data with DirectLOGIC PLCs easily.)	Octal
User-defined Memory Addresses	Yes	No
Bit of Memory	Available for all memory addresses (e.g. V100.2, D200.3)	Yes, D2-250(-1) and D2-260 only
Array Addressing	Available for all memory addresses (e.g. X[V100], D[V200])	Available only for V-memory addresses (e.g. P2000)
Math Calculation	No accumulator, the MATH instruction can support a mix of different data types.	Using accumulator or using the MATHBCD, MATHBIN or MATHR instruction for each data type.
Number of Code Blocks	1 system program 6 system tasks Up to 256 user programs Up to 256 user tasks	1
Looping	FOR-NEXT, WHILE-WEND, REPEAT-UNTIL	FOR-NEXT
Subroutines	No (Use Code-blocks)	Yes
User Document (Nicknames, Rung Comments…) Storing	Stored in the CPU module	No (Stored on PC only)
Password Protection	Multiple passwords	Single password
Run-time Editing	Bumpless	Ladder program execution is paused during the ladder program transfer in RUN mode.
Analog I/O Configuration	The X, WX and WY addresses are assigned to analog I/O channels automatically. (Manual addressing is available also.)	Configured by ladder program
Local Base Expansion	No	Yes (with D2-EM and D2-CM)
Number of PID Loops	Over 2000	4 (D2-250-1), 16 (D2-260)
Memory Back-up Battery	Included	Optional
Firmware Update	CPU module firmware can be updated from Do-more Designer.	Use firmware update tool
Built-in RS-232 Port	Yes, Full duplex	Yes, Half duplex
Built-in USB Port	Yes	No
Built-in Ethernet Port	Yes (H2-DM1E)	No
Programming Software	Do-more Designer	DirectSOFT

Dimensions and Installation

Understanding the installation requirements for your Do-more H2 Series PLC system will help ensure that the components operate within their environmental and electrical limits.

Plan for safety

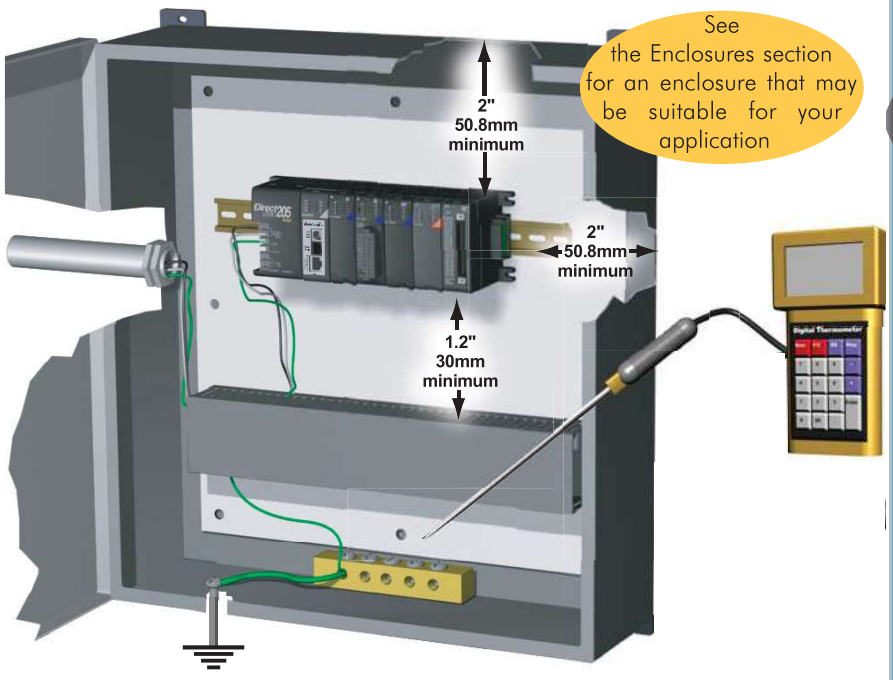
This catalog should never be used as a replacement for the user manual. The user manual, H2-DM-M (sold separately or downloadable online), contains important safety information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

Environmental specifications

The Environmental Specifications table at the right lists specifications that apply globally to the Do-more H2 Series PLC system (CPUs, bases, and I/O modules). Be sure that the system is operated within these environmental specifications.

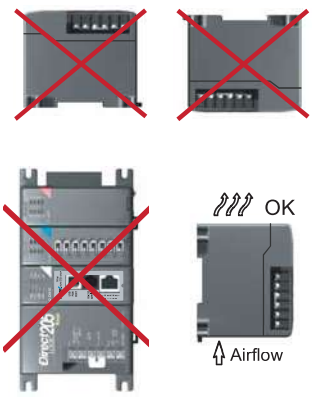
Base dimensions and mounting

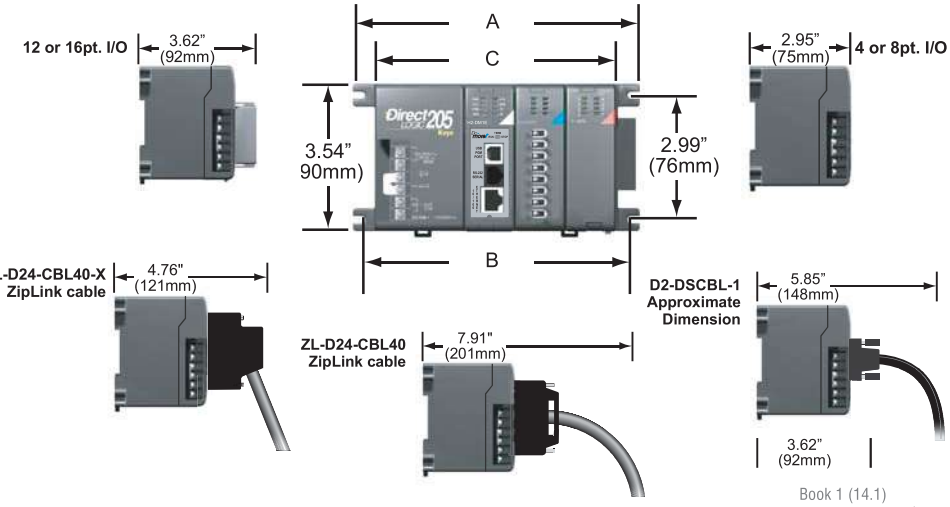
Use the diagrams below to make sure the Do-more H2 Series PLC system can be installed in your application. To ensure proper airflow for cooling purposes, bases must be mounted horizontally. It is important to check these dimensions against the conditions required for your application. For example, it is recommended that approximately 3" of space is left in front PLC surface for ease of access and cable clearances. Also, check the installation guidelines for recommended cabinet clearances.



Environmental Specification	Rating
Storage Temperature	-4°F - 158°F (-20°C to 70°C)
Ambient Operating Temperature	32°F - 131°F (0°C to 55°C)
Ambient Humidity	30%-95% relative humidity (non-condensing)
Vibration Resistance	MIL STD 810C, Method 514.2
Shock Resistance	MIL STD 810C, Method 516.2
Noise Immunity	NEMA (ICS3-304)
Atmosphere	No corrosive gases

Base	A (Base Total Width)		B (Mounting Hole)		C (Component Width)	
	Inches	*Millimeters*	*Inches*	*Millimeters*	*Inches*	*Millimeters*
3-slot	6.77"	172mm	6.41"	163mm	5.8"	148mm
4-slot	7.99"	203mm	7.63"	194mm	7.04"	179mm
6-slot	10.43"	265mm	10.07"	256mm	9.48"	241mm
9-slot	14.09"	358mm	13.74"	349mm	13.14"	334mm





Do-more H2 Series PLC System Specifications

General Specifications

General Specifications	
Operating Temperature	32°F to 131°F (0°C to 55°C)
Storage Temperature	–4°F to 158°F (–20°C to 70°C)
Ambient Humidity	30% to 95% relative humidity (non–condensing)
Environmental Air	No corrosive gases
Vibration	MIL STD 810C, Method 514.2 IEC60068-2-6 JIS C60068-2-6 (Sine wave vibration test)
Shock	MIL STD 810C, Method 516.2 IEC60068-2-27 JIS C60068-2-27
Noise Immunity	NEMA ICS3-304
Agency Approvals	UL508 (File No. E157382, E316037) CE (EN61131-2)

CPU Modules

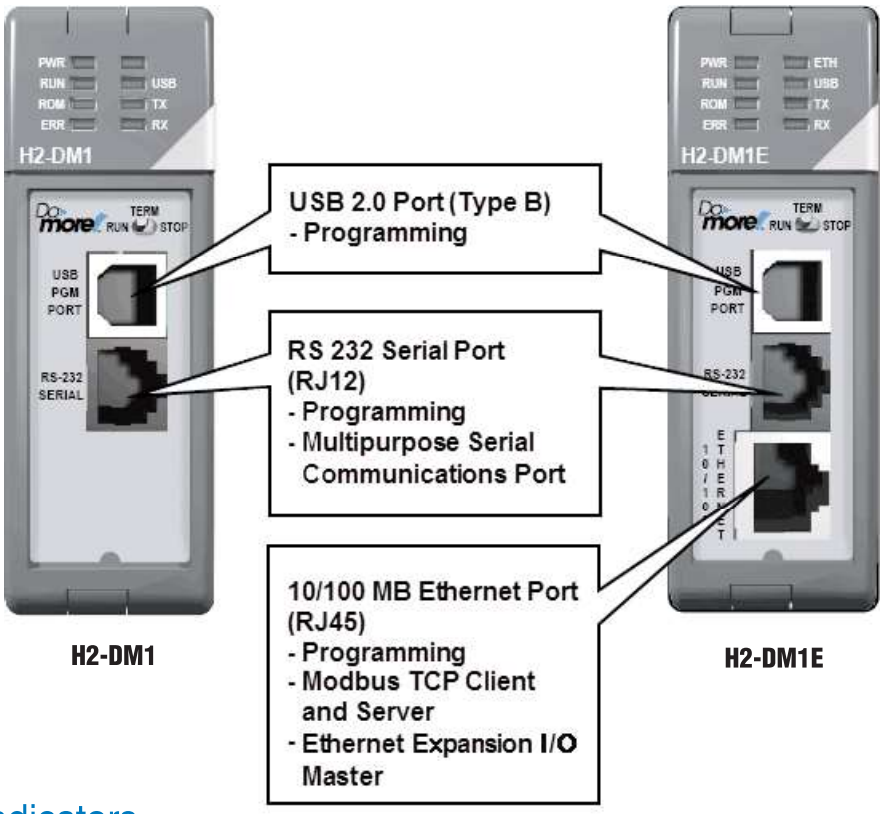
Specifications

H2-DM1
$299.00

H2-DM1E
$399.00

Feature	H2-DM1	H2-DM1E
Total Memory (bytes)	262,144 bytes	
Ladder Memory (instruction words)	65,536 instruction words	
V-Memory (words)	Configurable up to 65536 (4096 default)	
Non-volatile V Memory (words)	Configurable up to 65536 (4096 default)	
D-memory (DWORDs)	Configurable up to 65536 (4096 default)	
Non-volatile D Memory (DWORDs)	Configurable up to 65536 (4096 default)	
R-memory (REAL DWORDs)	Configurable up to 65536 (4096 default)	
Non-volatile R Memory (REAL DWORDs)	Configurable up to 65536 (4096 default)	
Boolean execution/K	50 uSec	
Stage Programming	Yes	
Number of Stages	128 per Program code-block; number of code-blocks configurable to memory limit	
Handheld Programmer	No	
Programming Software for Windows	FREE Do-more Designer	
Built-In communications ports	USB, RS-232	USB, RS-232, Ethernet (10/100 Base-T)
Program Memory	Flash ROM	
Total I/O points available	X, Y, each configurable up to 65536 (2048 default); WX, WY (analog in/out) each configurable up to 65536 (256 default)	
Local I/O points available	256	
Ethernet Remote I/O Discrete points	131,072	
Ethernet Remote I/O Analog I/O Channels	32,768	
Max Number of Ethernet slaves per Channel	16	
I/O points per Remote Channel	32,768	
Discrete I/O Module Point Density	4/8/12/16/32	
Slots per Base	3/4/6/9	
Number of instructions available	>160	>170
Control relays	Configurable up to 65536 (2048 default)	
Special relays (system defined)	1024	
Special registers (system defined)	512	
Timers	Configurable up to 65536 (256 default)	
Counters	Configurable up to 65536 (256 default)	
System Date/Time structures	8	
User Date/Time structures	Configurable up to 65536 (32 default)	
ASCII String/Byte buffer structures	Configurable up to memory limit (192 default)	
Modbus Client memory	Yes, configurable up to memory limit, default 1024 input bits, 1024 coil bits, 2048 input registers, 2048 holding registers	
DL Classic Client memory	Up to memory limit, default 512 X, 512 Y, 512 C, 2048 V	
Immediate I/O	No	
Interrupt input (hardware / timed)	No	
Subroutines	Program and Task code-blocks, up to memory limit	
Drum Timers	Yes, up to memory limit	
Table Instructions	Yes	
Loops	FOR/NEXT, WHILE/WEND, REPEAT/UNTIL loops	
Math	>60 operators and functions: Integer, Floating Point, Trigonometric, Statistical, Logical, Bitwise, Timing	
ASCII	Yes, IN/OUT, Serial, Ethernet TCP and UDP; 11 output script commands	
PID Loop Control, Built In	Yes, configurable to memory limit (over 2,000)	
Time of Day Clock/Calendar	Yes	
Run Time Edits	Yes	
Supports True Force	Yes	
Internal Diagnostics	Yes	
Password security	Multi-user, credentialed, session-based security	
System error log	Yes	
User error log	Yes	
Battery backup	Yes (Battery included)	

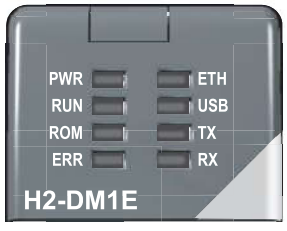
CPU Modules



H2-DM1 **H2-DM1E**

LED Status Indicators

H2-DM1



H2-DM1E

LED Indicators		
Indicator	**Status**	**Description**
PWR	Green	Base Power ON
	Yellow	Low Battery
RUN	Green	CPU is in RUN Mode
	Yellow	Forces are Active
ROM	Yellow	CPU is updating Non-volatile Memory
ERR	Red	CPU Fatal Error
ETH	Green	Ethernet Link Good
	Yellow	Ethernet Activity
USB	Green	USB Receive Activity
	Yellow	USB Transmit Activity
TX	Green	RS-232 Transmit Activity
RX	Green	RS-232 Receive Activity

PLC Mode Switch

Mode Switch Functions	
Mode Switch Position	**CPU Action**
RUN (Run Program)	CPU is forced into RUN Mode if no errors are encountered.
TERM (Terminal)	RUN, PROGRAM and DEBUG modes are available. In this mode, the mode of operation can be changed through the Programming Software.
STOP (Stop Program)	CPU is forced into STOP Mode.

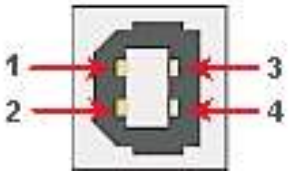
CPU Modules

Communication Ports

USB Port

Used exclusively for programming and monitoring via a PC running Do-more Designer.

USB Port Specifications	
Description	Standard USB 2.0 Slave input for programming and online monitoring, with built-in surge protection. Not compatible with older full speed USB devices.
Cables (ADC part #)	USB Type A to USB Type B: USB-CBL-AB3 (3 ft.) USB-CBL-AB6 (6 ft.) USB-CBL-AB10 (10 ft.) USB-CBL-AB15 (15 ft.)



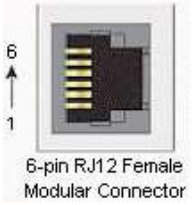
Pin	Description	
1	5V	Bus Voltage Sense
2	D-	Data -
3	D+	Data +
4	0V	Ground

RS-232 Port

RJ-12 style connector used for:

- Connection to a PC running Do-more Designer
- Modbus RTU Master connections
- Modbus RTU Slave connections
- ASCII Incoming and Outgoing communications
- Custom Protocol Incoming and Outgoing communications

RS-232 Port Specifications	
Description	Non-isolated, full duplex RS-232 DTE port used for programming, online monitoring or can connect the CPU as a Modbus RTU or ASCII master or slave to a peripheral device. Includes ESD and built-in surge protection.
Baud Rates	1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200
+5V Cable Power Source	220 mA maximum at 5V, +/- 5%. Reverse polarity and overload protected.
Maximum Output Load (TXD/RTS)	3 KΩ, 1,000 pf
Minimum Output Voltage Swing	+/-5V
Output Short Circuit Protection	+/-15 mA
Cable Options (ADC part #)	D2-DSCBL FA-CABKIT FA-ISOCON for converting RS-232 to isolated RS-422/485



Pin	Description	
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection (220 mA max.)
3	RXD	Receive Data (RS-232)
4	TXD	Transmit Data (RS-232)
5	RTS	Request to Send (RS-232)
6	CTS	Clear to Send (RS-232)

For a list of protocols supported by each port, please refer to the Communications topic of the Do-more H2 Series PLC Overview in this section.

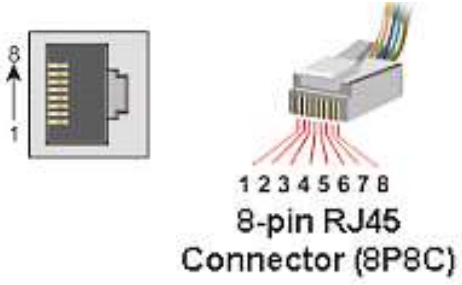
CPU Modules

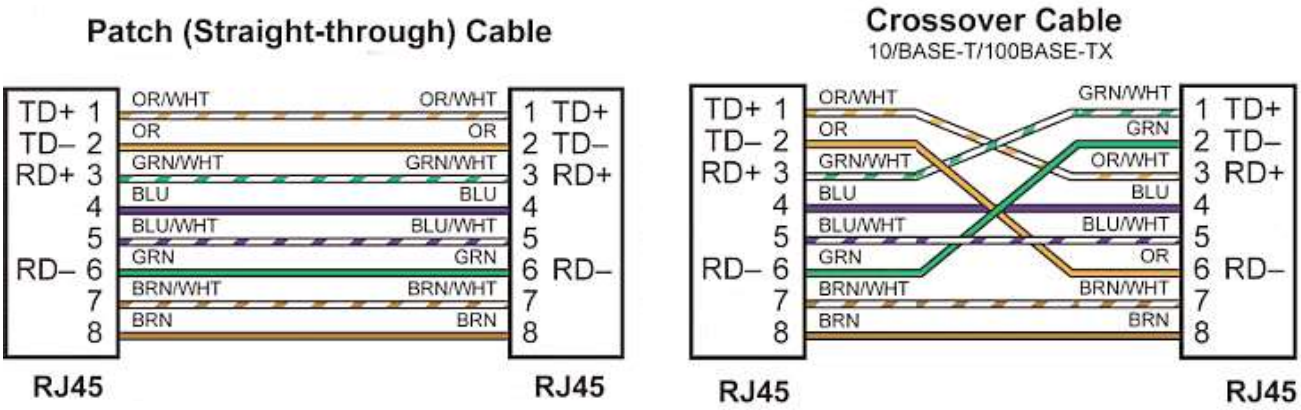
Ethernet Port

RJ-45 style connector used for:

- Connection to a PC running Do-more Designer
- Modbus TCP Client connections (Modbus requests sent from the CPU)
- Modbus TCP Server connections (Modbus requests received by the CPU)
- Ethernet Expansion I/O Master

Ethernet Port Specifications	
Description	Standard transformer isolated Ethernet port with built-in surge protection for programming, online monitoring, Modbus/TCP client/server connections (fixed IP or DHCP) and Ethernet Expansion I/O capabilities.
Transfer Rate	10/100 Mbps
Cables	Use a Patch (straight through) cable when a switch or hub is used. Use a Crossover cable when a switch or hub is not used.





For a list of protocols supported by each port, please refer to the Communications topic of the Do-more H2 Series PLC Overview in this section.

CPU Modules

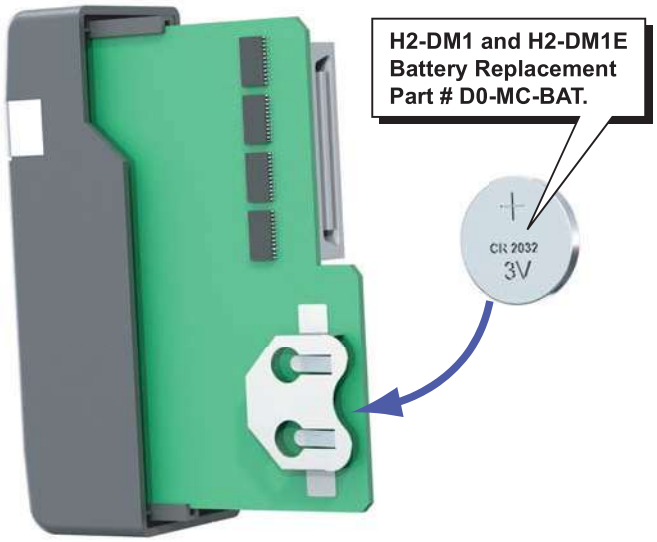
Battery Specifications

A battery is included with the Do-more CPU and is used to retain the Time and Date along with any Tagname values that are set up as retentive. It is recommended that the battery be replaced once every five years or when one year of cumulative OFF time has been exceeded.

Up to two hours is allowed to change out a battery without loss of data.

D0-MC-BATis $3.00..

Battery	
D0-MC-BAT	Coin type, 3.0V Lithium battery, number CR2032



CPU Modules

Ethernet Expansion I/O

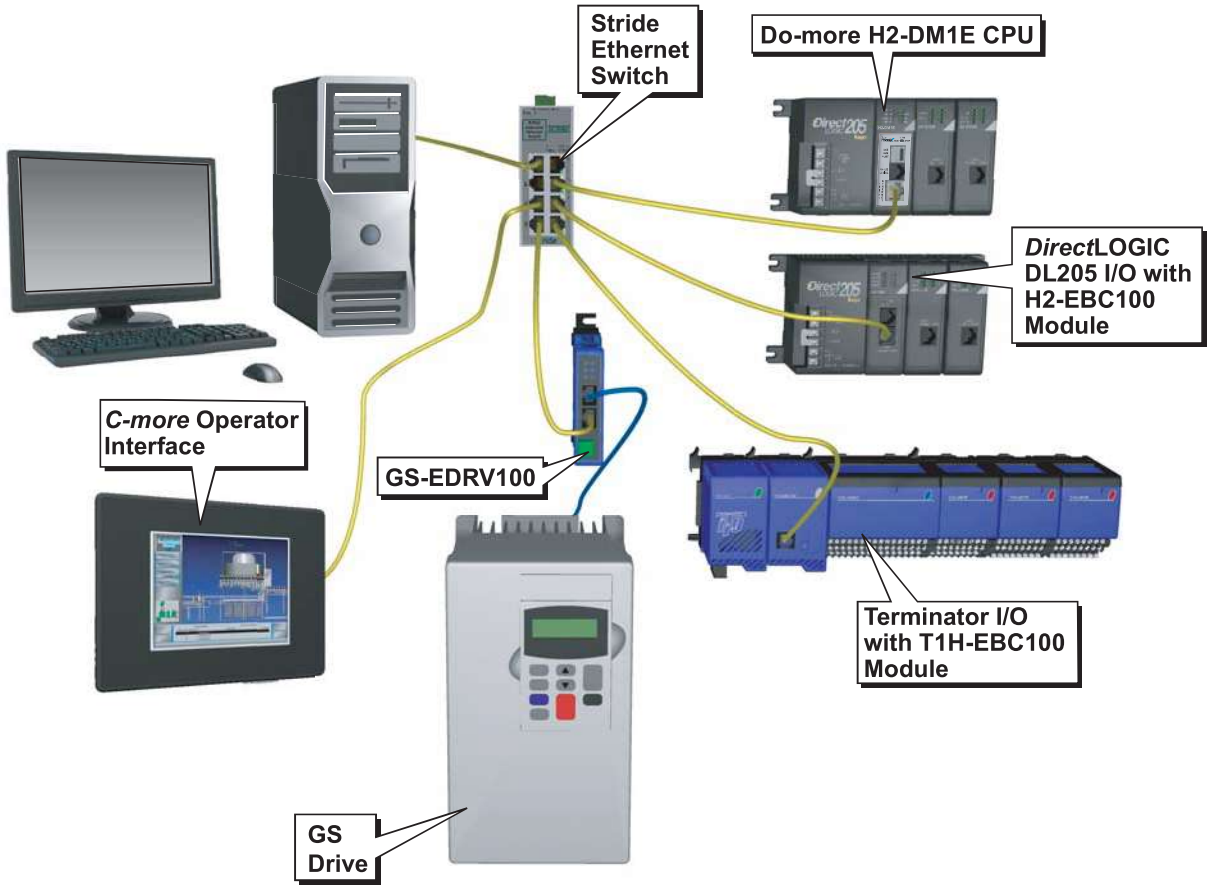
With Do-more Designer Software version V1.1 and newer, the H2-DM1E CPU's built-in Ethernet port can be configured as an Ethernet Expansion I/O master. Much like the H2-ERM(100) module, the Ethernet Expansion I/O feature allows expansion beyond the local chassis to slave I/O using the onboard high-speed Ethernet link.

The onboard Ethernet port can support up to 16 slave devices. The slave I/O modules supported are:

- H2-EBC100
- T1H-EBC100 (Terminator I/O)
- GS-EDRV100 (GS Drives)

The Ethernet Expansion I/O network uses Category 5 UTP cables for cable runs up to 100 meters (328 ft.) with extended distances achieved through Ethernet switches.

It is highly recommended that a dedicated network be used with the Ethernet Expansion I/O feature. Ethernet Expansion I/O networks and ECOM/office networks should be isolated from one another to prevent network delays.



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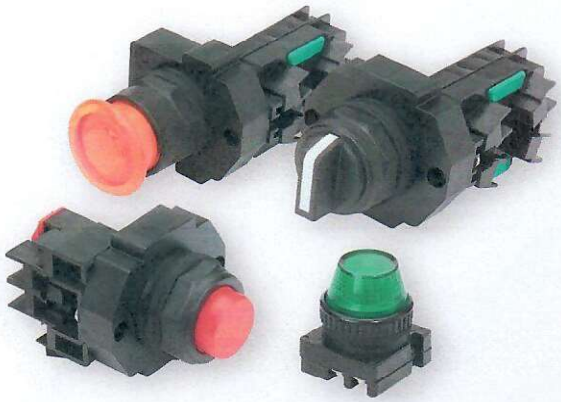
PALM DESERT, CA 92260
(442) 600-2444
INFO@COMPRESSORDS.COM

HAZARDOUS PILOT DEVICES

E-STOP: SERIES H LWQ/1539
2-WAY SWITCHES: SERIES H LWQ/1539
LED LIGHTS: 52PC4G2/1523

30MM HAZARDOUS PILOT DEVICES

SERIES 30 PRODUCT PROFILE



c3controls **30mm Hazardous Pilot Devices** are designed for your most demanding hazardous duty applications and include a wide range of push buttons, pilot lights, and selector switches. Full-voltage, transformer, resistor, and dual input operators are available from 6V-480V AC/DC.

LEADING THE INDUSTRY WITH OUR INNOVATIVE AND RUGGED DESIGN

✓ Easy to Install	Our contact blocks snap-on for secure assembly and are color coded for quick circuit identification.
✓ Class 1, Division 2	Leading the industry with the largest selection of Class 1, Div 2 hermetically sealed reed contact blocks and factory sealed contact blocks.
✓ Simple Customization	Our light modules come with various lens color options for appropriate operator interface and are available in incandescent, neon, or our LED lamps with leakage protection
✓ Visible Certifications	Our product certifications and electrical ratings are clearly marked on the outside of the contact blocks for easy reference during installation.
✓ Heavy Duty	Polyester construction provides superior durability, corrosion resistance, moisture rejection and electrical insulation. For added protection, metal parts are nickel-plated.
✓ Convenient	Reduce inventory with our interchangeable modular design, providing endless options for appropriate operator interface
✓ 100% Reliability	Hermetically sealed and factory sealed contact blocks are manufactured with all stainless steel hardware for use in harsh environments
✓ Added Security	All 30mm hazardous location operators come with a screw tightened mounting bracket to ensure contact blocks remain snug against operator.
✓ Environmentally Secure	With 4/4X and IP65 ratings, our 30mm line of pilot devices are built to last and withstand dust, corrosion, ice, and rain
✓ Lifetime Warranty*	Every product is backed by our lifetime warranty—unmatched in the industry—bringing you quality components that perform in the most demanding applications.
✓ Guaranteed Same-Day Shipping*	Product availability reduces inventory, and improves cash flow—saving you money. With c3controls any order for standard catalog items received by 6:00pm ET is guaranteed to ship same-day.
✓ Advantage Pricing	Our approach to product development, manufacturing, and focus on servicing the OEM and Electrical Equipment Builder reduces cost. The result—the best value in the industry.

*See c3controls Terms & Conditions

UNIQUE FEATURES

Metal on the inside—where it counts!

- c3controls 30mm Push-Twist-Release Emergency Stop devices feature a nickel-plated detent mechanism with stainless steel ball, and our Push-Pull operators contain a solid stainless steel detent mechanism. These features ensure reliable operation in emergency stop applications and provide safe interruption of circuits and longer life.

U-Cup Seal

- Our revolutionary U-Cup seal is infused with a Teflon coating to eliminate cracking when exposed to harsh conditions and keeps water, oils, and dust away from the contact blocks.

Internal Self-Lubricant

- All frictional parts are molded with an internal self-lubricant to provide outstanding wear without troublesome greases used by others.

One Cam Design

- Our single cam design eliminates the need for multiple cam and selector switch configurations, reducing inventory and saves you labor time and costs.

Rubber Boots

- Our state-of-the-art Fluorosilicone rubber boots protect both the operators and the circuits behind them from harsh chemicals and climates. They feature a nickel-plated brass thread ring that is molded into a special thermoset compound guaranteed to out perform Hypalon boots.

c3controls®
PO Box 496 • Beaver, PA 15009

30MM HAZARDOUS PILOT DEVICES

SPECIFICATIONS

DIELECTRIC STRENGTH (MECHANICAL CONTACTS) 2200V for 1 Minute

FACTORY SEALED CONTACT BLOCK - CBFS/CBFSR

Class I Div. 2 Gr. B, C, & D/Zone 2 Gr. IIB +H2

	Utilization Category				
	IEC	UL	Make Rating	Break Rating	Ith Thermal Current
AC	AC-15	A600	7200VA	720VA	10A
DC	DC-13	P300	138VA	138VA	5A

NOTE: For AC voltage below 72V AC (28V DC) the max. allowed switching current is 10A=Ith (5A=Ith).
For switching applications below 24V/40mA, Hermetic Reed contacts are recommended.

HERMETICALLY SEALED POWER REED CONTACT BLOCK

Class I Div. 2 Gr. A, B, C, & D/Zone 2 Gr. IIC

	Utilization Category				
	IEC	UL	Make Rating	Break Rating	Ith Thermal Current
AC	AC-15	B300	3600VA	360VA	5A
	AC-15	C600	1800VA	180VA	2.5A
DC	DC-13	Q300	69VA	69VA	2.5A

NOTE: For AC voltage below 72V AC (28V DC) the max. allowed switching current is 5A=Ith (2.5A=Ith).
Suitable for switching DRY circuits and Low Energy Circuits (Less than 24V-40mA).

HERMETICALLY SEALED MEDIUM-LOGIC REED CONTACT BLOCK

Class I Div. 2 Gr. A, B, C, & D/Zone 2 Gr. IIC

	Utilization Category				
	IEC	UL	Inductive	Resistive	Ith Thermal Current
AC	AC-12	250V Max.	40VA	100 Watt	3A

NOTE: Suitable for switching DRY circuits and Low Energy Circuits (Less than 24V-40mA).

HERMETICALLY SEALED MID-POWER REED CONTACT BLOCK

Class I Div. 2 Gr. A, B, C, & D/Zone 2 Gr. IIC

	Utilization Category				
	IEC	UL	Make Rating	Break Rating	Ith Thermal Current
AC	AC-15	C300	1800VA	180VA	2.5A
DC	DC-13	Q150	69VA	69VA	2.5A

NOTE: For AC voltage below 72V AC (28V DC) the max. allowed switching current is 2.5A=Ith (2.5A=Ith).
Suitable for switching DRY circuits and Low Energy Circuits (Less than 24V-40mA).

HERMETICALLY SEALED LOGIC REED CONTACT BLOCK

Class I Div. 2 Gr. A, B, C, & D/Zone 2 Gr. IIC

	Utilization Category				
	IEC	UL	Inductive	Resistive	Ith Thermal Current
AC		220V Max.	N/A	40 Watt	2A

NOTE: Suitable for switching DRY circuits and Low Energy Circuits (Less than 24V-40mA).

INDICATING LIGHTS

Light Unit	T-Code
FV Incandescent Lights	T4A
FV LED Lights	T6 (No marking required)
Resistor Incandescent Lights	T3C
Resistor LED Lights	T4A
Transformer Lights Incand. & LED	T4A
Multi-Voltage 20V-277V LED Lights	T4A

ENVIRONMENTAL RATINGS

	Type 1, 2, 3, 3R, 4/4X, 12, 13, and IP65
Operating Temperature	-40° F to +131° F (-40° C to +55° C)
Storage Temperature	-40° F to +185° F (-40° C to +85° C)

TERMINAL & WIRING CONSIDERATION

Wire: AWG 22-12 CU	(Copper only - Solid/Stranded) [.5 ~ 4mm²] 1 or 2 wires permitted per termination.
Recommended Torque	7-10 lb-in [0.8-1.0 Nm]

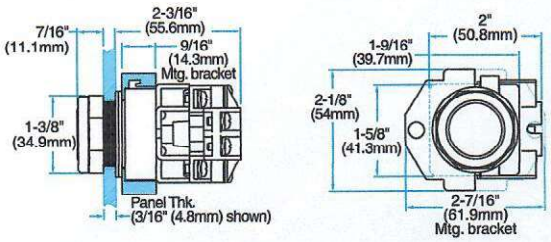
ROHS COMPLIANCE

For RoHS compliance documentation by product, refer to www.c3controls.com.

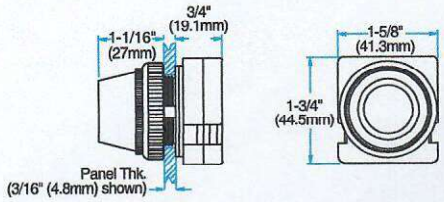
For complete ratings and detailed specifications refer to www.c3controls.com.

DIMENSIONS

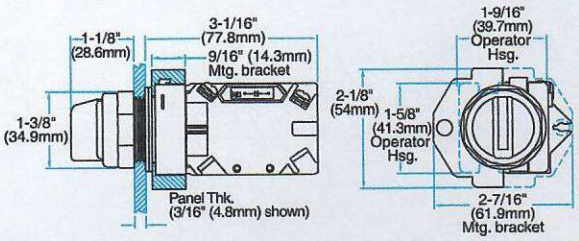
Non-Illuminated Operator (shown with Flush Cap & Factory Sealed Contact Block)



Full Voltage Pilot Light Operator (shown with PLL)



Selector Switch Operator (shown with Standard Handle)



CERTIFICATIONS

Conformity to Standards:

PILOT DEVICES
UL 508, 698, 1604 & 2279

CSA C22.2 No. 0, 14, 25, 30M, 157 & 213
IEC 60947-1, 60947-5-1

MULTI-VOLTAGE PILOT LIGHTS
UL 508, 1604

IEC 60947-1, 60947-5-1

Certifications:

UL File #: E157436 (Guide NOIV, NOIV2, NOIV7),
E68568 (Guide NKCR, NKCR7)
CSA File #: LR47446
CE Marked (per EU Low Voltage Directive 2006/95/EC and RoHS Directive 2011/65/EU)

UL File #: E68568 (Guide NKCR, NKCR7); E157436 (Guide NOIV)
CE Marked (per EU Low Voltage Directive 2006/95/EC and RoHS Directive 2011/65/EU)

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• Revised •
03/20/2012

Indicator lights

Selection and ordering data

	Version	Color of actuator	Contact blocks	Order no. Plastic Lens	List Price $	Order no. Glass Lens	List Price $	Pack Unit
Pilot light	**Indicator Light Integrated LED Module**							
	24V AC/DC	red		**52PL4L2**		**52PL5L2**		1
		green		**52PL4L3**		**52PL5L3**		
		amber		**52PL4L9**		**52PL5L9**		
	120V AC	red		**52PL4M2**		**52PL5M2**		1
		green		**52PL4M3**		**52PL5M3**		
		amber		**52PL4M9**		**52PL5M9**		
	240V AC	red		**52PL4N2**		**52PL5N2**		1
		green		**52PL4N3**		**52PL5N3**		
		amber		**52PL4N9**		**52PL5N9**		
	Indicator Light Full Voltage①④							
	24V AC/DC with 52AADN, 24V 757 type lamp or option: XB = 52AED*, 24V Single LED③ XY = 52AED*7, 24V Cluster LED③	less operating head		**52PL4DN**		**52PL5DN**		1
		red		**52PL4D2**		**52PL5D2**		
		green		**52PL4D3**		**52PL5D3**		
		amber		**52PL4D9**		**52PL5D9**		
	120V AC with 52AAENC1, 120 V 120MB type lamp or option: XB = 52AEE*, 120 V Single LED③ XY = 52AEE*7, 120 V Cluster LED③	less operating head		**52PL4EN**		**52PL5EN**		1
		red		**52PL4E2**		**52PL5E2**		
		green		**52PL4E3**		**52PL5E3**		
		amber		**52PL4E9**		**52PL5E9**		
	Indicator Light Transformer①							
	120V AC with 52AABN, 6 V 755 type lamp or option: XB = 52AEB*, 6 V Single LED③ XY = 52AEB*7, 6 V Cluster LED③	less operating head		**52PL4GN**		**52PL5GN**		1
		red		**52PL4G2**		**52PL5G2**		
		green		**52PL4G3**		**52PL5G3**		
		amber		**52PL4G9**		**52PL5G9**		
	240V AC with 52AABN, 6 V 755 type lamp or option: XB = 52AEB*, 6 V Single LED③ XY = 52AEB*7, 6 V Cluster LED③	less operating head		**52PL4HN**		**52PL5HN**		1
		red		**52PL4H2**		**52PL5H2**		
		green		**52PL4H3**		**52PL5H3**		
		amber		**52PL4H9**		**52PL5H9**		
	480V AC with 52AABN, 6 V 755 type lamp or option: XB = 52AEB*, 6 V Single LED③ XY = 52AEB*7, 6 V Cluster LED③	less operating head		**52PL4JN**		**52PL5JN**		1
		red		**52PL4J2**		**52PL5J2**		
		green		**52PL4J3**		**52PL5J3**		
		amber		**52PL4J9**		**52PL5J9**		
	600V AC with 52AABN, 6 V 755 type lamp or option: XB = 52AEB*, 6 V Single LED③ XY = 52AEB*7, 6 V Cluster LED③	less operating head		**52PL4KN**		**52PL5KN**		1
		red		**52PL4K2**		**52PL5K2**		
		green		**52PL4K3**		**52PL5K3**		
		amber		**52PL4K9**		**52PL5K9**		
	Color code table②:	blue		**5**		**5**		
		clear		**A**		**A**		
		white		**B**		**B**		

Technical Specifications on page 10/169A

① **LED option available.** For single LED, append **XB** to the end of the order number. For a cluster LED, append **XY** to the end of the order number. Single LEDs available for all colors, while cluster LEDs are available for red, green and amber only. LED color and lens color must match. LED option is not available on units sold "less operating head".
Example: Single LED: 52PL5G3**XB** Cluster LED: 52PL5G3**XY**

② To order a color option, replace the last digit of the order number.

③ Replace asterisk (*) in LED part number with color option that matches lens. See replacement lamps on page 10/161, for complete catalog number.

④ Full Voltage modules are available with additional voltage ratings from the factory. For Incandescent lamps change the 6th Character to **B**=6V, or **C**=12V (Example: Order 52PL4**B**2 for 6V Incandescent Lamp). For LED options change the 6th Character to **B**=6V AC (Example: Order 52PL4**B**2XB for 6V AC LED Lamp option).

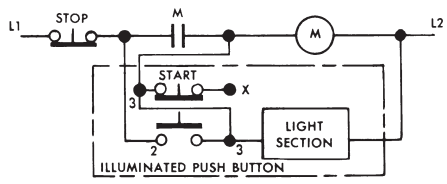
Selection and ordering data

	Version	Color of actuator	Contact blocks	Order no. Plastic Lens④	List Price $	Pack Unit
Push to test	**Illuminated pushbutton / Push to test Integrated LED Module**					
	24V AC/DC	red	1NO - 1NC	**52PT6L2A**		1
		green	1NO - 1NC	**52PT6L3A**		
		amber	1NO - 1NC	**52PT6L9A**		
	120V AC	red	1NO - 1NC	**52PT6M2A**		1
		green	1NO - 1NC	**52PT6M3A**		
		amber	1NO - 1NC	**52PT6M9A**		
	240V AC	red	1NO - 1NC	**52PT6N2A**		1
		green	1NO - 1NC	**52PT6N3A**		
		amber	1NO - 1NC	**52PT6N9A**		
	Illuminated pushbutton / Push to test Full Voltage①⑤					
	24V AC/DC with 52AADN, 24V 757 type lamp or option: B = 52AED*, 24V Single LED3)	less operating head	1NO - 1NC	**52PT6DNA**		1
		red	1NO - 1NC	**52PT6D2A**		
		green	1NO - 1NC	**52PT6D3A**		
		amber	1NO - 1NC	**52PT6D9A**		
	Illuminated pushbutton / Push to test Transformer①					
	120V AC with 52AABN, 6 V 755 type lamp or option: B = 52AEB*, 6 V Single LED3)	less operating head	1NO - 1NC	**52PT6GNA**		1
		red	1NO - 1NC	**52PT6G2A**		
		green	1NO - 1NC	**52PT6G3A**		
		amber	1NO - 1NC	**52PT6G9A**		
	240V AC with 52AABN, 6 V 755 type lamp or option: B = 52AEB*, 6 V Single LED3)	less operating head	1NO - 1NC	**52PT6HNA**		1
		red	1NO - 1NC	**52PT6H2A**		
		green	1NO - 1NC	**52PT6H3A**		
		amber	1NO - 1NC	**52PT6H9A**		
	480V AC with 52AABN, 6 V 755 type lamp or option: B = 52AEB*, 6 V Single LED3)	less operating head	1NO - 1NC	**52PT6JNA**		1
		red	1NO - 1NC	**52PT6J2A**		
		green	1NO - 1NC	**52PT6J3A**		
		amber	1NO - 1NC	**52PT6J9A**		
	600V AC with 52AABN, 6 V 755 type lamp or option: B = 52AEB*, 6 V Single LED3)	less operating head	1NO - 1NC	**52PT6KNA**		1
		red	1NO - 1NC	**52PT6K2A**		
		green	1NO - 1NC	**52PT6K3A**		
		amber	1NO - 1NC	**52PT6K9A**		
	Color code table②:	blue		**5**		
		clear		**A**		
		white		**B**		

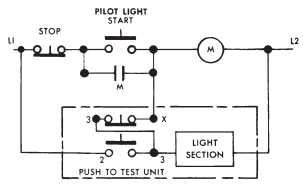
Technical Specifications on page 10/169A

Wiring Diagrams

Illuminated Push Button



Push to Test



① **LED option available**. For single LED only, append **B** to the end of the order number. Single LEDs available for all colors. LED color and lens color must match. LED option is not available on units sold "less operating head" Example: Single LED: 52PT6D3A**B** (Cluster LED option is not available for PTT Pilot Lights.)

② To order a color option, replace the 7th digit of the order number.

③ Replace asterisk (*) in LED part number with color option that matches lens. See replacement lamps on page 10/161, for complete catalog number.

④ 52AAGL Chrome Lens Guard is available for Push-to-test/Illuminated Pushbuttons and Indicator Lights.

⑤ Full Voltage modules are available with additional voltage ratings from the factory. For Incandescent lamps change the 6th Character to **B**=6V, **C**=12V, or **E**=120V (Example: Order 52PT6**B**2A for 6V Incandescent Lamp). For LED options change the 6th Character to **B**=6V AC, or **E**=120V AC (Example: Order 52PT6**B**2AB for 6V AC LED Lamp option).

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LINE VOLTAGE THERMOSTAT

100773REV3

Operating Instructions

1UHH1 thru 1UHH4, 2NNR5 thru 2NNR9, 2NNT1 thru 2NNT5, and 6EDY3 thru 6EDY7

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Line Voltage Thermostats

Description

These Line Voltage Thermostats are designed for reliable use in heating, ventilating, and refrigeration applications. A broad temperature range between -30° and +120°F (-34° and +49°C) allows for a wide range of heating, ventilating, and refrigeration applications. Snap-acting contacts are in a dust protected enclosure. SPDT switches are enclosed and protected.

Specifications

ELECTRICAL RATINGS

AC Voltage	120 V	208 V	240 V	277 V
Models 1UHH1 thru 1UHH4, 2NNR5 thru 2NNR7, 2NNR9, 2NNT1 thru 2NNT4 & 6EDY3 thru 6EDY7:				
Inductive Full Load Amps	16.0	9.2	8.0	–
Locked Rotor Amps	96.0	55.2	48.0	–
Models 2NNR8 & 2NNT5:				
Inductive Full Load Amps	12.0	–	–	–
Locked Rotor Amps	72.0	–	–	–
Resistive Load Amps (not lamp loads):				
Models 1UHH1, 1UHH2, 2NNR6, 2NNR7, 2NNR9 & 2NNT3:				
SPST (when connected)	22.0	22.0	22.0	22.0
SPDT (when connected)	16.0	9.2	8.0	7.2
Models 1UHH3, 2NNT1 & 6EDY4:				
SPDT Rating	16.0	9.2	8.0	7.2
Models 1UHH4, 2NNR5 & 2NNT4:				
SPST Rating	22.0	22.0	22.0	22.0
Models 2NNR8 & 2NNT5*:				
SPST Rating	12.0	–	–	–

Pilot Duty . . . . . 125 VA 24/600 VAC

(*) Model numbers 2NNR8 and 2NNT5 include a 6 foot "Piggyback" cord.

NOTE: When used as a two circuit switch, the total load must not exceed 2000 VA.

Figure 1

General Safety Information

⚠ WARNING ***Disconnect all power before installing or servicing this product. If the power disconnect is out of view, lock it in the open position and tag it to prevent unexpected restarting of power. Failure to do so could result in fatal electric shock.***

1. Special attention must be given to any grounding information on this product and to other equipment associated with its installation and use. To ensure a proper ground, the grounding means must be checked by a qualified electrician.
2. Be certain that the electrical ratings of the thermostat conform to the power source and the load(s) being controlled. Loads that exceed the rating of the thermostat should be handled with a suitable rated relay or motor starter.

⚠ WARNING ***Do not depend upon the thermostat as the sole means of disconnecting power when installing or servicing the product it is controlling. Always disconnect power at the main circuit breaker as described above. Failure to do so could result in fatal electric shock.***

3. This thermostat is intended ONLY for permanent installation in accordance with the United States National Electrical Code (NEC), all applicable local codes and ordinances, and all sections of this manual. All wiring should be done by a qualified electrician, using copper wire only.

⚠ WARNING ***These thermostats are intended for general heating, ventilating, and refrigeration ONLY. They must NOT be used in potentially dangerous locations such as flammable, explosive, chemical laden areas or in wet atmospheres.***

⚠ WARNING ***These thermostats are designed for use as operating controls only. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (supervisory alarm systems) that protect against, or warn of control failure.***

ADDITIONAL SPECIFICATIONS

Model Number	Application	Switch	Temperature Range	Temperature Differential*	Sensor	Construction	Housing Rating
1UHH1	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Polymeric	1
1UHH2	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Steel	1
1UHH3	2 Stage Heat/Cool	SPDT/SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Steel	1
1UHH4	Cool Only	SPST	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Steel	1
2NNR5	Refrigeration	SPST	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Steel	1
2NNR6	Heat/Cool	SPDT	0 to 120°F (-18 to 49°C)	3.5°F	Extended	Polymeric	4X
2NNR7	Heat/Cool	SPDT	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Steel	1
2NNR8	Heat Only	SPST	35 to 95°F (2 to 35°C)	3.5°F	Fixed	Steel	1
2NNR9	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Stainless Steel	1
2NNT1	2 Stage Heat/Cool	SPDT/SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Stainless Steel	1
2NNT2	Cool Only	SPST	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Stainless Steel	1
2NNT3	Heat/Cool	SPDT	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Stainless Steel	1
2NNT4	Refrigeration	SPST	-30 to 90°F (-34 to 32°C)	3.5°F	Extended	Stainless Steel	1
2NNT5	Heat Only	SPST	35 to 95°F (2 to 35°C)	3.5°F	Fixed	Stainless Steel	1
6EDY3	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5 to 12°F	Fixed	Polymeric	1
6EDY4	2 Stage Heat/Cool	SPDT/SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Polymeric	1
6EDY5	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5°F	Fixed	Polymeric	1
6EDY7	Heat/Cool	SPDT	30 to 110°F (-1 to 43°C)	3.5 to 12°F	Extended	Steel	1

(*) Temperature between stages on Models 1UHH3, 2NNT1 and 6EDY4 is fixed. The low stage makes contacts R (Red) to Y (Yellow) at the knob setting while the high stage makes contact approximately 3°F above the knob setting.

General Safety Information (Continued)

⚠ WARNING ***In cases where personal injury or property damage may result from malfunction of the thermostat, a backup system must be used. Where critical or high value products are maintained, an approved temperature limit should be wired in series with this thermostat. In less critical applications, a second thermostat with alarm contacts may be used for redundancy.***

Installation

LOCATION

Mount this product 5 to 6 feet above the floor so it will be exposed to the average temperature of the controlled space. Do not mount control where it could be affected by unusual heat or cold such as in sunlight or beside equipment. Avoid locations near a door, window or other opening. Do not mount on an outside wall. When the thermostat is mounted with coil pointed down, it is protected from falling objects, dirt, and debris.

MOUNTING – FIXED INSTALLATIONS

Four mounting holes for fixed installations are found in the back of the case. On rough surfaces use the top mounting holes only. When mounting this control on uneven surfaces, when all four mounting screws are tightened, the housing may deform enough to affect the thermostat calibration and operation.

⚠ CAUTION ***Do not dent or deform the sensor coil of this control. A dent or deformation will change the calibration and cause the control to cycle at a temperature lower than the knob setting.***

NOTE: Dimensions and performance specifications appearing below (Figures 2 and 2A) are nominal and are subject to accepted manufacturing tolerances and application variables.

MOUNTING – PORTABLE HEATER THERMOSTATS (2NNR8 & 2NNT5)

Thermostat model numbers 2NNR8 and 2NNT5 are designed to be used with portable heaters. They are supplied with a 6 foot (1.8 m) HSJ class cord and a "series" plug for 120 volt 12 amp service. The thermostat case is connected to the green "ground" wire.

⚠ CAUTION ***To reduce the risk of electric shock, this product has a grounding type plug that has a third (grounding) pin. This plug will only fit into a grounding type power outlet. If the plug does not fit into the outlet, contact a qualified electrician to install the proper outlet. Do not change the plug in any way.***

To install this device, unfold the bail wire on the back of the thermostat and hang the unit where it can be plugged into a 3-prong (grounded) power supply. Then plug the heater into the "piggyback" portion of the thermostat plug.

For best results, be sure the thermostat is suitably mounted above the floor and away from the heater discharge. If an extension cord is required, use only 3-wire grounded extension cords with adequate wire size.

⚠ WARNING ***Do not allow the thermostat to be placed on the floor where it could come in contact with moisture, or be stepped on. Doing so could result in a fatal electric shock.***

MOUNTING – RAINTIGHT THERMOSTAT INSTALLATION (2NNR6)

Thermostat model 2NNR6 is designed for use in wet or humid environments. It meets NEMA 4X requirements when used with approved watertight connectors (not included).

To ensure water tightness, a UL listed cord seal or conduit hub marked "4X" should be tightened onto the conduit before installing in the enclosure. A drip loop must be used to prevent moisture from entering the thermostat housing. Make certain that all connectors are securely tightened.

When reinstalling the cover, make sure it is squarely positioned over the gasket. Then uniformly tighten the screws, evenly compressing the gasket to provide a watertight seal. Do not overtighten.

MOUNTING – EXTENDABLE BULB THERMOSTAT INSTALLATION (2NNR5, 2NNR6, 2NNR7, 2NNT3 & 2NNT4)

Thermostat models 2NNR5, 2NNR6, 2NNR7, 2NNT3 and 2NNT4 have a sensor bulb attached to the end of an extendable capillary tube. The sensor bulb on these units is designed to monitor temperature remotely from the control module.

When extending the sensor, avoid bending or kinking the extendable capillary tube, as this will affect the accuracy of the unit. Make sure that any excess tubing is coiled beneath the thermostat control module.

The control module should be located in a convenient place within a distance easily reached by the thermostats' extendable sensing bulb.

Care should be taken to install the sensing bulb where it will sense the average ambient temperature of the area to be controlled.

For **remote room installations**, mount the sensing bulb in a location where the ambient air can easily circulate around the sensing bulb. For **cold room installations**, the sensing bulb may also be mounted on the suction side of a refrigerant line, and secured in position.

For **duct installations**, position the sensing bulb where it is in the primary air stream and avoid mounting the sensing bulb close to hot pipes, cooling coils, or other areas which may cause an inaccurate reading.

For **tank installations**, the sensing bulb can be inserted directly into the tank fluid. Place the sensing bulb in a location where the liquid will circulate around the sensing bulb and where it is not affected by extraneous temperatures. When mounting in a tank:

- First drain the system.
- Then screw an approved boiler plug into a pipe tapping (not supplied).
- Position a packing nut on the capillary tubing of the sensing bulb.
- Slip the sensing bulb completely through the boiler plug.
- Put the composition disc and slotted brass washers on the capillary tubing.
- Slide the assembly into the boiler plug and tighten the packing nut.
- Refill the system and check for leaks.
- Coil the excess capillary tubing, taking care to avoid any crimps.

For models 6EDY3 and 6EDY7 you may adjust the difference between the on and off temperature by moving the tab to "MIN" for a 3 degree difference or up to "MAX" for a 12 degree difference (see Figure 3).

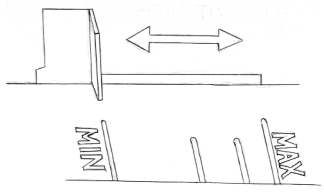


Figure 3 – Adjustable Differential Models

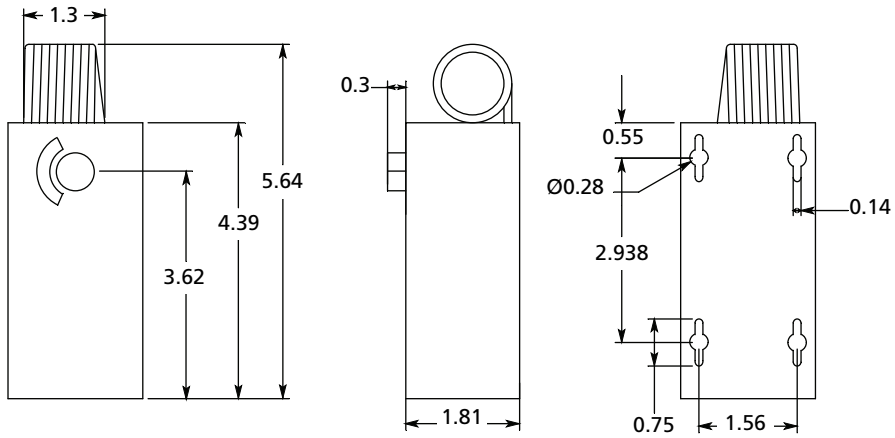


Figure 2 – Dimensions of Metal Cased Thermostat (in inches)

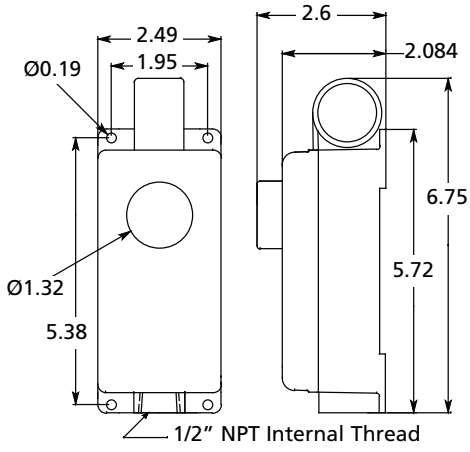


Figure 2A – Plastic Cased Thermostat

Installation (Continued)

WIRING

IMPORTANT: All wiring should be done in accordance with applicable codes, ordinances and regulations. Use disconnect device and overload protection to assure safe installation complying with local and national codes. Figures 4, 5 and 6 illustrate typical wiring for control of heating, cooling, refrigeration, and combination heating/cooling control systems (copper conductors only).

NOTE: Letters **R**, **B** and **Y** (red, blue and yellow) refer to color of paint dots near terminals (see Figures 4-11).

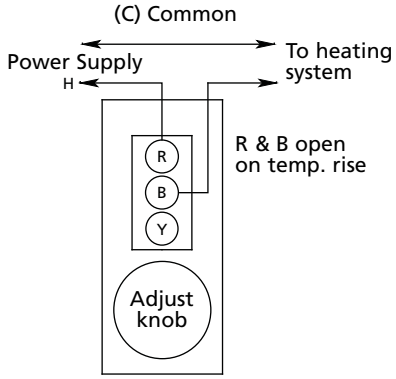


Figure 4 – Connection for a Typical Heating Control Circuit

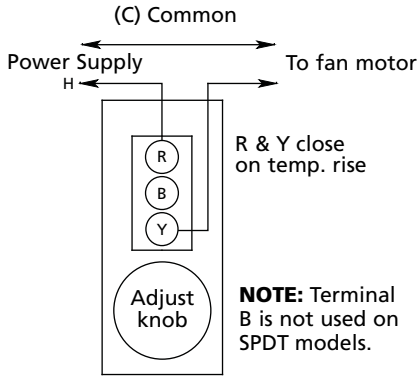
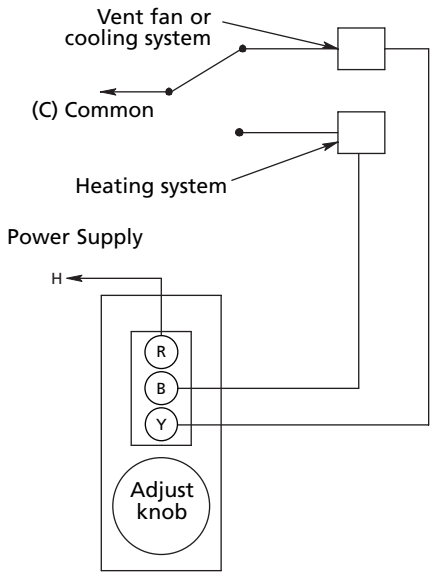


Figure 5 – Connection for a Typical Refrigeration, Ventilation or Cooling Control Circuit



NOTE: SPDT switch not included.

Figure 6 – SPDT Thermostats in Control of Heating and Ventilation Systems

Figure 7 shows wiring for controlling a two-speed ventilating fan. When the control element reaches the knob settings, the low temperature switch starts the fan on low speed. If the ambient temperature continues to rise, the high temperature switch supplies power to the high-speed motor winding while disconnecting the low-speed winding.

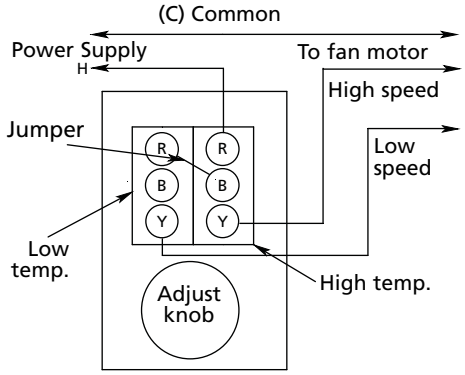


Figure 7 – Two-stage SPDT/SPDT Thermostats in Control of a Two-speed Ventilating Fan

Figure 8 shows a typical SPDT/SPDT hook-up for a two-volume fan application. The damper motor will be energized when the temperature reaches the knob setting. If the temperature continues to rise, the fan motor will be energized by the high temperature switch.

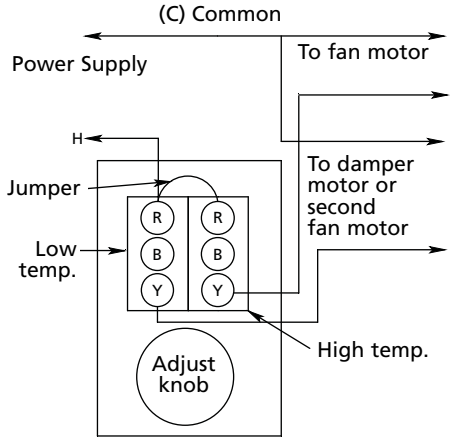


Figure 8 – Two-stage SPDT/SPDT Thermostats in Control of a Single-speed Ventilating Fan and Volume Increase Damper Motor

SPDT/SPDT units can also be used to control a combination heating and ventilating or cooling system, as shown in Figure 9. A temperature increase to the knob setting will turn off the heating system when the R-B contacts of the low temperature switch break. An increase in temperature of about 3°F will turn on the fan or cooling system through the R-Y contacts of the high temperature switch.

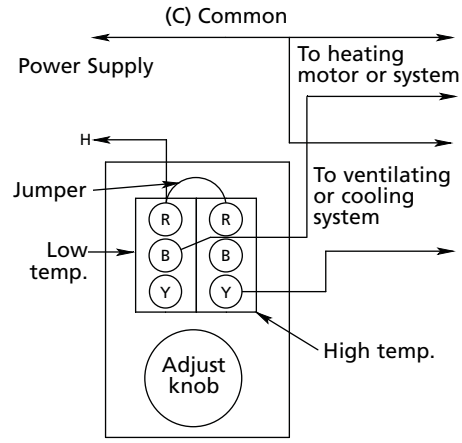


Figure 9 – Two-stage SPDT/SPDT Thermostats with Automatic Changeover in Control of Heating and Cooling Systems

Figure 10 illustrates typical wiring for SPDT/SPDT units for control of two heating stages. As the ambient temperature decreases to the knob setting, the high temperature switch will make R-B contact, turning on the first stage of heating. If the temperature continues to drop (about 3°F) the low temperature switch will make R-B contact, turning on the second stage of heating.

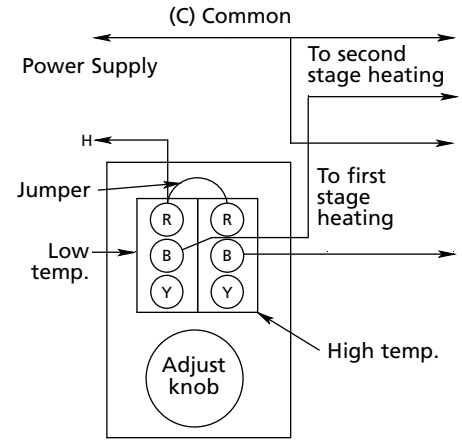


Figure 10 – Two-stage SPDT/SPDT Thermostats in Control of a Two-stage Heating System

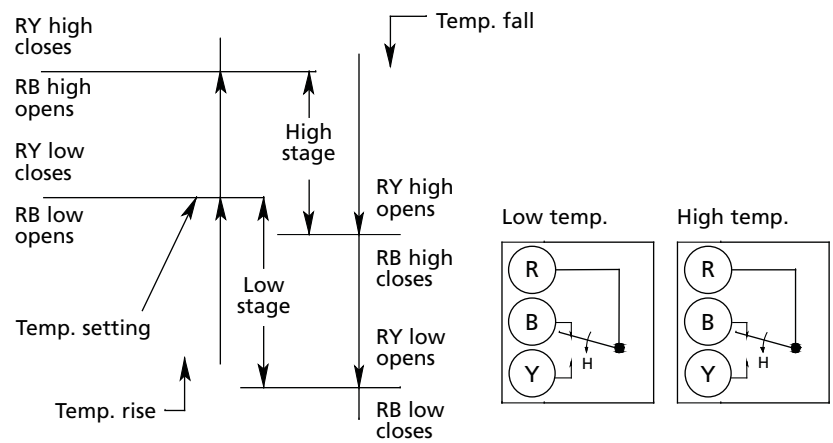


Figure 11 – Operational Sequence of Two-stage SPDT/SPDT Thermostats

Installation (Continued)

CHECKOUT PROCEDURE

Before leaving the installation, a complete operating cycle should be observed to ensure that all components are functioning properly. Check for correct operation in the following sequence:

1. When thermostats are connected to Refrigeration, Ventilating, or Cooling Systems: Turn knob clockwise to a setting above ambient temperature. Fan or Cooling System should be off. When knob is turned counterclockwise (to lower temperature setting), the fan or cooling system should turn on approximately at the knob setting.
2. When thermostats are connected to a Heating device or system: Turn knob clockwise above the ambient temperature; the heating unit should be on. When knob is turned counterclockwise (to lower temperature setting), the heating unit should turn off approximately at the knob setting.
3. Thermostats with SPDT/SPDT 2 Stage switching: If connection is similar to Figure 7, fan should start at approximately ambient temperature and should change to high speed, as the knob is turned counterclockwise to a lower temperature setting. If wiring is similar to Figure 8, the damper should open as the knob is turned counterclockwise (to lower temperature setting). The devices should act in reverse sequence when the knob is turned clockwise.

This product is set at the factory for the maximum temperature scale setting. The maximum temperature setting can be reduced by removing the cover, slightly loosening the adjusting screw adjacent to the adjust knob, and moving the adjusting screw along the slot to the desired maximum temperture. Once this is done, retighten the adjusting screw and replace the cover.

Operation

Figure 11, page 3 illustrates the operation of thermostats with SPDT/SPDT 2 Stage switching. On a temperature increase to the knob setting, the circuit between R and Y of the low stage switch (RYL) closes. Simultaneously the circuit between R and B (RBL) opens.

On a further increase in temperature the high stage switch operates and closes (RYH) while simultaneously opening (RBH). The reverse sequencing takes place with a decrease in temperature.

NOTE: No Replacement parts available. Do not attempt any field repair.

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Prompt Disposition. *A good faith effort will be made for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.*

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714-4014 U.S.A.

Troubleshooting Chart

Symptom	Possible Cause(s)	Corrective Action
Cooling:		
Cooling or fan does not operate	1. Improper wiring 2. Knob set above ambient temperature	1. Check wiring 2. Set knob to lower temperature
Cooling or fan runs continuously	1. Improper wiring 2. Knob set below ambient temperature	1. Check wiring 2. Set knob to higher temperature
System operates in reverse	Improper wiring	Check wiring
Heating:		
Heating unit does not operate	1. Improper wiring 2. Knob set below ambient temperature	1. Check wiring 2. Set knob to higher temperature
Heating unit runs continuously	1. Improper wiring 2. Knob set above ambient temperature	1. Check wiring 2. Set knob to lower temperature
System operates in reverse	Improper wiring	Check wiring

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3RV CIRCUIT BREAKERS

PRL2A

SIEMENS

Data sheet 3RV2011-0JA10

CIRCUIT-BREAKER SZ S00, FOR MOTOR PROTECTION, CLASS 10, A-REL. 0.7...1A, N-RELEASE 13A, SCREW CONNECTION, STANDARD SW. CAPACITY

product brand name	SIRIUS
Product designation	3RV2 circuit breaker

General technical data:	
Size of the circuit-breaker	S00
Size of contactor can be combined company-specific	S0
Product expansion	
• Auxiliary switch	Yes
Power loss [W] total typical	6 W
Insulation voltage with degree of pollution 3 rated value	690 V
Surge voltage resistance rated value	6 kV
Protection class IP	
• on the front	IP20
• of the terminal	IP20
Shock resistance	
• acc. to IEC 60068-2-27	25g / 11 ms
Mechanical service life (switching cycles)	
• of the main contacts typical	100 000
• of auxiliary contacts typical	100 000

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Electrical endurance (switching cycles)	
• typical	100 000
Type of protection	Increased safety
Certificate of suitability relating to ATEX	on request
Protection against electrical shock	finger-safe
Equipment marking acc. to DIN EN 81346-2	Q

Ambient conditions:	
Installation altitude at height above sea level maximum	2 000 m
Ambient temperature	
• during operation	-20 ... +60 °C
• during storage	-50 ... +80 °C
• during transport	-50 ... +80 °C
Temperature compensation	-20 ... +60 °C
Relative humidity during operation	10 ... 95 %

Main circuit:	
Number of poles for main current circuit	3
Adjustable response value current of the current-dependent overload release	0.7 ... 1 A
Operating voltage	
• rated value	690 V
• at AC-3 rated value maximum	690 V
Operating frequency rated value	50 ... 60 Hz
Operating current rated value	1 A
Operating current	
• at AC-3	
— at 400 V rated value	1 A
Operating power	
• at AC-3	
— at 230 V rated value	180 W
— at 400 V rated value	250 W
— at 500 V rated value	370 W
— at 690 V rated value	550 W
Operating frequency	
• at AC-3 maximum	15 1/h

Auxiliary circuit:	
Number of NC contacts	
• for auxiliary contacts	0
Number of NO contacts	
• for auxiliary contacts	0
Number of CO contacts	

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• for auxiliary contacts	0

Protective and monitoring functions:	
Trip class	CLASS 10
Design of the overload release	thermal
Operational short-circuit current breaking capacity (Ics) at AC	
• at 240 V rated value	100 kA
• at 400 V rated value	100 kA
• at 500 V rated value	100 kA
• at 690 V rated value	100 kA
Maximum short-circuit current breaking capacity (Icu)	
• at AC at 240 V rated value	100 kA
• at AC at 400 V rated value	100 kA
• at AC at 500 V rated value	100 kA
• at AC at 690 V rated value	100 kA
Breaking capacity short-circuit current (Icn)	
• at 1 current path at DC at 150 V rated value	10 kA
• with 2 current paths in series at DC at 300 V rated value	10 kA
• with 3 current paths in series at DC at 450 V rated value	10 kA
Response value current of the instantaneous short-circuit release	13 A

UL/CSA ratings:	
Full-load current (FLA) for three-phase AC motor	
• at 480 V rated value	1 A
• at 600 V rated value	1 A
• Yielded mechanical performance [hp] for three-phase AC motor	
— at 575/600 V rated value	0.5 hp

Short-circuit protection	
Design of the short-circuit trip	magnetic
Design of the fuse link for IT network for short-circuit protection of the main circuit	
• at 500 V	gL/gG 10 A
• at 690 V	gL/gG 10 A

Installation/ mounting/ dimensions:	
Mounting position	any
Mounting type	screw and snap-on mounting onto 35 mm standard mounting rail according to DIN EN 60715
Height	97 mm
Width	45 mm

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Depth	96 mm
Required spacing	
• with side-by-side mounting	
— forwards	0 mm
— Backwards	0 mm
— upwards	50 mm
— downwards	50 mm
— at the side	0 mm
• for grounded parts	
— forwards	0 mm
— Backwards	0 mm
— upwards	50 mm
— at the side	30 mm
— downwards	50 mm
• for live parts	
— forwards	0 mm
— Backwards	0 mm
— upwards	50 mm
— downwards	50 mm
— at the side	30 mm

Connections/ Terminals:	
Product function	
• removable terminal for auxiliary and control circuit	No
Type of electrical connection	
• for main current circuit	screw-type terminals
Arrangement of electrical connectors for main current circuit	Top and bottom
Type of connectable conductor cross-sections	
• for main contacts	
— single or multi-stranded	2x (0,75 ... 2,5 mm²), 2x 4 mm²
— finely stranded with core end processing	2x (0.5 ... 1.5 mm²), 2x (0.75 ... 2.5 mm²)
• at AWG conductors for main contacts	2x (18 ... 14), 2x 12
Tightening torque	
• for main contacts with screw-type terminals	0.8 ... 1.2 N·m
Design of screwdriver shaft	Diameter 5 to 6 mm
Design of the thread of the connection screw	
• for main contacts	M3

Safety related data:	
B10 value with high demand rate acc. to SN 31920	50 000
Proportion of dangerous failures	

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• with low demand rate acc. to SN 31920	40 %
• with high demand rate acc. to SN 31920	40 %
Failure rate [FIT]	
• with low demand rate acc. to SN 31920	50 FIT
T1 value for proof test interval or service life acc. to IEC 61508	10 y
Display version	
• for switching status	Handle

Certificates/approvals

General Product Approval					For use in hazardous locations
CCC	CSA	UL	KTL	EAC	ATEX

For use in hazardous locations	Declaration of Conformity	Test Certificates			Shipping Approval
IECEx	EG-Konf.	Werksbescheinigungen	spezielle Prüfbescheinigungen	Typprüfbescheinigung/Werkszeugnis	ABS

Shipping Approval					
BUREAU VERITAS	DNV	GL	LRS	PRS	RINA

Shipping Approval	other			Railway
RMRS	Umweltbestätigung	Bestätigungen	VDE	Schwingen/Schocken

Further information

Information- and Downloadcenter (Catalogs, Brochures,…)
http://www.siemens.com/industrial-controls/catalogs

Industry Mall (Online ordering system)
https://mall.industry.siemens.com/mall/en/en/Catalog/product?mlfb=3RV20110JA10

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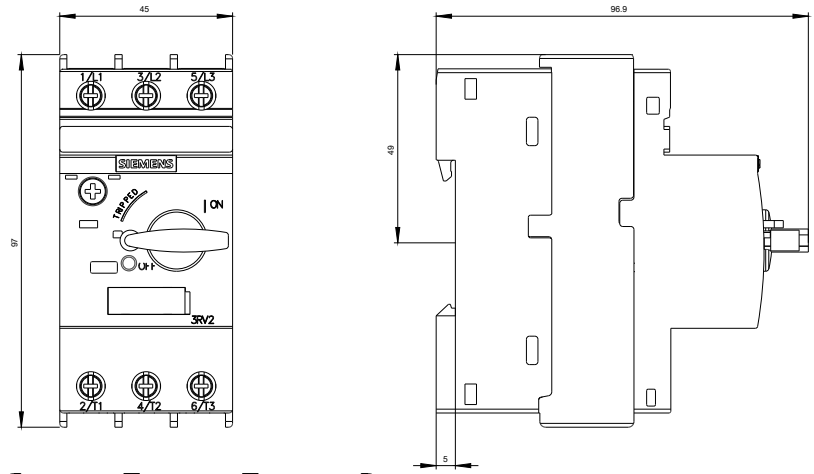
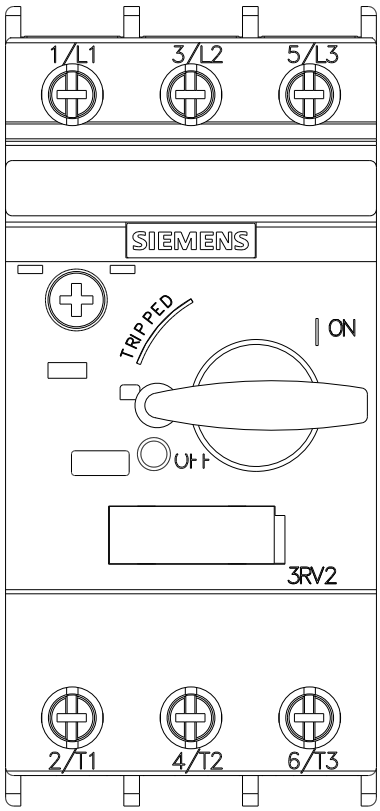
Cax online generator
http://support.automation.siemens.com/WW/CAXorder/default.aspx?lang=en&mlfb=3RV20110JA10

Service&Support (Manuals, Certificates, Characteristics, FAQs,...)
https://support.industry.siemens.com/cs/ww/en/ps/3RV20110JA10

Image database (product images, 2D dimension drawings, 3D models, device circuit diagrams, EPLAN macros, ...)
http://www.automation.siemens.com/bilddb/cax_de.aspx?mlfb=3RV20110JA10&lang=en





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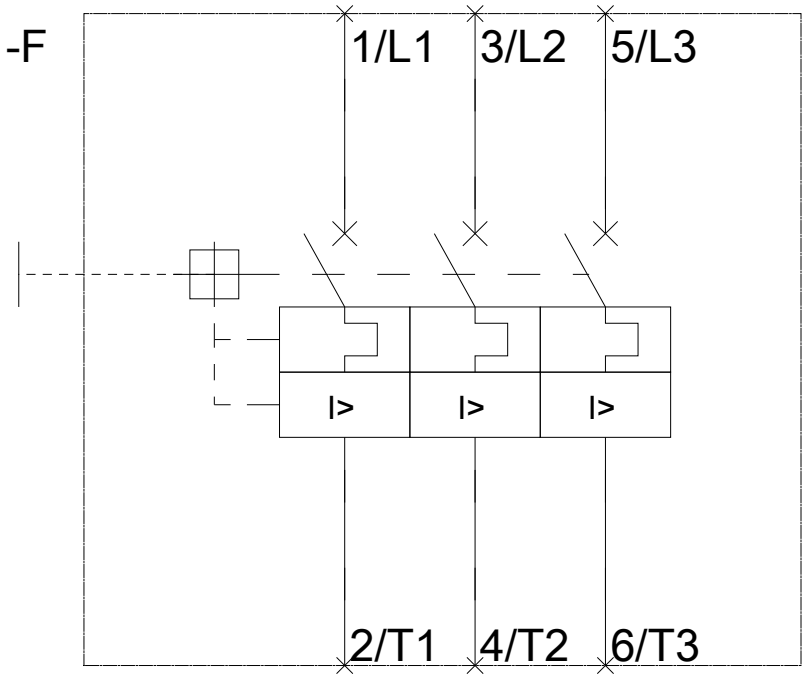

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3RT SCREW TERMINALS

3RT2015-1AK61

SIEMENS

Product data sheet 3RT2015-1AK61

CONTACTOR, AC-3, 3KW/400V, 1NO,
AC110V 50HZ, 120V 60HZ 3-POLE,
SZ S00 SCREW TERMINAL

General technical data:		
product brand name		SIRIUS
Size of the contactor		S00
Product extension / auxiliary switch		Yes
Protection class IP / on the front		IP20
Protection against electrical shock		finger-safe
Degree of pollution		3
Installation altitude / at a height over sea level / maximum	m	2,000
Ambient temperature		
• during storage	°C	-55 … +80
• during operating	°C	-25 … +60
Shock resistance		
• at rectangular impulse		
• at AC		6,7g / 5 ms, 4,2g / 10 ms
• at sine pulse		
• at AC		10,5g / 5 ms, 6,6g / 10 ms
Impulse voltage resistance / rated value	kV	6
Insulation voltage / rated value	V	690
Mechanical operating cycles as operating time		
• of the contactor / typical		30,000,000

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• of the contactor with added auxiliary switch block / typical		10,000,000
• of the contactor with added electronics-compatible auxiliary switch block / typical		5,000,000

Main circuit:		
Number of NC contacts / for main contacts		0
Number of NO contacts / for main contacts		3
Operating current		
• at AC-1 / at 400 V		
• at 40 °C ambient temperature / rated value	A	18
• at 60 °C ambient temperature / rated value	A	16
• at AC-2 / at 400 V / rated value	A	7
• at AC-3 / at 400 V / rated value	A	7
• at AC-4 / at 400 V / rated value	A	6.5
Operating current		
• with 1 current path / at DC-1		
• at 24 V / rated value	A	15
• at 110 V / rated value	A	1.5
• with 2 current paths in series / at DC-1		
• at 24 V / rated value	A	15
• at 110 V / rated value	A	8.4
• with 3 current paths in series / at DC-1		
• at 24 V / rated value	A	15
• at 110 V / rated value	A	15
• with 1 current path / at DC-3 / at DC-5		
• at 24 V / rated value	A	15
• at 110 V / rated value	A	0.1
• with 2 current paths in series / at DC-3 / at DC-5		
• at 24 V / rated value	A	15
• at 110 V / rated value	A	0.25
• with 3 current paths in series / at DC-3 / at DC-5		
• at 24 V / rated value	A	15
• at 110 V / rated value	A	15
Service power		
• at AC-2 / at 400 V / rated value	kW	3
• at AC-3 / at 400 V / rated value	kW	3
• at AC-4 / at 400 V / rated value	kW	3
Active power loss / per conductor / typical	W	0.4
Off-load operating frequency		
• at AC	1/h	10,000

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• at DC	1/h	10,000
Frequency of operation / at AC-1 / according to IEC 60947-6-2	1/h	1,000
Frequency of operation / at AC-2 / according to IEC 60947-6-2	1/h	750
Frequency of operation / at AC-3 / according to IEC 60947-6-2	1/h	750
Frequency of operation / at AC-4 / according to IEC 60947-6-2	1/h	250

Control circuit:		
Type of voltage / of the controlled supply voltage		AC
Control supply voltage / 1		
• at 50 Hz / for AC / rated value	V	110
• at 60 Hz / for AC / rated value	V	120
Operating range factor control supply voltage rated value / of the magnet coil		
• at 50 Hz / for AC		0.8 … 1.1
• at 60 Hz / for AC		0.85 … 1.1
Apparent pull-in power / of the solenoid / for AC	V·A	32
Apparent holding power / of the solenoid / for AC	V·A	4.8
Inductive power factor		
• with the pull-in power of the coil		0.8
• with the pull-in power of the coil		0.25
Closing delay		
• at AC	ms	9 … 35
Opening delay		
• at AC	ms	3.5 … 14
Arcing time	ms	10 … 15

Auxiliary circuit:		
Contact reliability / of the auxiliary contacts		1 faulty switching per 100 million (17 V, 1 mA)
Number of NC contacts / for auxiliary contacts / instantaneous switching		0
Number of NO contacts / for auxiliary contacts / instantaneous switching		1
Operating current / of the auxiliary contacts		
• at AC-12 / maximum	A	10
• at AC-15		
• at 230 V	A	10
• at 400 V	A	3
• at DC-12		
• at 48 V	A	6
• at 60 V	A	6
• at 110 V	A	3

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• at 220 V	A	1
• at DC-13		
• at 24 V	A	10
• at 48 V	A	2
• at 60 V	A	2
• at 110 V	A	1
• at 220 V	A	0.3

Short-circuit:

Design of the fuse link		
• for short-circuit protection of the auxiliary switch / required		fuse gL/gG: 10 A
• for short-circuit protection of the main circuit		
• with type of assignment 1 / required		gL/gG LV HRC 3NA, DIAZED 5SB, NEOZED 5SE: 35 A
• at type of coordination 2 / required		gL/gG LV HRC 3NA, DIAZED 5SB, NEOZED 5SE: 20A

Installation/mounting/dimensions:

mounting position		+/-180° rotation possible on vertical mounting surface; can be tilted forward and backward by +/- 22.5° on vertical mounting surface
Type of mounting		screw and snap-on mounting onto 35 mm standard mounting rail according to DIN EN 50022
Type of fixing/fixation / series installation		Yes
Width	mm	45
Height	mm	57.5
Depth	mm	73
Distance, to be maintained, to the ranks assembly / sidewards	mm	0
Distance, to be maintained, to earthed part / sidewards	mm	6

Connections:

Design of the electrical connection		
• for main current circuit		screw-type terminals
• for auxiliary and control current circuit		screw-type terminals
Type of the connectable conductor cross-section		
• for main contacts		
• solid		2x (0.5 ... 1.5 mm²), 2x (0.75 ... 2.5 mm²), 2x 4 mm²
• finely stranded		
• with conductor end processing		2x (0.5 ... 1.5 mm²), 2x (0.75 ... 2.5 mm²)
• for AWG conductors / for main contacts		2x (20 ... 16), 2x (18 ... 14), 2x 12
• for auxiliary contacts		
• solid		2x (0.5 ... 1.5 mm²), 2x (0.75 ... 2.5 mm²), 2x 4 mm²
• finely stranded		

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• with conductor end processing		2x (0.5 ... 1.5 mm²), 2x (0.75 ... 2.5 mm²)
• for AWG conductors / for auxiliary contacts		2x (20 ... 16), 2x (18 ... 14), 2x 12

Certificates/approvals:

General Product Approval				Declaration of Conformity	Test Certificates
CCC	CSA	GOST	UL	EG-Konf.	Special Test Certificate

Shipping Approval					
ABS	DNV	GL	LRS	PRS	RINA

Shipping Approval	other
RMRS	Confirmation

VDE

UL/CSA ratings:

yielded mechanical performance (hp)		
• for single-phase squirrel cage motors		
• at 110/120 V / rated value	hp	0.25
• at 230 V / rated value	hp	0.75
• for three-phase squirrel cage motors		
• at 200/208 V / rated value	hp	1.5
• at 220/230 V / rated value	hp	2
• at 460/480 V / rated value	hp	3
• at 575/600 V / rated value	hp	5
Operating current (FLA) / for three-phase squirrel cage motors		
• at 480 V / rated value	A	4.8
• at 600 V / rated value	A	6.1
Contact rating designation / for auxiliary contacts / according to UL		A600 / Q600

Sicherheitsrelevante Kenngrößen:

B10 value / with high demand rate		
• according to SN 31920		1,000,000
T1 value / for proof test interval or service life		
• according to IEC 61508	a	20
Proportion of dangerous failures		
• with low demand rate / according to SN 31920	%	40
• with high demand rate / according to SN 31920	%	73

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Failure rate (FIT value) / with low demand rate		
• according to SN 31920	FIT	100
Product function		
• mirror contact to IEC 60947-4-1		Yes
• comment		with 3RH29
• positively driven operation to IEC 60947-5-1		No

Further information:

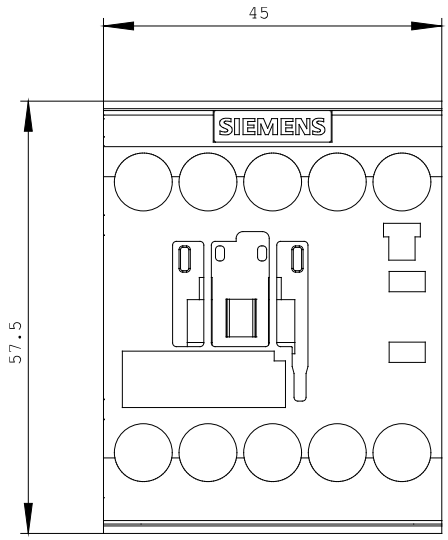
Information- and Downloadcenter (Catalogs, Brochures,…)
http://www.siemens.com/industrial-controls/catalogs

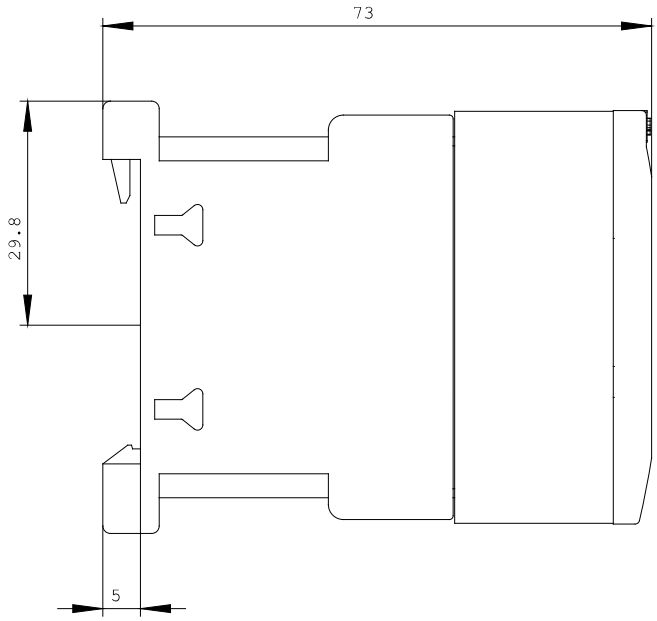
Industry Mall (Online ordering system)
http://www.siemens.com/industrial-controls/mall

Cax online generator:
http://www.siemens.com/cax

Service&Support (Manuals, Certificates, Characteristics, FAQs,...)
http://support.automation.siemens.com/WW/view/en/3RT2015-1AK61/all

Image database (product images, 2D dimension drawings, 3D models, device circuit diagrams, ...)
http://www.automation.siemens.com/bilddb/cax_en.aspx?mlfb=3RT2015-1AK61





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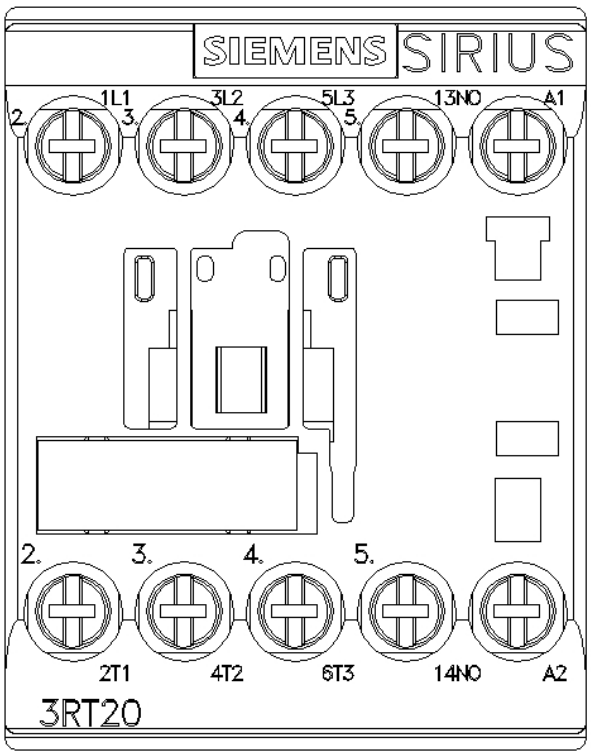

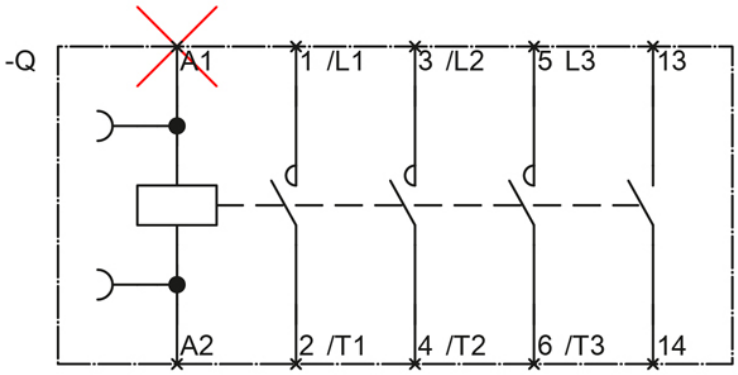

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(442) 600-2444
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DISTRIBUTION TRANSFORMER

T2535153S

TEMCo TRANSFORMER DIVISION

Acme Electric

Acme Dry Type Distribution Transformer T2535153S to T2535183S

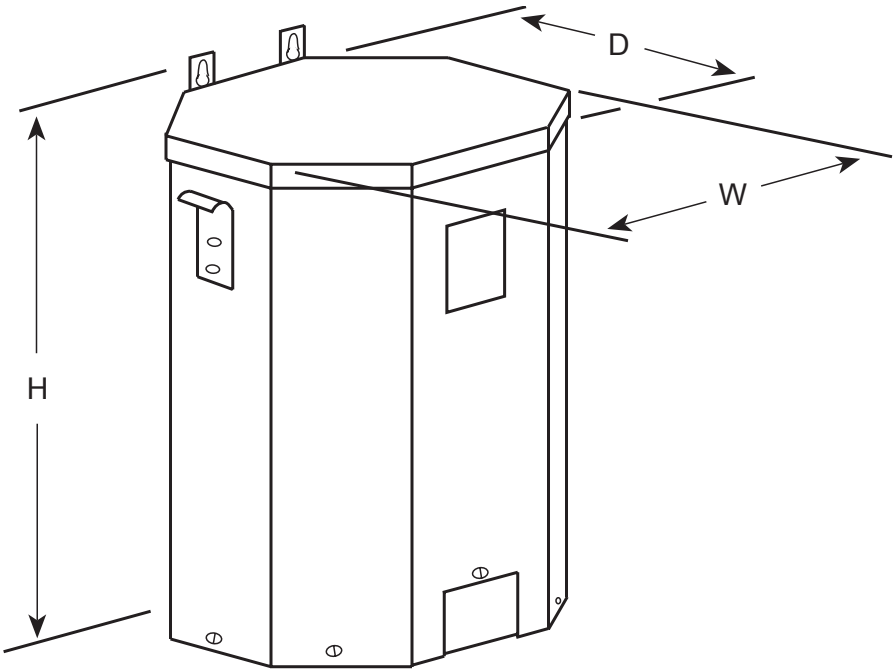
240 x 480 Primary Volts - 120/240 Secondary Volts - Four Windings

Subcategory :	Isolation
Phase :	Single
Frequency:	60 Hz
kVA:	7.5 to 25 kVA
K rating:	1
Pri. configuration:	Two winding
Sec. configuration:	Two winding
Reverse connectable:	Yes
Winding material:	Aluminum
Electrostatic shielded:	Yes
Temperature rise:	115 Deg C
Insulation system:	180 Deg C
Enclosure rating:	NEMA 3R
Enclosure material:	Steel
Construction style:	Enclosed - Encapsulated Core & Coil
Mounting type:	Wall
Connection type:	Wire Leads
Cooling:	Air/dry
Agency approvals:	UL Listed, CSA Approved, meets NEMA, ANSI and OSHA standards.
Sound level:	Below NEMA standards.
Warranty:	10 years

Corporate Headquarters: *TEMCo* – Tower Electric Motor Company 41474 Christy Street Fremont, CA 94538
Inside USA (877) 474-8209 International (510) 490-2187 Fax (510) 490-1507 www.temcoindustrialpower.com

Dimensions, Weight and Impedance may vary slightly from information provided. For certified drawings please contact a TEMCo representative.

Acme Dry Type Distribution Transformer T2535153S to T2535183S



Dimensions (in inches)

Part #	KVA	Height	Width	Depth	Weight (lbs)
T2535153S	7.5	15.19	13.5	10.84	115
T2535163S	10	15.19	13.5	10.84	125
T2535173S	15	16.94	14.12	11.59	170
T2535183S	25	18.44	16.13	13.34	250

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Dimensions, Weight and Impedance may vary slightly from information provided. For certified drawings please contact a TEMCo representative.

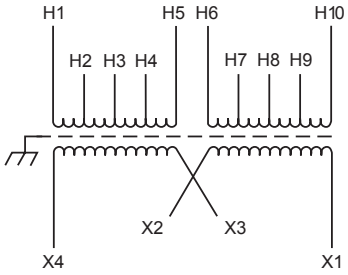
TEMCo TRANSFORMER DIVISION

Acme Electric

Acme Dry Type Distribution Transformer T2535153S to T2535183S

4

PRIMARY: 240 X 480
SECONDARY: 120/240
2, 2 ½% ANFC, 4, 2 ½% BNFC



Primary Volts	Connect Primary Lines To	Inter-Connect	Connect Secondary Lines To
216	H1-H10	H1 to H9 H10 to H2	
228	H1-H10	H1 to H8 H10 to H3	
240	H1-H10	H1 to H7 H10 to H4	
252	H1-H10	H1 to H6 H10 to H5	
432	H1-H10	H2 to H9	
444	H1-H10	H3 to H9	
456	H1-H10	H3 to H8	
468	H1-H10	H4 to H8	
480	H1-H10	H4 to H7	
492	H1-H10	H5 to H7	
504	H1-H10	H5 to H6	
Secondary Volts			
240		X2 to X3	X1-X4
120/240		X2 to X3	X1-X3-X4
120		X1 to X3 X2 to X4	X1-X4

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SILENCERS

54-105-AA*

UNIVERSAL

Acoustic & Emission Technologies

Blower Silencers

Technical Literature

Inlet Silencers

Discharge Silencers

Accessories

Universal AET retains the right to update this technical sheet without notice.
Please contact your Universal representative to verify the timelines of this technical literature sheet.

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In a closed blower discharge system, structure-borne noise—such as that radiated by pipe wall and silencer shell—may be a consideration, particularly where a stringent, close-proximity noise specification applies.

For these applications, various means are available to treat the pipe and shell radiated noise, such that most reasonable specifications may be met.

For instance, it is possible to lag the silencer shell externally and reduce any shell noise contribution to below the casing and mechanical noise of the blower and driving machinery.

Universal invites your inquiries concerning special applications where EPA, OSHA or other noise specifications apply. Special applications are handled on an individual basis and recommendations are made according to specific requirements of the installation.

General Information

Blower Silencers

Rotary Positive Blowers

The Rotary Positive Blower is a two impeller compressor that delivers a large quantity of gas or air relative to the individual pulses. Blower capacities are expressed in CFM at inlet conditions (ICFM). Blower size is usually expressed as gear diameter by rotor length. Pitch Line Velocity (PLV) is the peripheral velocity of the timing gear—equal to the product of the gear circumference and the rotative speed of the blower, usually expressed in feet per minute (FPM).

The blower presents two problems:
1) pulsation within the piping system and,
2) noise radiation in the vicinity of the blower and piping.

The importance of these relative to each other is a function of blower size and speed; both increase proportionately to the blower size and the square of the speed.

Pulsation is more pronounced on the discharge side. Peak pulse pressures are quite severe and can result in unsilenced discharge sound power levels up to 140–145 dB. The inlet, although producing less severe pulsation and noise, receives equal attention since the inlet is usually open to atmosphere and the noise much more apparent.

Silencers

There is little question that silencers are a necessity on any blower installation. Regardless of the size or speed of the blower, silencers of some type are nearly always used.

In the selection of blower silencers, there are two basic considerations: 1) the silencer must be the correct size (i.e., sufficient capacity for the volume flow) and, 2) the silencer must be the proper type for the application. The nominal silencer size need only be based on the gas volume, (i.e., the CFM of the gas or air at the operating conditions). However, the silencer (design) must be selected with consideration of the blower size and operating speed. Complete application and capacity information is given on page 3.

There are two types of silencers commonly used on positive blowers: a reactive type silencer which consists of a series of expansion chambers having interconnecting tubes, a more sophisticated silencer design. is the combination chamber-absorptive type. This combination silencer is similar to the reactive type with the exception that an acoustically-packed, sound absorbing section is included, comprising an extension of the silencer connection closest to the blower. The inlet of a discharge silencer and the outlet of an inlet silencer are the ends having the packed section.

A third basic type of silencer—the simple, straight-through packed type—is occasionally used on blowers. This type of silencer is usually used on small, high speed machines which characteristically produce significant high frequency noise and relatively mild pulsations.

The PLV is normally the criterion for silencer type selection. If the blower is operating in the critical PLV range, it will generate objectionable high frequency noise which may cause shell ring or tank hammer in the piping and silencer. These critical PLV conditions will always require a combination chamber-absorptive silencer for satisfactory results.

Inlet Silencers

For inlet service, a PLV of 3,300 ft/min or greater is considered critical. This transition speed is empirically established and is somewhat arbitrary, however, it is commonly accepted that blowers operating at or above 3,300 ft/min are considered critical for the purpose of inlet silencer application. Those operating below 3,300 ft/min are considered subcritical. Subcritical PLV applications can usually be silenced adequately with a chamber-type silencer, such as Universal URB or UCI Series. Blowers operating above the critical PLV of 3,300 ft/min will invariably require the RIS Series combination chamber-absorptive type silencer. Inlet Filters or Filter Silencers are commonly used on blower inlets, either individually or in series with a separate inlet silencer. Please reference Filters and Filter Silencers Technical Literature booklet #94-1553.

Discharge Silencers

For the more severe discharge conditions of typical blower installations, a PLV of 2,700 ft/min is accepted as the critical transition speed. Blowers operating below 2,700 ft/min are considered subcritical and can usually be adequately silenced on the discharge side by use of a chamber-type silencer UCD or URD Series. Machines operating above the 2,700 ft/min transition speed will require combination chamber-absorptive silencers such as SD or RD Series.

In some larger blower installations, piping requirements or space restrictions may preclude the use of a large, single discharge silencer such as the SD or RD Series.

Where two or more blowers discharge into a common header, individual silencers upstream of the header are required to subdue the individual blower pulsations. Otherwise, the pulsations tend to beat with each other and can be extremely objectionable.

Note: Silencers should be mounted as close to the blower as possible since any piping between the blower and silencer will radiate noise. Standard silencer connections are not designed to carry external piping or valve loads, so good piping support practices should be used to prevent stresses that cause fatigue and eventual fracture of the silencer or piping. It is also good practice to isolate the blower from the silencer with a flexible expansion joint. Contact Universal for special design considerations where loading is a factor.

Attenuation Curves

Noise attenuation curves are given for the various models within this catalog.

The curves represent insertion loss of airborne noise for typical applications under average conditions. It is not feasible to chart the expected performance of a silencer over a wide range of applications and conditions, therefore, the curves must be used with discretion. Structure-borne noise (see above) may be a consideration and will require separate analysis, since it is not airborne noise and not used for silencer performance rating.

Use our online Blower Silencer calculator at www.universalAET.com.

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General Information

Rotary Positive Blowers

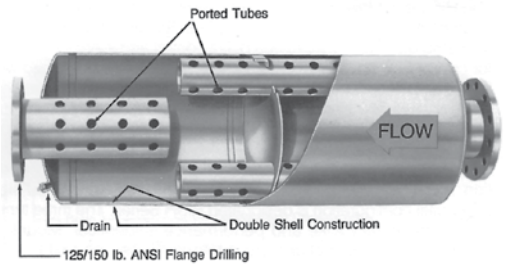
The silencers shown below are more fully described on the individual catalog pages. These units are designed specifically for use on Rotary Positive Blowers.

There are fundamental similarities between blower silencers and other types, particularly reciprocating engine silencers, which also require a silencer design that provides effective pulse control as well as noise attenuation. However, blower silencers generally must be constructed more ruggedly to withstand prolonged exposure to severe pulsations produced by the blower.

All silencers described are of standard with end in, end-out design. Low or high side inlet and outlet connections are available and are described on the individual catalog pages.

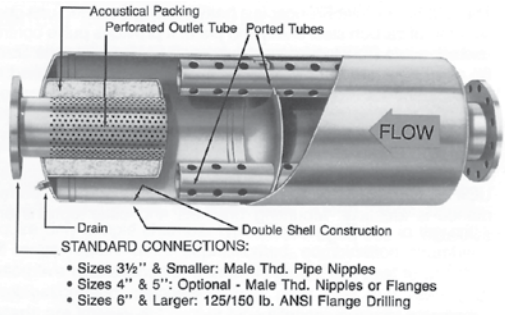
Accessories, Special Features

- Mounting Brackets
- Inspection Openings
- Pressure Vessel Construction
- Oversize Flanges
- Special Finishes
- Special Materials



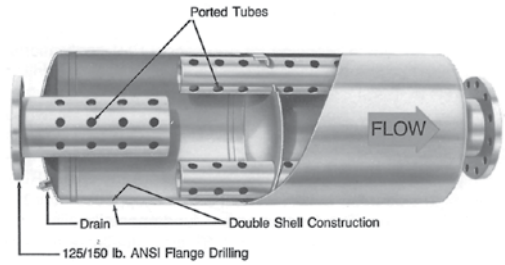
UCI Series
Inlet Silencer

Chamber-type inlet silencer for use on sub-critical PLV applications. Available in pipe sizes 8"–30". Smaller sizes use URB Series. Available with side connections and mounting brackets.



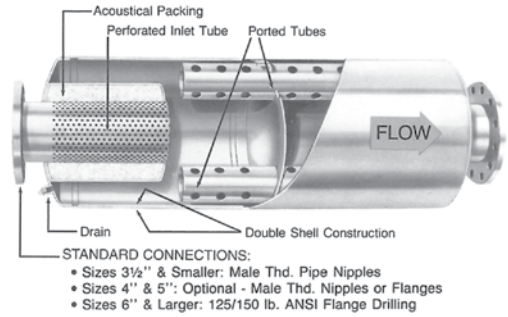
RIS Series
Inlet Silencer

Combustion chamber-absorptive type inlet silencer for critical PLV applications. Available in pipe sizes 2"–30". Low or high side outlet and mounting brackets available on most sizes.



UCD Series
URB/URD Series
Discharge Silencers

Chamber-type discharge silencer for use on sub-critical PLV applications. Available in pipe sizes 8"–30". (Smaller sizes use URB Series). Low, high, or opposed side connections and mounting brackets available.



SD Series
RD Series
Discharge Silencers

Combination chamber-absorptive type discharge silencers for critical PLV applications. Available in pipe sizes 2"–30". Low, high, or opposed side connections and mounting brackets available on most sizes.

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Application, Capacity, Pressure Drop Data

Blower Silencers

Silencer Recommendations

As mentioned on page 2 pitch line velocity (PLV) is the speed of the timing gear in feet per minute (ft/min). For purposes of silencer application. PLV is considered "critical" at 3,300 ft/min for intake and 2,700 ft/min for discharge.

Table 1 gives transition speeds in RPM. Blowers running at these speeds or greater will have critical PLV. Operating speeds below transition will be in the sub-critical range. Blowers operating in the sub-critical speed range usually require only simple chamber-type silencers while those in the critical range require combination chamber-absorptive type silencers. If there is doubt, it is best to use the combination-type silencers. When gear size and operating speeds are known, the proper type silencer is easily selected.

Silencer Size Selection, Capacity

Table 3 gives the nominal capacity of the various size silencers. "Size" in this table refers to the silencer "nominal size," or its "inlet size." Capacities are expressed in inlet CFM (ICFM), thus, discharge silencers are rated at higher capacities than inlet silencers since the air is compressed to reduced volume at the discharge operating pressure.

A From Table 1 determine whether blower RPM is above or below the transition speed for critical PLV.

B Consult Table 2 for recommended silencer models.

Pressure Drop

The following formulas may be used to calculate pressure drop through the silencers covered in this catalog.

Inlet: $$\triangle P = \left(\frac{V}{4005}\right)^2 c$$

(assumes silencer inlet is open to atmosphere)

Discharge: $$\triangle P = \left(\frac{V}{4005}\right)^2 c \times \frac{P}{14.7} \times \frac{530}{T}$$

$\triangle P$ = pressure drop through silencer, inches of water

V = air velocity through silencer, ft/min*

c = individual silencer restriction coefficient—empirical constant (see Table 4)

P = discharge pressure, PSIA (operating pressure in PSIG + 14.7)

T = discharge temperature, ˚R absolute (operating temperature in ˚F + 460)

* To calculate velocity through silencer, divide flow in ACFM by cross-sectional area of silencer inlet diameter in square feet.

1 Blower Transition Speed

Blower Gear Size	Transition Speed-RPM	
	Inlet	Discharge
2	6,300	5,155
2.5	5,040	4,125
3	4,200	3,435
4	3,150	2,575
5	2,520	2,060
6	2,100	1,720
7	1,800	1,470
8	1,575	1,290
10	1,260	1,030
12	1,050	860
14	900	735
16	785	645
18	700	570
20	630	515
22	570	470
24	525	430

2 Silencer Model Specifications

Pitch Line Velocity	Inlet Silencer	Discharge Silencer
Below Transition	UCI, URB	URB, UCD, URD
Above Transition	RIS	SD, RD

3 Silencer Capacity

Size	Capacity (Inlet CFM 14.7 PSIA at 70˚F)					
	Inlet Silencer	Discharge Silencer				
		4 PSIG	6 PSIG	8 PSIG	10 PSIG	15 PSIG
1	30	35	40	40	40	45
1.5	70	80	85	90	95	105
2	120	140	150	160	165	185
2.5	190	220	235	245	255	285
3	270	320	335	355	370	415
3.5	370	430	455	480	505	560
4	480	560	600	630	660	735
5	750	880	935	985	1,030	1,150
6	1,080	1,260	1,340	1,410	1,480	1,650
8	1,920	2,250	2,390	2,510	2,630	2,940
10	3,000	3,520	3,730	3,930	4,110	4,590
12	4,300	5,070	5,370	5,660	5,920	6,600
14	5,900	6,890	7,310	7,700	8,060	8,990
16	7,700	9,000	9,550	10,000	10,500	11,800
18	9,700	11,400	12,100	12,700	13,300	14,900
20	12,000	14,000	14,900	15,700	16,400	18,400
22	14,500	17,000	18,100	19,000	19,900	22,200
24	17,300	20,200	21,500	22,600	23,700	26,400
26	20,300	23,800	25,200	26,600	27,800	31,000
28	23,500	27,600	29,300	30,800	32,200	36,000
30	27,000	31,700	33,600	35,400	37,000	41,300
Est Temp.	70˚F	115˚F	140˚F	165˚F	190˚F	240˚F

4 Pressure Drop Coefficients

Model	Pressure Drop Coefficient *(C)*
URB, URBY	4.2
UCI, UCIY, UCIH	4.2
RIS, RISY, RISH	4.2
UCD, UCDY	4.2
URD, URDY, URDH	4.2
SD, SDY, SDH	4.2
RD, RDY, RDH	4.2
RDS, SDS, URDS	7.0

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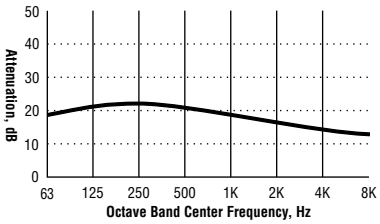
Specifications
UCI Group

Chamber Type
Inlet Silencer

Typical Attenuation Curve

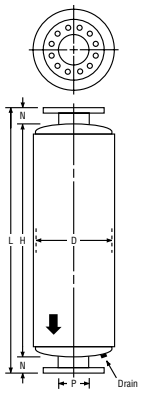


Pressure Vessel Construction

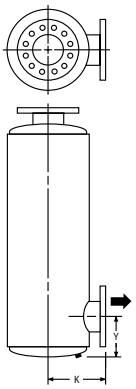
Silencers may be fabricated in accordance with Div. 1, Section VIII—ASME Code for Unfired Pressure Vessels. Dimensions are similar to standard models, but material types and thicknesses are selected to meet code requirements. Prices are quoted on application to meet your pressure and temperature conditions.

The UCI Series Inlet Silencer is a heavy-duty, all welded unit constructed of carbon steel sheet and plate. It provides pulse control and silencing for most subcritical PLV applications. Sizes 8" and larger are equipped with flanged connections drilled to 125/150 lb ANSI specifications. Exterior surfaces receive a shop coat of rust-inhibitive primer and may be finish painted in the field if desired. The UCI Series is the basic inlet model and is the conventional end-in,end-out version. The low side inlet model is designated UCIY Series and the high side inlet type is designated UCIH Series. The three types are fundamentally alike and performance is identical. Mounting brackets and other options are available—see page 11.

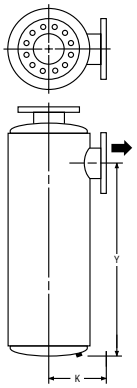
UCI Series



UCIY Series
(Low Side Outlet)



UCIH Series
(High Side Outlet)



Chamber Type Inlet Silencers

P (Size)	Part Number	D	L	N	H	K	Y UCIY Min	Y UCIY Max	Y UCIH Min	Y UCIH Max	Weight
1											
1.5											
2											
2.5											
3					***Sizes 1"–6" Use URB Series (page 7)***						
3.5											
4											
5											
6											
8	53-108-AA	22	61	3.5	54	14.5	9	21	28.5	45.5	240
10	53-110-AA	26	74	3.5	67	16.5	11	27	34.5	57	345
12	53-112-AA	30	87	3.5	80	18.5	12.5	34	41	69	575
14	53-114-AA	30	99	3.5	92	18.5	13.5	40	47.5	80.5	635
16	53-116-AA	36	113	3.5	106	21.5	15.5	48	53.5	91.5	925
18	53-118-AA	42	126	3.5	119	24.5	17.5	55.5	59.5	103.5	1,200
20	53-120-AA	42	140	4.5	131	25.5	19	60.5	67	114	1,350
22	53-122-AA	48	153	4.5	144	28.5	20.5	66.5	75	126	1,950
24	53-124-AA	54	167	4.5	158	31.5	22.5	72	83	138	2,500
26	53-126-AA	54	179	4.5	170	31.5	23.5	85	84	149	2,750
28	53-128-AA	60	193	4.5	184	34.5	25.5	87	91	161	3,445
30	53-130-AA	66	206	4.5	197	37.5	27.5	95	100	173	4,650

Note: Dimensions and weights are nominal and may vary slightly with production models.
Request certified drawings of specific models for exact dimensions.

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Pressure Vessel Construction

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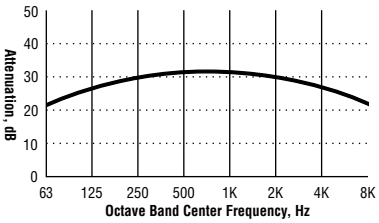
Typical Attenuation Curve



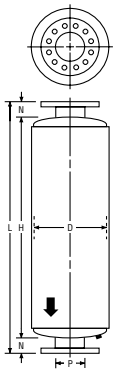
Specifications RIS Group

Combination Chamber-Absorptive Type Inlet Silencer

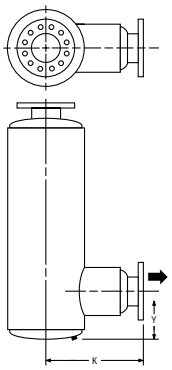
The RIS Series Inlet Silencer is a heavy-duty, all welded unit constructed of carbon steel sheet and plate. It features an acoustically-treated outlet and will provide pulse control and silencing suitable for critical PLV applications. Sizes 4" and larger are equipped with flanged connections drilled to 125/150 lb ANSI specifications. Smaller sizes are standard with male threaded pipe nipples. Units sized 4" and 5" are available in either flanged or male pipe threads. Exterior surfaces receive a shop coat of rust inhibitive primer and may be finish painted in the field if desired.

The RIS Series is the basic model, having conventional end-in, end-out configuration. A low side outlet version is designated RISY Series and high side outlet configuration is designated RISH Series. The three types are fundamentally alike and performance is identical. Mounting brackets and other options are available—see page 11.

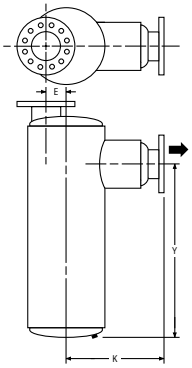
RIS Series



RISY Series
(Low Side Outlet)



RISH Series
(High Side Outlet)



Combination Chamber-Absorptive Type Inlet Silencers

P (Size)	Part Number	D	L	N	H	K		E	Y				Weight
						RISY	RISH		RISY		RISH		
									Min	Max	Min	Max	
1	*Sizes 1"–1.5" use U5 Series (Absorptive Silencers Technical Literature booklet #94-1549 page 2)*												
1.5													
2	54-102-AA	8	28.5	3	22.5	8.5	—	—	FIXED AT 6				25
2.5	54-125-AA	8	33	3	27	9	—	—	FIXED AT 7		2.5" THRU 3.5"		25
3	54-103-AA	8	39	3	33	10	—	—	FIXED AT 7		AVAILABLE ON		30
3.5	54-135-AA	10	39.5	3	33.5	11	—	—	FIXED AT 8		SPECIAL ORDER		40
4	54-104-AA*	10	45	3	39	12.5	14.5	2.25	7.5	16.5	30.5	32.5	50
5	54-105-AA*	12	57.5	3	51.5	15.5	17.5	2.75	9	23	40	43.5	80
6	54-106-AA	14	64	3	58	17	20	3.25	9	25.5	43.5	49	110
8	54-108-AA	18	72	3.5	65	21.5	26.5	4	12	30.5	49.5	54	190
10	54-110-AA	22	85	3.5	78	25.5	32.5	5	13.5	37	61.5	65.5	380
12	54-112-AA	26	98	3.5	91	29.5	38	6	15	44	69	77	550
14	54-114-AA	30	111	3.5	104	30	40	7.5	16.5	50	81	89.5	800
16	54-116-AA	36	113	3.5	106	35.5	49.5	0	18.5	51	56.5	88.5	1,050
18	54-118-AA	42	126	3.5	119	41	57.5	0	20.5	58.5	62.5	100.5	1,350
20	54-120-AA	42	140	4.5	131	47	62.5	0	22	63.5	70	111	1,500
22	54-122-AA	48	153	4.5	144	46.5	65.5	0	23.5	69.5	78	123	2,100
24	54-124-AA	54	167	4.5	158	54	75.5	0	25.5	75	86	135	2,700
26	54-126-AA	54	179	4.5	170	55.5	76	0	25.5	87	86	147	3,050
28	54-128-AA	60	193	4.5	184	61	84.5	0	29.5	91	95	157	3,850
30	54-130-AA	66	206	4.5	197	66.5	93.5	0	30.5	98	103	170	5,150

Note: Dimensions and weights are nominal and may vary slightly with production models.
Request certified drawings of specific models for exact dimensions.

*Specify -TT for male pipe threaded units.

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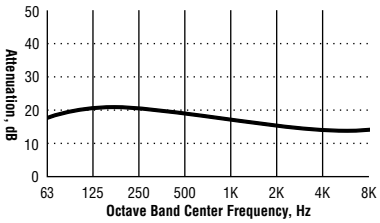
Specifications
UCD Group

Chamber Type
Discharge Silencer

Typical Attenuation Curve

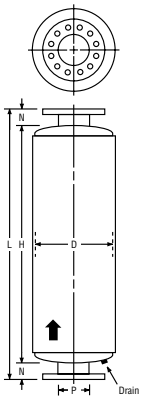


Pressure Vessel Construction

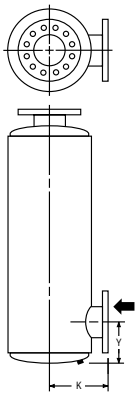
Silencers may be fabricated in accordance with Div. 1, Section VIII—ASME Code for Unfired Pressure Vessels. Dimensions are similar to standard models, but material types and thicknesses are selected to meet code requirements. Prices are quoted on application to meet your pressure and temperature conditions.

The UCD Series Discharge Silencer is a heavy-duty, all welded unit constructed of carbon steel sheet and plate. It provides pulse control and silencing for subcritical PLV applications where the higher performance of the URD Series on page 7 is not warranted. Sizes 8" and larger are equipped with flanged connections drilled to 125/150 lb ANSI specifications. Exterior surfaces receive a shop coat of rust-inhibitive primer and may be finish painted in the field if desired. The UCD Series is the basic end-in, end-out configuration. A low side inlet version is designated UCDY Series. The two types are fundamentally alike and performance characteristics are identical. Mounting brackets and other options are available—see page 11.

UCD Series



UCDY Series
(Low Side Inlet)



Chamber Type Discharge Silencers

P (Size)	Part Number	D	L	N	H	K	Y Min	Y Max	Weight
1									
1.5									
2									
2.5									
3				***Sizes 1"–6" use URB Series (page 7)***					
3.5									
4									
5									
6									
8	56-108-AA	22	61	3.5	54	14.5	9	21	240
10	56-110-AA	26	74	3.5	67	16.5	11	27	340
12	56-112-AA	30	87	3.5	80	18.5	12.5	34	520
14	56-114-AA	30	99	3.5	92	18.5	13.5	40	595
16	56-116-AA	36	113	3.5	106	21.5	15.5	48	950
18	56-118-AA	42	126	3.5	119	24.5	17.5	55.5	1,200
20	56-120-AA	42	140	4.5	131	25.5	19	60.5	1,350
22	56-122-AA	48	153	4.5	144	28.5	20.5	66.5	1,950
24	56-124-AA	54	167	4.5	158	31.5	22.5	72	2,450
26	56-126-AA	54	179	4.5	170	31.5	23.5	85	2,750
28	56-128-AA	60	193	4.5	184	34.5	25.5	87	3,445
30	56-130-AA	66	206	4.5	197	37.5	27.5	95	4,650

Note: Dimensions and weights are nominal and may vary slightly with production models. Request certified drawings of specific models for exact dimensions.

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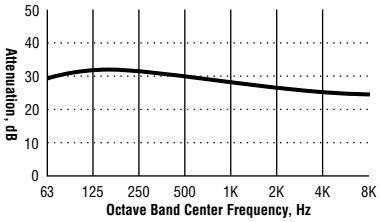
Pressure Vessel Construction

Silencers may be fabricated in accordance with Div. 1, Section VIII—ASME Code for Unfired Pressure Vessels. Dimensions are similar to standard models, but material types and thicknesses are selected to meet code requirements. Prices are quoted on application to meet your pressure and temperature conditions.

Note: Sizes 1"–6" are URB Series; sizes 8"–30" are URD Series. Both series are fundamentally the same in design and the performance characteristics are identical.

Typical Attenuation Curve

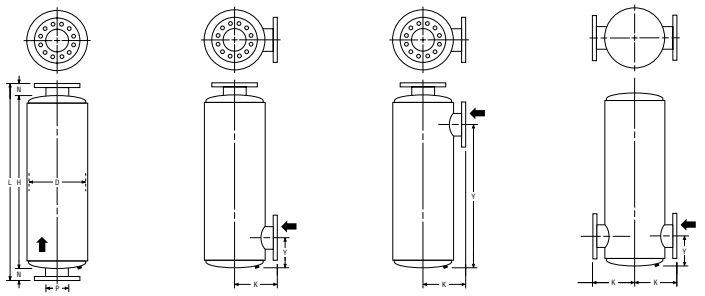


Specifications
URB Group
URD Group

Chamber Type Discharge Silencer

The URB/URD Series Discharge Silencer is a heavy-duty, all welded unit constructed of carbon steel sheet and plate. It provides pulse control and silencing for subcritical PLV applications. Sizes 4" and larger are equipped with flanged connections drilled to 125/150 lb ANSI specifications. Smaller sizes are standard with male threaded pipe nipples. Units sized 4" and 5" are available in either flanged or male pipe threads. Exterior surfaces receive a shop coat of rust-inhibitive primer and may be finish painted in the field if desired. The URB/URD Series is the basic end-in, end-out configuration. A low side inlet version is designated URBY/URDY Series; high side inlet is designated URDH Series; and low opposed connection is designated URDS Series. The four types are fundamentally alike and performance characteristics are identical. Mounting brackets and other options are available—see page 11.

URB, URD Series | **URBY, URDY Series** (Low Side Inlet) | **URDH Series** (High Side Inlet) | **URDS Series** (Opposed Connections)



Chamber Type Discharge Silencers

P (Size)	Part Number	D	L	N	H	K	Y URBY, URDY Min	Y URBY, URDY Max	Y URDH Min	Y URDH Max	Y URDS Min	Y URDS Max	Weight
1	55-101-AA	4.5	21	2	17	—	—	—	—	—	—	—	10
1.5	55-115-AA	6.5	24	2	20	—	—	—	—	—	—	—	15
2	55-102-AA	8	33	3	27	7	FIXED AT 6		—	—	—	—	25
2.5	55-125-AA	10	34	3	28	8	FIXED AT 7		—	—	—	—	30
3	55-103-AA	10	46	3	40	8	FIXED AT 7		—	—	—	—	40
3.5	55-135-AA	12	52	3	46	9	FIXED AT 8		—	—	—	—	65
4	55-104-AA*	14	53	3	47	10	6	22	—	—	8	16	75
5	55-105-AA*	16	65	3	59	11	6.5	29	28	52	9	19	115
6	55-106-AA	18	72	3	66	12	8	32	31	59	10	22	150
8	55-108-AA	22	97	3.5	90	14.5	9	48	62	82	12	29	355
10	55-110-AA	26	122	3.5	115	16.5	11	63.5	76.5	106	14	40.5	545
12	55-112-AA	30	135	3.5	128	18.5	12.5	69	88	117.5	15.5	42	775
14	55-114-AA	36	161	3.5	154	21.5	14.5	81	107	141	17.5	49	1,240
16	55-116-AA	42	181	3.5	174	24.5	16.5	92.5	119.5	158.5	19.5	55.5	1,600
18	55-118-AA	48	188	3.5	181	27.5	18.5	98	126.5	164.5	21.5	56.5	2,300
20	55-120-AA	48	202	4.5	193	28.5	19.5	103	134	175.5	22.5	61	2,500
22	55-122-AA	54	204	4.5	195	31.5	21.5	103	137	175.5	24.5	60	2,950
24	55-124-AA	54	239	4.5	230	31.5	22.5	126	156.5	210.5	25.5	76.5	3,450
26	55-126-AA	60	259	4.5	250	34.5	25	132	175	228	27	78	4,400
28	55-128-AA	66	279	4.5	270	37.5	27	144	188	246	31	85	6,150
30	55-130-AA	72	304	4.5	295	40.5	29	161	203	272	32	96	7,250

Note: Dimensions and weights are nominal and may vary slightly with production models. Request certified drawings of specific models for exact dimensions.

*Specify -TT for male pipe threaded units.

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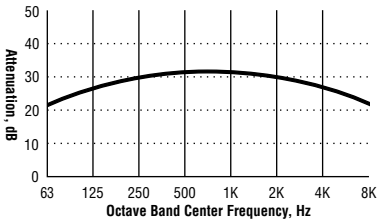
Specifications
SD Group

Combination Chamber-Absorptive Type Discharge Silencer

Typical Attenuation Curve



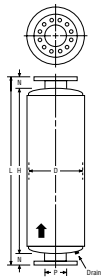
Pressure Vessel Construction

Silencers may be fabricated in accordance with Div. 1, Section VIII—ASME Code for Unfired Pressure Vessels. Dimensions are similar to standard models, but material types and thicknesses are selected to meet code requirements. Prices are quoted on application to meet your pressure and temperature conditions.

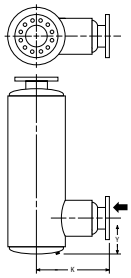
Acoustical packing is suitable for 325˚F

The SD Series Discharge Silencer is a heavy-duty, all welded unit constructed of carbon steel sheet and plate. It will provide excellent pulse control and is equipped with an acoustically-treated inlet for use on critical PLV applications. Its pulse and noise performance is recommended for all but the most demanding applications, which may require the RD Series on page 9. Sizes 4" and larger are equipped with flanged connections drilled to 125/150 lb ANSI specifications. Smaller sizes are standard with male threaded pipe nipples. Units sized 4" and 5" are available in either flanged or male pipe threads. Exterior surfaces receive a shop coat of rust-inhibitive primer and may be finish painted in the field if desired. The SD Series is the basic end-in, end-out configuration. A low side inlet is designated the SDY Series; high side inlet, SDH Series; and low opposed connection, SDS Series. The four types are fundamentally alike and performance characteristics are identical. Mounting brackets and other options are available—see page 11.

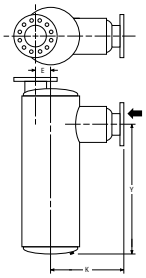
SD Series



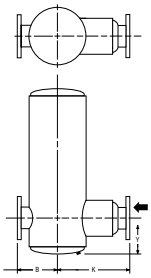
SDY Series
(Low Side Inlet)



SDH Series
(High Side Inlet)



SDS Series
(Opposed Connection)



Combination Chamber-Absorptive Type Discharge Silencers

P (Size)	Part Number	D	L	N	H	K			B	E	Y						Weight
						SDY	SDH	SDS			SDY		SDS		SDH		
											Min	Max	Min	Max	Min	Max	
1	*Sizes 1" and 1.5" use URB Series (page 7)*																
1.5																	
2	54-102-AA	8	28.5	3	22.5	8.5	—	—	—	—	—	—	—	—	—	—	20
2.5	54-125-AA	8	33	3	27	9	—	—	—	—	—	—	—	—	—	—	25
3	54-103-AA	8	39	3	33	10	—	—	—	—	—	—	—	—	—	—	30
3.5	54-135-AA	10	39.5	3	33.5	11	—	—	—	—	—	—	—	—	—	—	40
4	54-104-AA*	10	45	3	39	12.5	14.5	14.5	8	2.25	7.5	16.5	7.5	9.5	30.5	32.5	50
5	54-105-AA*	12	57.5	3	51.5	15.5	17.5	17.5	9	2.75	9	23	9	12.5	40	43.5	80
6	54-106-AA	14	64	3	58	17	20	20	10	3.25	9	25.5	10	15.5	43.5	49	115
8	54-108-AA	18	72	3.5	65	21.5	26.5	26.5	12.5	4	12	30.5	12	16.5	49.5	54	185
10	54-110-AA	22	85	3.5	78	25.5	32.5	32.5	14.5	5	13.5	37	13.5	18	61.5	65.5	405
12	54-112-AA	26	98	3.5	91	29.5	38	38	16.5	6	15	44	15	24	69	77	535
14	54-114-AA	30	111	3.5	104	30	40	40	18.5	7.5	16.5	50	16.5	25	81	89.5	820
16	58-116-AA	36	137	3.5	130	35.5	47	47	21.5	9.5	18.5	65	18.5	36	96	113.5	1,265
18	58-118-AA	42	150	3.5	143	41	52	52	24.5	11.5	20.5	70.5	20.5	40.5	104.5	124.5	1,640
20	58-120-AA	42	176	4.5	167	47	62	62	25.5	10.5	21.5	87.5	21.5	48.5	120.5	147.5	1,900
22	58-122-AA	48	195	4.5	186	47	61	61	28.5	12.5	23.5	93.5	23.5	50.5	138.5	165.5	2,710
24	58-124-AA	48	213	4.5	204	55.5	72	72	28.5	11.5	24.5	110.5	24.5	60.5	146.5	182.5	3,030
26	58-126-AA	54	233	4.5	224	55	76	76	31.5	13.5	26	117	26	70	157.5	201.5	3,915
28	58-128-AA	54	250	4.5	241	62	81	81	31.5	12.5	28.5	126.5	28.5	71.5	173.5	216.5	4,400
30	58-130-AA	60	276	4.5	267	68	90	90	34.5	14.5	29.5	139	29.5	81	190	241.5	5,425

Note: Dimensions and weights are nominal and may vary slightly with production models. Request certified drawings of specific models for exact dimensions.

*Specify -TT for male pipe threaded units.

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Pressure Vessel Construction

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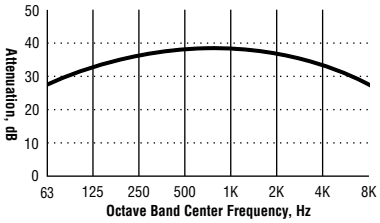
Acoustical packing is suitable for 325°F

Typical Attenuation Curve

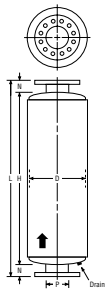


Specifications RD Group

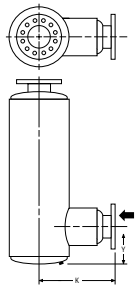
Combination Chamber-Absorptive Type Discharge Silencer

The RD Series Discharge Silencer is a heavy-duty, all welded unit constructed of carbon steel sheet and plate. It provides excellent pulse control and is equipped with an acoustically treated inlet for use on critical PLV applications. Pulse control and noise attenuation provided by the RD Series is the ultimate and is necessary for only the most demanding installations. Sizes 4" and larger are equipped with flanged connections drilled to 125/150 lb ANSI specifications. Smaller sizes are standard with male threaded pipe nipples. Units sized 4" and 5" are available in either flanged or male pipe threads. Exterior surfaces receive a shop coat of rust inhibitive primer and may be finish painted in the field if desired. The RD Series is the basic end-in, end-out configuration. A low side inlet is designated the RDY Series; high side inlet, RDH Series; and low opposed connections, RDS Series. The four types are fundamentally alike and performance is identical. Mounting brackets and other options are available—see page 11.

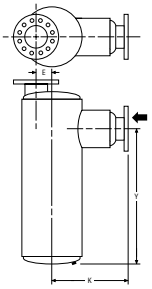
RD Series



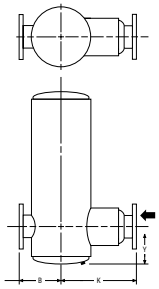
RDY Series
(Low Side Inlet)



RDH Series
(High Side Inlet)



RDS Series
(Opposed Connection)



Combination Chamber-Absorptive Type Discharge Silencers

P (Size)	Part Number	D	L	N	H	K			B	E	Y						Weight
						RDY	RDH	RDS			RDY Min	RDY Max	RDS Min	RDS Max	RDH Min	RDH Max	
1	*Sizes 1"–1.5" use URB Series (page 7) or use U5 Series: (Absorptive Silencers Technical Literature booklet #94-1549 page 2)*																
1.5																	
2	57-102-AA	8	33	3	27	9	—	—	—	—	FIXED AT 6		—	—	—	—	25
2.5	57-125-AA	10	34	3	28	10	—	—	—	—	FIXED AT 7		—	—	—	—	30
3	57-103-AA	10	43	3	40	10	—	—	—	—	FIXED AT 7		—	—	—	—	40
3.5	57-135-AA	12	52	3	46	11	—	—	—	—	FIXED AT 8		—	—	—	—	75
4	57-104-AA*	14	53	3	47	14.5	16	14.5	10	4	8	20	8	14	33	39	80
5	57-105-AA*	16	65	3	59	16.5	18	16.5	11	4.5	9	26.5	9	16.5	43.5	51	155
6	57-106-AA	18	72	3	66	20.5	22.5	20.5	12	5	10	30	10	20	46	56	200
8	57-108-AA	22	97	3.5	90	24.5	28.5	26	14.5	6	12	45	12	26	65	79	430
10	57-110-AA	26	122	3.5	115	28.5	34	32	16.5	7	14	60.5	14	37.5	79.5	103	600
12	57-112-AA	30	135	3.5	128	35	42	39.5	18.5	8	15.5	66	15.5	39	91	114.5	880
14	57-114-AA	36	161	3.5	154	40.5	47.5	45.5	21.5	10.5	17.5	78	17.5	46	110	138	1,410
16	57-116-AA	42	181	3.5	174	44.5	52.5	50	24.5	12.5	19.5	89.5	19.5	52.5	122.5	155.5	1,825
18	57-118-AA	48	188	3.5	181	47	54	52.5	27.5	14.5	21.5	95	21.5	53.5	129.5	161.5	2,550
20	57-120-AA	48	202	4.5	193	53.5	65	63.5	28.5	13.5	22.5	100	22.5	58	137	172.5	2,795
22	57-122-AA	54	204	4.5	195	59.5	72	70	31.5	15.5	24.5	100	24.5	57	140	172.5	3,300
24	57-124-AA	54	239	4.5	230	66	81.5	79.5	31.5	14.5	25.5	123	25.5	73.5	159.5	207.5	3,885
26	57-126-AA	60	259	4.5	250	72	87	85	34.5	16.5	27	130	27	76	177	226	5,025
28	57-128-AA	66	279	4.5	270	78	93.5	91	37.5	18.5	31	140	31	81	192	242	7,030
30	57-130-AA	72	304	4.5	295	78	95.5	94	40.5	20.5	32	158	32	93	205	266	8,140

Note: Dimensions and weights are nominal and may vary slightly with production models. Request certified drawings of specific models for exact dimensions.

*Specify -TT for male pipe threaded units.

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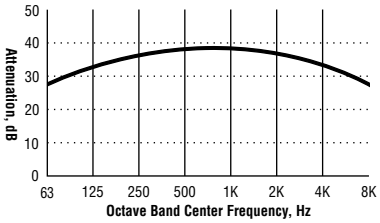
Specifications
SURS Group

Chamber Type Multi-Use Silencer

Typical Attenuation Curve



Pressure Vessel Construction

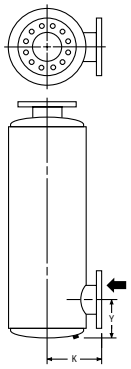
Silencers may be fabricated in accordance with Div. 1, Section VIII—ASME Code for Unfired Pressure Vessels. Dimensions are similar to standard models, but material types and thicknesses are selected to meet code requirements. Prices are quoted on application to meet your pressure and temperature conditions.

SURS Series blower silencers are heavy-duty, all welded steel construction, suitable for application as either and inlet or discharge silencer on rotary positive. These units are designed for blowers running above critical transition speed, and therefore, no acoustic packing material is included in the design. Instead, these units have a specially designed, high-performance, three chamber system which incorporates a diffuser on the blower side of the silencer units. The unit will provide excellent pulse control and is designed for the most demanding applications.

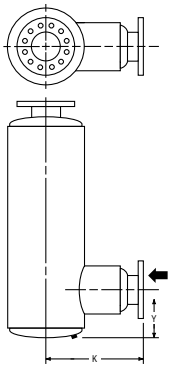
Sizes smaller than four inches are equipped with standard male threaded pipe nipples, while the 4" and larger units have flanged connections drilled to 125/150 lb ANSI specifications. The SURS Series employs a high-heat aluminum paint system.

The SURS is a basic end-in, end-out configuration. A low-side inlet model is designated as the SURSY Series; the SURSY is fundamentally identical to the SURS series in both dimension and attenuation performance. Both series are designed to operate at pressures to 15 psi. Mounting brackets, shell lagging and other accessories are available for both series of blower silencers.

SURS Series



SURSY Series
(Low Side Inlet)



Combination Chamber Type Multi-Use Discharge Silencers

SURS		SURSY		P	D	L	N	H	Y			
Model	Part	Model	Part						K	Min.	Max	Weight
SURS-2	55-A02-SS	SURSY-2	55-B02-SS	2	12	40	3	34	9	4.5	13	55
SURS-2.5	55-A25-SS	SURSY-2.5	55-B25-SS	2.5	12	40	3	34	9	4.5	13	55
SURS-3	55-A03-SS	SURSY-3	55-B03-SS	3	12	46	3	40	9	5	15	65
SURS-3.5	55-A35-SS	SURSY-3.5	55-B35-SS	3.5	14	59	3	53	10	5.5	20	90
SURS-4	55-A04-SS*	SURSY-4	55-B04-SS*	4	14*	59	3	53	10	6	20	100
SURS-5	55-A05-SS*	SURSY-5	55-B05-SS*	5	16*	71	3	65	11	7	25	165
SURS-6	55-A06-SS	SURSY-6	55-B06-SS	6	18	72	3	66	12	8	25	195
SURS-8	55-A08-SS	SURSY-8	55-B08-SS	8	26	111	3.5	104	16.5	10	41	575
SURS-10	55-A10-SS	SURSY-10	55-B10-SS	10	30	136	3.5	129	18.5	12	51	800
SURS-12	55-A12-SS	SURSY-12	55-B12-SS	12	36	138	3.5	131	21.5	14	50	1,275
SURS-14	55-A14-SS	SURSY-14	55-B14-SS	14	36	168	3.5	161	21.5	16	63	1,380
SURS-16	55-A16-SS	SURSY-16	55-B16-SS	16	42	181	3.5	174	24.5	18	51	1,815
SURS-18	55-A18-SS	SURSY-18	55-B18-SS	18	48	188	3.5	181	27.5	20	48	2,520
SURS-20	55-A20-SS	SURSY-20	55-B20-SS	20	48	214	4.5	205	28.5	22	56	2,880

*Specify -TT for male pipe threaded units.

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CBF/CBFI Series

Compact Blower
Inlet Filter-Silencer

Pressure Vessel Construction

Silencers may be fabricated in accordance with Div. 1, Section VIII—ASME Code for Unfired Pressure Vessels. Dimensions are similar to standard models, but material types and thicknesses are selected to meet code requirements. Prices are quoted on application to meet your pressure and temperature conditions.

Filter and silencer combined in one unit.
The CBF and CBFI have the acoustic capabilities of the Universal Silencer RIS Series silencers and the filtration performance of CC series filters.

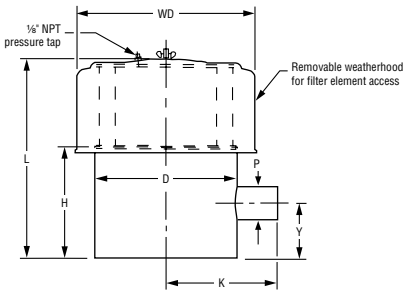
Reduced cost, overall package size, weight, storage space, freight cost and damage.

Approximately one third the size of conventional blower silencer, with the added benefit of excellent, high-efficiency filtration.

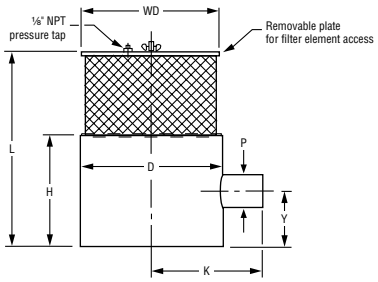
Reduced overall package noise without further acoustic treatment.

Versatile—Suitable for inlet applications in confined areas, outdoor or indoor, without compromising acoustic or pressure drop performance.

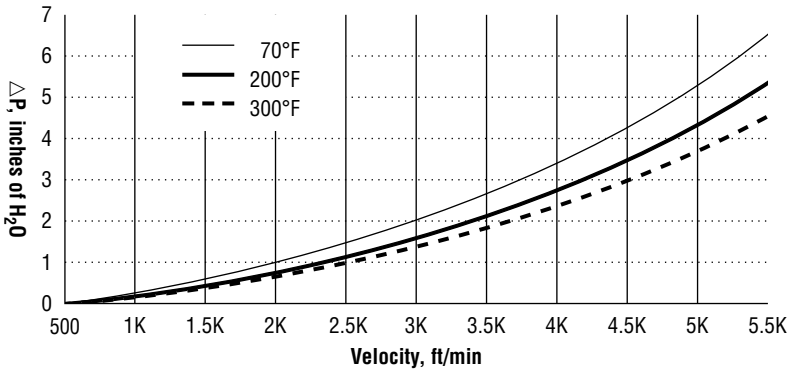
CBF Series (outdoor use)



CBFI Series (indoor use)



Pressure Drop Curves



P (nom.)	Element Part Number		
	Paper	Felt	Wire
2	81-0471*	81-1203*	81-1036*
2.5	81-0471*	81-1203*	81-1036*
3	81-1063	81-1205	81-1038
4	81-1063	81-1205	81-1038
5	81-0475	81-1207	81-1040
6	81-0475	81-1207	81-1040
8	81-1163	81-1209	81-1200
10	81-1163	81-1209	81-1200
12	81-1164	81-1210	81-1201

*Pair of elements required (stacked).

Models, Dimensions, Weights and Elements

CBF/CBFI						CBF				CBFI			
P (nom.)	D	H	Y	K	CFM CAP	Part	WD	L	Weight	Part	WD	L_1	Weight
2	8	8	4	7	120	34-702-AA	10	13.25	25	34-G02-AA	6.5	13	20
2.5	8	9.5	4.75	7	175	34-725-AA	10	14.75	25	34-G25-AA	6.5	14.5	25
3	12	10.5	5.25	9	275	34-703-AA	16	17	50	34-G03-AA	10.5	16.5	40
4	12	15	7.5	9	500	34-704-AA	16	21.25	60	34-G04-AA	10.5	20.875	55
5	16	17	8.5	11	750	34-705-AA	20	26	85	34-G05-AA	14	25.625	85
6	16	23	11.5	11	1,100	34-706-AA	20	32	105	34-G06-AA	14	31.625	100
8	24	27.5	13.75	15.5	2,200	34-708-AA	30	39	215	34-G08-AA	17	37.5	195
10	30	35.5	17.75	18.5	3,000	34-710-AA	36	46.44	335	34-G10-AA	17	45.375	305
12	34	39.5	19.75	20.5	4,300	34-712-AA	40	54.5	430	34-G12-AA	24	53.75	370

Notes: 1. Non-ASME Code construction suitable for 15" Hg vacuum.
2. Weights are approximate and do no include the weight of the filter element.

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Pressure Vessel Construction

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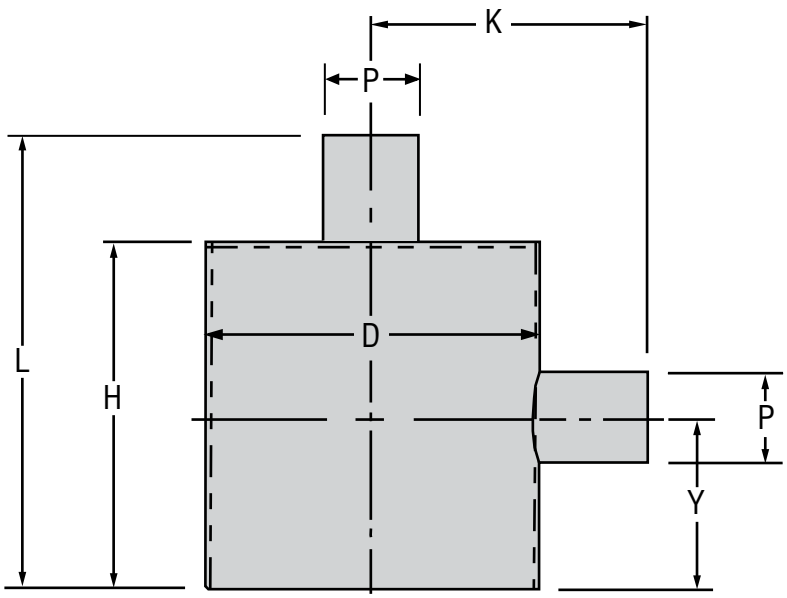
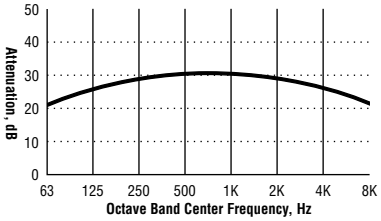
CB Series

Compact Blower Silencer

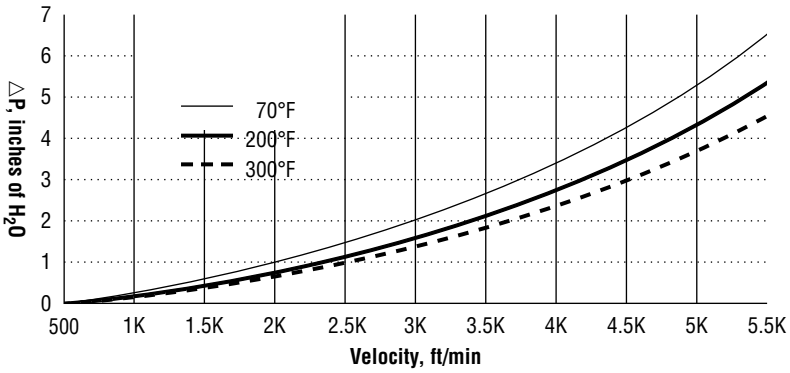


This extremely compact blower silencer works as either an inlet or discharge silencer on rotary positive blowers. It is about one-third the size of a standard silencer, and reduces overall package size, cost, weight and storage space. The unit's internal pack material is suitable for temperatures up to 325 degrees. The unit is operable in conditions up to 15 psig. Flanged or threaded connections are available. Exterior surfaces receive a shop coat of rust inhibitive primer.

Typical Attenuation Curve



Pressure Drop Curves



Compact Blower Silencers

Model	Part Number	P (nom.)	D	L	H	Y	K	Weight	CFM CAP
CB-2	56-702-AA	2	8	11	8	4	7	15	120
CB-2.5	56-725-AA	2.5	8	12.5	9.5	4.75	7	20	187
CB-3	56-703-AA	3	12	13.5	10.5	5.25	9	40	270
CB-4	56-704-AA	4	12	18	15	7.5	9	50	480
CB-5	56-705-AA	5	16	20	17	8.5	11	75	750
CB-6	56-706-AA	6	16	26	23	11.5	11	105	1,080
CB-8	56-708-AA	8	24	31	27.5	13.75	15.5	250	1,920
CB-10	56-710-AA	10	30	39	35.5	17.75	18.5	440	3,000
CB-12	56-712-AA	12	34	43	39.5	19.75	20.5	510	4,320

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UNI-BASE Ultra-Wide Base Plates/Components

Rotary Positive Blowers

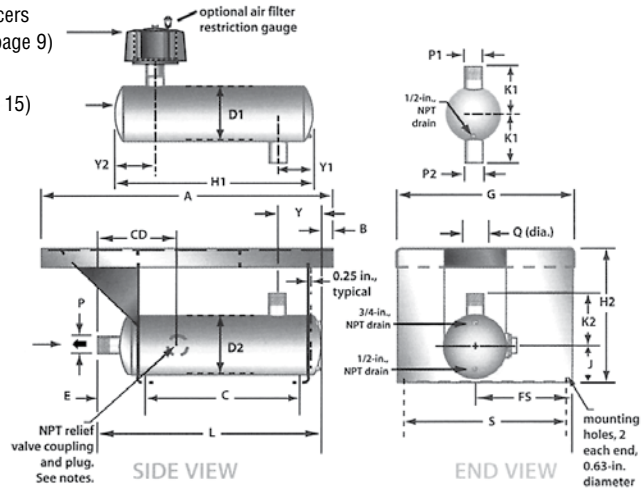
These wide base plate products accommodate a variety of blower package designs. The UNI-BASE package and the USI-BASE base plate use the same basic base plate and discharge silencer. The UNI-BASE package includes the Universal Silencer model URBN high-side inlet silencer and CCF inlet air filter, while the UNI-BASE base plate is only the basic plate and the URBY discharge silencer. Please see page 2 for performance and sizing information for the URBY series silencers, page 2 for information on the URBN series silencers, and page 9 in Filters and Filter-Silencers (#94-1553) for performance data, weights and dimensions of CCF filters.

UNI-BASE Package

CCF (see Filter and Filter-Silencers Technical Literature #94-1553 page 9)

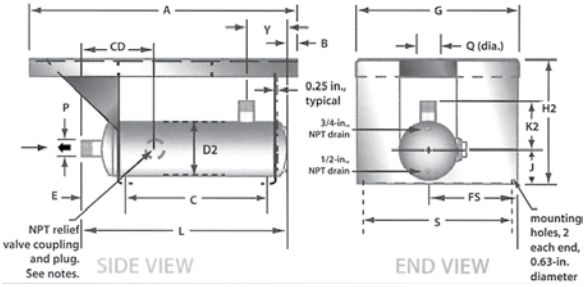
URBN (see page 15)

URBY (see page 7)



UNI-BASE Base Plate Only

URBY (see page 7)



UNI-BASE Base Plates/Components Part Numbers

Size	UNI-BASE Package	Base Plate Only	URBN Only	URBY Only	CCF Only
2	80-1873	55-202-ABP	55-502-AA	55-202-AA	34-L02-TT*
2.5	80-1874	55-225-ABP	55-525-AA	55-225-AA	34-L25-TT*
3	80-1875	55-203-ABP	55-503-AA	55-203-AA	34-L03-TT*
4	80-1876	55-204-ABP	55-504-AA	55-204-AA	34-L04-TT*
5	80-1877	55-205-ABP	55-505-AA	55-205-AA	34-L05-TT*
6	80-1878	55-206-ABP	55-506-AA	55-206-AA	34-L06-TT*

*Specify "P" at end of part number for unit with pleated paper elements, "F" for pleated felt or "W" for wire mesh.
Refer to Filter and Filter-Silencers Technical Literature booklet #94-1553 for filter element details.

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Dimensions and Weights

UNI-BASE Base Plate (w/URBY)

P (nom.)	A	B	C	CD	D2	E	FS	G	H2	J	K2	L	Q (Dia.)	S	Y	Approx. Weight
2	39	1.5	20.75	10.75	8	6.5	13	23.5	16	5	7	30	3.5	21	6	125
2.5	44.5	1.5	20.88	11.375	10	6.75	14.25	27.5	17	6	8	31	4	25	7	160
3	55.5	4	31.5	12	10	7.5	15.25	29.75	17	6	8	43	4.75	26.25	7	250
4	56	—	37.5	15.5	14	8	16.5	33	24.5	8	10	50	6	29.75	11	335
5	66	—	43.5	18.25	16	13.75	14.75	35	23.5	9	11	62.5	11	30.5	12	460
6	66	—	52	18.25	18	10.5	15.25	35.25	26.5	10.25	12	69	12	30.5	12	600

Notes: 1. Sizes 2"–3" URBY discharge silencers are shipped standard with male pipe threaded connections. 4" and 5" URBY discharge silencers are shipped standard with male pipe threaded discharge connections and plain pipe blower connections. 6" URBY discharge silencers are shipped standard with flanged discharge connection drilled to 125/150 lb. ANSI specifications and plain pipe blower connections.
2. Sizes 2"–3" URBY discharge silencers have a 2" NPT relief valve coupling and plug. Sizes 4"–6" URBY discharge silencers have a 3" NPT relief valve coupling and plug.

URBN Silencers

P1/P2 (nom.)	D1	H1	K1	Y1	Y2	Approx. Weight
2	8	27	7	6	3.5	25
2.5	10	28	8	7	4.5	35
3	10	40	8	7	4.5	50
4	14	47	10	6	5.5	80
5	16	60	11	6.5	6.5	140
6	18	66	12	8	7.5	170

Notes: 1. Sizes 2"–4" URBN inlet silencers are shipped with male pipe threaded inlets and plain pipe outlets. Sizes 5" and 6" URBN inlet silencers are shipped standard with flanged inlet connections drilled to 125/150 lb ANSI specifications and plain pipe outlets.

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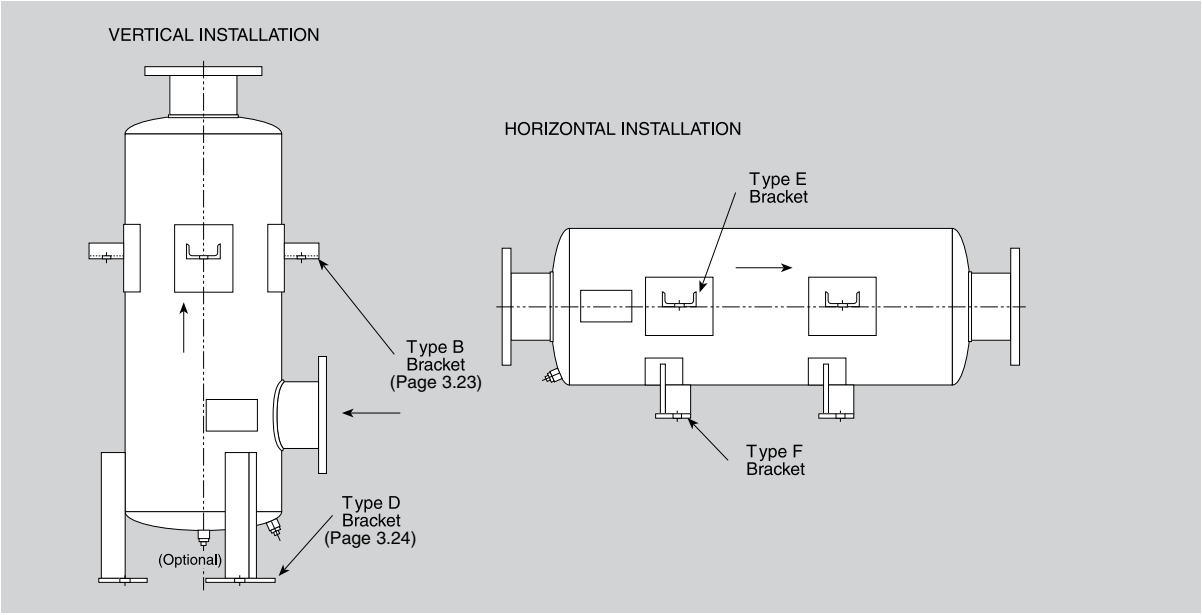
- All dimensions are in inches unless otherwise stated. All weights are in lbs and are approximate.

Weld-On Attachment Brackets

Universal provides several options for attaching the silencer to a structure or floor. Vertical silencer installations have a Type B or D attachment option. Horizontal silencer installations have a Type E or Type F attachment option. Please indicate attachment option on order. The brackets and legs will be factory installed so no field welding is required.



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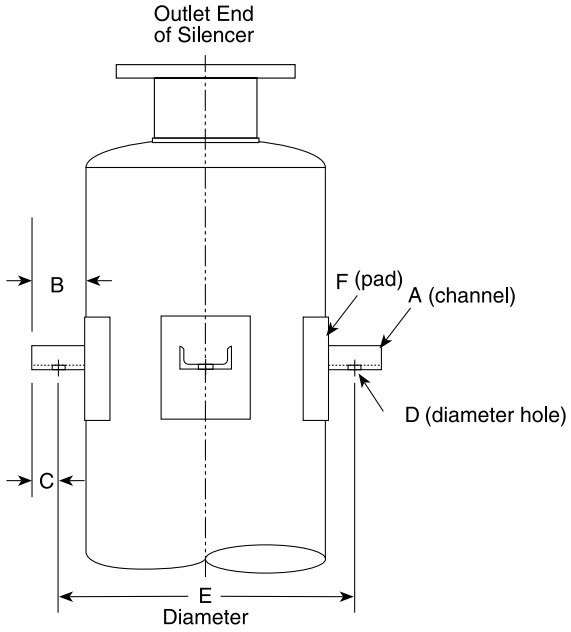
Weld-On Attachment Brackets



Type "B" Mounting Brackets*

Body Diamter	A	B	C	D	E
10.12	C4 7.25	4.0	2.0	0.500	14.3
11.12	C4 7.25	4.0	2.0	0.500	15.3
12.12	C4 7.25	4.0	2.0	0.500	16.3
14.12	C4 7.25	4.0	2.0	0.500	18.3
16.12	C4 7.25	4.0	2.0	0.500	20.3
18.12	C4 7.25	4.0	2.0	0.500	22.3
22.12	C4 7.25	4.0	2.0	0.500	26.4
26.12	C4 7.25	4.0	2.0	0.625	30.4
30.12	C4 7.25	4.0	2.0	0.625	34.4
36.12	C4 7.25	4.0	2.0	0.625	40.4
42.25	C4 7.25	4.0	2.0	0.625	46.5
48.25	C4 7.25	4.0	2.0	0.625	52.5
54.25	C4 7.25	4.0	2.0	0.875	58.5
60.25	C4 7.25	4.0	2.0	0.875	64.5

*Add "N" to the part number when ordering a silencer with Type B brackets (for example, a 61308F would be ordered as 61308N).

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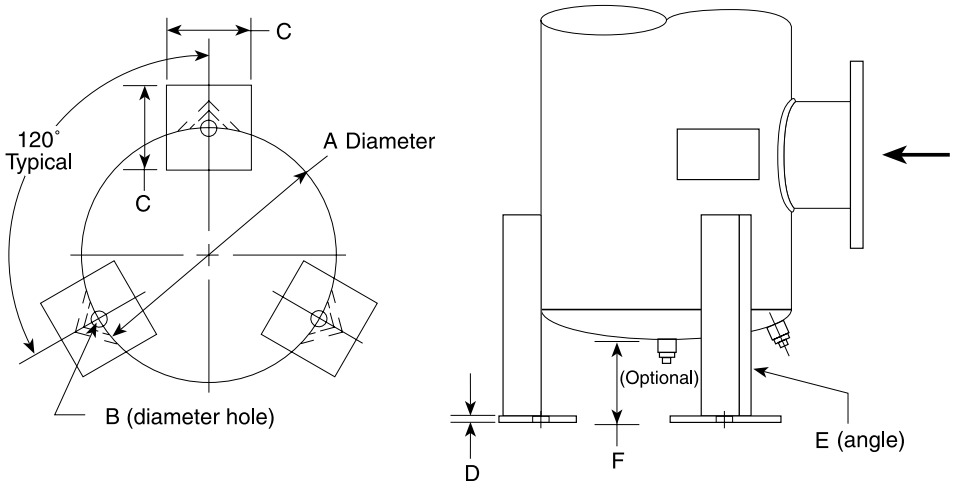
Weld-On Legs



Type "D" Mounting Brackets* - Legs

Body Diameter	A	Hole Diameter	Foot Width	Foot Gauge	Leg Angles	F
10.12	10.0	0.500	6.0	0.5	2.0 2.0 .187	5.0
11.12	11.0	0.500	6.0	0.5	2.0 2.0 .187	5.0
12.12	12.0	0.500	6.0	0.5	2.0 2.0 .187	5.0
14.12	14.0	0.500	6.0	0.5	2.0 2.0 .187	5.0
16.12	16.0	0.500	6.0	0.5	2.0 2.0 .187	5.0
18.12	18.0	0.500	6.0	0.5	2.0 2.0 .187	5.0
22.12	22.0	0.625	6.0	0.5	3.0 3.0 .500	5.0
26.12	26.0	0.625	6.0	0.5	3.0 3.0 .500	5.0
30.12	30.0	0.625	6.0	0.5	3.0 3.0 .500	5.0
36.12	36.0	0.875	6.0	0.5	3.0 3.0 .500	5.0
42.25	42.0	0.875	7.0	0.5	4.0 4.0 .500	5.0
48.25	48.0	1.125	7.0	0.5	4.0 4.0 .500	5.0
54.25	54.0	1.125	7.0	0.5	4.0 4.0 .500	5.0
60.25	60.0	1.125	7.0	0.5	4.0 4.0 .500	5.0

*Add "E" to the part number when ordering a silencer with Type D brackets (for example, a 61308F would be ordered as 61308E).

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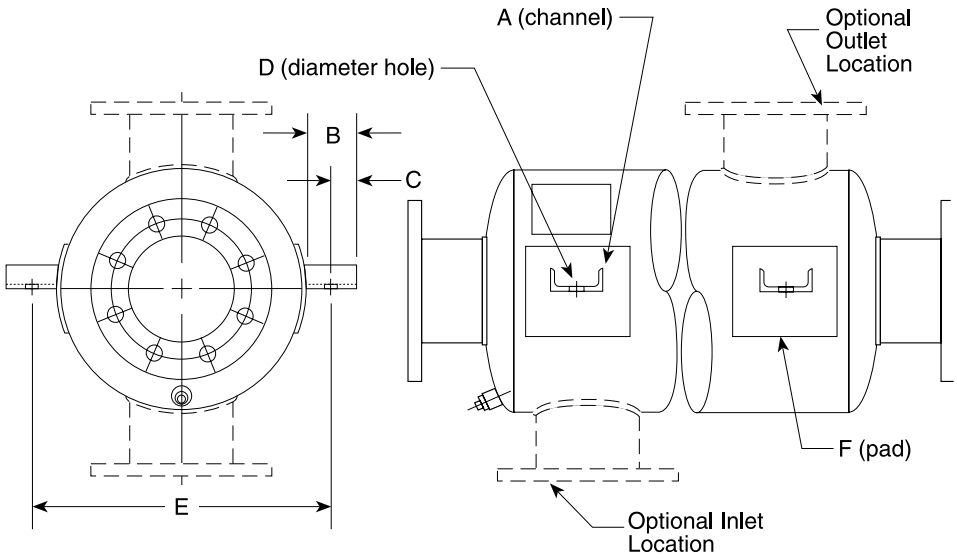
- All information correct at time of printing. Universal has a policy of continuous improvement. Therefore we reserve the right to change the specifications of these silencers without notice.
- All dimensions are in inches unless otherwise stated. All weights are in lbs and are approximate.

Weld-On Attachment Brackets



Type "E" Mounting Brackets*

Body Diamter	A	B	C	D	E
10.12	C4 7.25	4.0	2.0	0.500	14.3
11.12	C4 7.25	4.0	2.0	0.500	15.3
12.12	C4 7.25	4.0	2.0	0.500	16.3
14.12	C4 7.25	4.0	2.0	0.500	18.3
16.12	C4 7.25	4.0	2.0	0.500	20.3
18.12	C4 7.25	4.0	2.0	0.500	22.3
22.12	C4 7.25	4.0	2.0	0.500	26.4
26.12	C4 7.25	4.0	2.0	0.625	30.4
30.12	C4 7.25	4.0	2.0	0.625	34.4
36.12	C4 7.25	4.0	2.0	0.625	40.4
42.25	C4 7.25	4.0	2.0	0.625	46.5
48.25	C4 7.25	4.0	2.0	0.625	52.5
54.25	C4 7.25	4.0	2.0	0.875	58.5
60.25	C4 7.25	4.0	2.0	0.875	64.5

*Add "C" to the part number when ordering a silencer with Type E brackets (for example, a 61308F would be ordered as 61308C).

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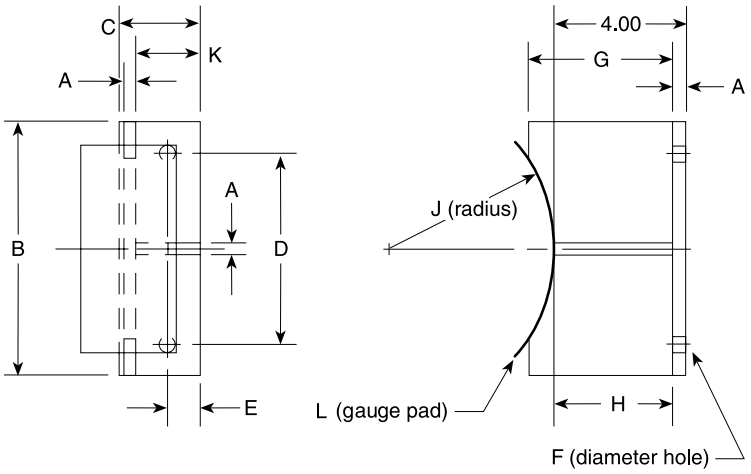
Weld-On Attachment Brackets



Type "F" Mounting Brackets*

Body Diamter	A	B	C	D	E	F	G	H	J	K	L
8.12	0.250	7.0	2.0	5.0	0.75	0.438	5.0	3.69	4.11	1.5	16.0
9.00	0.250	7.0	2.0	5.0	0.75	0.438	4.5	3.69	4.55	1.5	16.0
10.12	0.375	8.0	2.5	6.0	1.00	0.500	1.5	3.55	5.14	2.0	14.0
11.12	0.375	9.0	2.5	7.0	1.00	0.500	5.0	3.55	5.64	2.0	14.0
12.12	0.375	10.0	2.5	8.0	1.00	0.500	5.5	3.55	6.14	2.0	14.0
14.12	0.375	13.0	2.5	11.0	1.00	0.500	6.0	3.55	7.14	2.0	14.0
16.12	0.375	15.0	2.5	13.0	1.00	1.00	6.5	3.52	8.17	2.0	12.0
18.12	0.375	17.0	2.5	15.0	1.00	1.00	7.0	3.52	9.17	2.0	12.0
22.12	0.500	20.0	3.0	18.0	1.00	1.00	7.0	3.36	11.22	2.0	10.0
26.12	0.500	24.0	3.0	22.0	1.00	1.00	8.0	3.36	13.24	2.0	10.0
30.12	0.500	29.0	4.0	26.0	1.50	1.50	9.0	3.36	15.24	3.0	10.0
36.12	0.500	32.0	4.0	28.0	1.50	1.50	10.0	3.36	18.26	3.0	10.0
42.25	0.500	34.0	4.0	30.0	1.50	1.50	10.0	3.36	21.26	3.0	10.0
48.25	0.500	39.0	4.0	35.0	1.50	1.50	11.0	3.32	24.30	3.0	7.0
54.25	0.500	44.0	4.0	40.0	1.50	1.50	11.0	3.32	27.33	3.0	7.0
60.25	0.500	49.0	4.0	45.0	1.50	1.50	12.0	3.32	30.33	3.0	7.0

*Add "Y" to the part number when ordering a silencer with Type F brackets (for example, a 61308F would be ordered as 61308Y).

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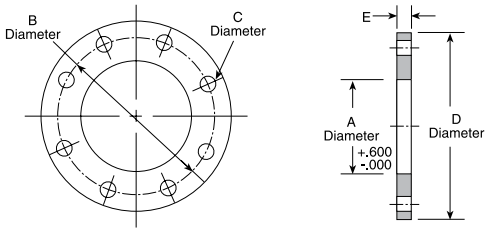
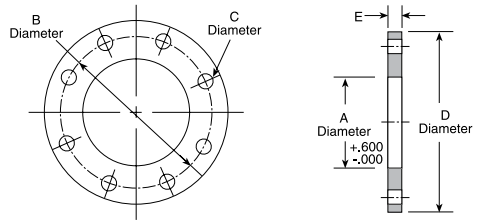
Reduction/Oversize Flange Kits

Frequently the engine's flange size is larger than the required silencer's connection. Rather than use a larger silencer, it is usually more economical to use an oversize reducing flange on the silencer. Universal offers single reduction and double reduction ANSI Flange.



Reduction Flange: Single

Pipe Size Reduction	Part Number	A	D	# of Holes	B	C	E	Weight
5x4	82-1015	4.56	10.00	8	8.50	0.875	0.375	6
6x5	82-1016	5.63	11.00	8	9.50	0.875	0.500	9
8x6	82-1017	6.69	13.50	8	11.75	0.875	0.500	14.5
10x8	82-1018	8.75	16.00	12	14.25	1.000	0.500	17
12x10	82-1019	10.88	19.00	12	17.00	1.000	0.500	26
14x12	82-1020	12.88	21.00	12	18.75	1.125	0.500	29
16x14	82-1021	14.19	23.50	16	21.25	1.125	0.500	37
18x16	82-1022	16.19	25.00	16	22.75	1.250	0.500	38
20x18	82-1023	18.19	27.50	20	25.00	1.250	0.500	44
22x20	82-1024	20.19	29.50	20	27.25	1.375	0.500	47
24x22	82-1025	22.19	32	20	29.50	1.375	0.500	55



Reduction Flange: Double

Pipe Size Reduction	Part Number	A	D	# of Holes	B	C	E	Weight
6x4	82-1039	4.56	11.00	8	9.50	0.875	0.500	10.5
8x5	82-1040	5.63	13.50	8	11.75	0.875	0.500	16
10x6	82-1041	6.69	16.00	12	14.25	1.000	0.500	22
12x8	82-1042	8.75	19.00	12	17.00	1.000	0.500	30
14x10	82-1043	10.88	21.00	12	18.75	1.125	0.500	34
16x12	82-1044	12.88	23.50	16	21.25	1.125	0.500	41
18x14	82-1045	14.19	25.00	16	22.75	1.250	0.500	44
20x16	82-1046	16.19	27.50	20	25.00	1.250	0.500	52
22x18	82-1047	18.19	29.50	20	27.25	1.375	0.500	56
24x20	82-1048	20.19	32.00	20	29.50	1.375	0.500	64
26x22	82-1049	22.19	34.25	24	31.75	1.375	0.750	106

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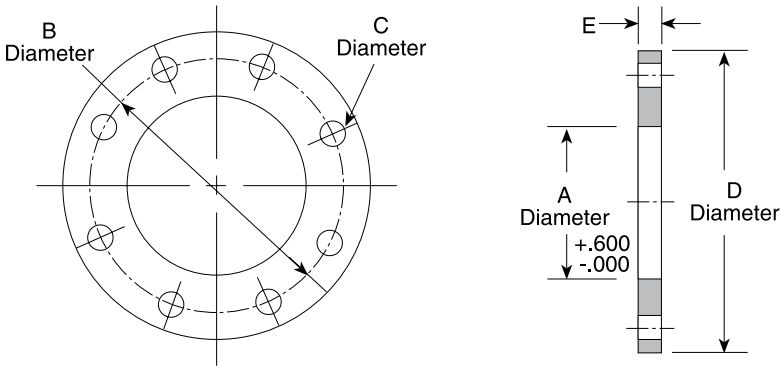
Field repairs, retrofits and custom projects sometimes require flanges to be installed on a bare pipe end. Universal offers weld-on flanges. Each flange kit includes two flanges, gaskets, and bolt and nut for each hole.

Companion Flange Kits



Pipe Size	Part Number	A Inner Diameter	D Outer Diameter	# of Holes	C Hole Diameter	T Flange Thickness	Weight
4	82-1117	4.56	9.00	8	0.750	0.375	8
5	82-1118	5.63	10.00	8	0.875	0.375	10
6	82-1119	6.69	11.00	8	0.875	0.500	13
8	82-1120	8.75	13.50	8	0.875	0.500	16
10	82-1121	10.88	16.00	12	1.000	0.500	25
12	82-1122	12.88	19.00	12	1.000	0.500	32
14	82-1123	14.19	21.00	12	1.125	0.500	39
16	82-1124	16.19	23.50	16	1.125	0.500	49
18	82-1125	18.19	25.00	16	1.250	0.500	57
20	82-1126	20.19	27.50	20	1.250	0.500	69
22	82-1127	22.19	29.50	20	1.375	0.500	110

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Companion Flange Kits

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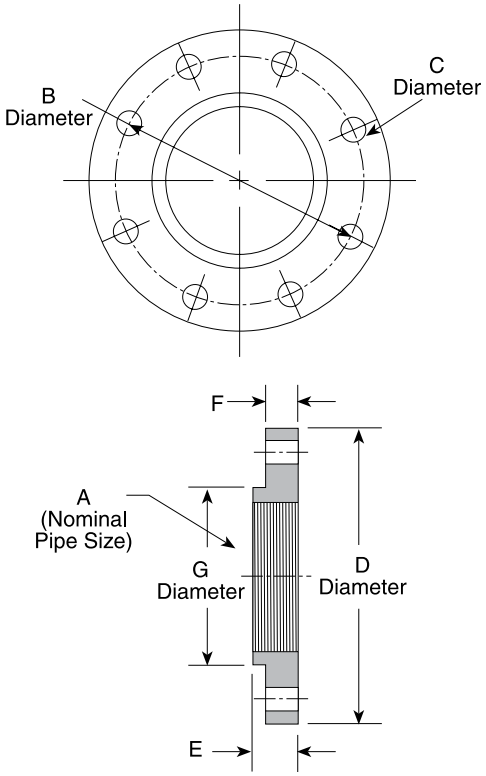

Dual Mounting Flanges Kits (Threaded)

Part Number	A	B	C	D	E	F	G	# of Holes	Weight
82-1150	4	7.50	0.750	9.0	1.31	0.94	5.31	8	8
82-1151	5	8.50	0.875	10.0	1.44	0.94	6.44	8	10
82-1152	6	9.50	0.875	11.0	1.56	1.00	7.56	8	13
82-1153	8	11.75	0.875	13.5	1.75	1.12	9.75	8	16

∴ A “kit” consists of a mounting flange, a gasket, and one capscrew and nut for each mounting hole. Available in dual or single flange kits. Listed part number for dual flange kits. Please call for single flange kits.

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GLOBAL HEADQUARTERS

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P.O. Box 411
Stoughton, WI 53589 USA
Phone (608) 873-4272
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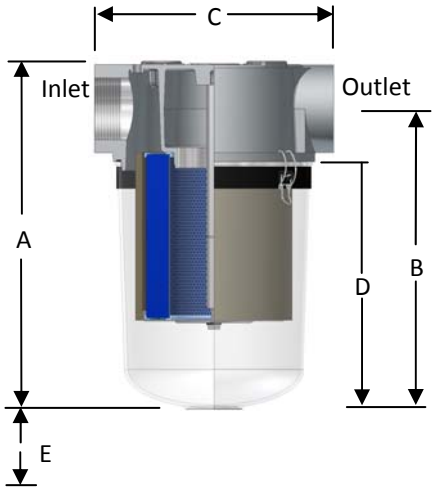
PALM DESERT, CA 92260
(442) 600-2444
INFO@COMPRESSORDS.COM

SOLBERG FILTERS

CT-275P-500C

”T” Style Vacuum Filters
ST/CT Series 1” – 6” FPT



General Features

- Compact design for space restrictions; min. service area
- Inlet above element for extended element life & maintenance intervals
- Cast, corrosion resistant aluminum top with machined connections: - Integrated baffle design
  - 4 M12 taps for mounting brackets: 2” to 6”
- ”T” style design minimizes piping requirements
- 1/4” differential gauge ports: 2” to 6”

ST Series Specifications

- See-through bucket made from polycarbonate material
- Bucket has a high tensile strength for dimensional stability
- Temp ratings: - Complete assembly max: 220°F (104°C)
  - See-through bucket only max: 257°F (125°C)
- Increased holding capacity

Technical Specifications

- Vacuum Rating: Gas tight seal
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20” H2O over initial Δ P
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron

Options

- Swing bolts for heavy duty environments
- 1” to 1-1/2” housings have dimples for optional gauge ports & mounting bracket taps
- Epoxy coated housings
- Drain ports
- Spool piece extender on select models
- ISO flange connections: NW25, NW40 (select models)

FPT Inlet & Outlet	Assembly SCFM Rating	Assembly Part Number		Dimensions - inches				Suggested Service HT.	Approx. Weight	Replacement Element Part No.		Element SCFM Rating
		Polyester	Paper	A	B	C	D	E	lbs.	Polyester	Paper	
1"	40	ST-897-100C	ST-896-100C	13 3/8	11 15/16	7	10 3/8	9	11	897	896	115
1-1/4"	60	ST-897-125C	ST-896-125C	13 3/8	11 15/16	7	10 3/8	9	11	897	896	115
1-1/2"	80	ST-897-150C	ST-896-150C	13 3/8	11 15/16	7	10 3/8	9	10	897	896	115
2"	175	ST-851/1-200C	ST-850/1-200C	16 1/4	14 1/4	9	12 1/2	9	15	851/1	850/1	290
2-1/2"	210	ST-851/1-250C	ST-850/1-250C	16 1/4	14 1/4	9	12 1/2	9	14	851/1	850/1	290
3"	300	ST-235P-300C	ST-234P-300C	19 3/4	17	13 1/2	14	9	29	235P	234P	570
4"	520	ST-235P-400C	ST-234P-400C	19 3/4	17	13 1/2	14	9	25	235P	234P	570

Dimension tolerance ± 1/4”

CT Series Specifications

- Carbon steel black enamel drop down bucket
- Swing bolts standard on 6” housings

FPT Inlet & Outlet	Assembly SCFM Rating	Assembly Part Number		Dimensions - inches				Suggested Service HT.	Approx. Weight	Replacement Element Part No.		Element SCFM Rating
		Polyester	Paper	A	B	C	D	E	lbs.	Polyester	Paper	
1"	40	CT-897-100C	CT-896-100C	13 3/8	11 13/16	7	10 3/8	9	12	897	896	115
1-1/4"	60	CT-897-125C	CT-896-125C	13 3/8	11 13/16	7	10 3/8	9	12	897	896	115
1-1/2"	80	CT-897-150C	CT-896-150C	13 3/8	11 13/16	7	10 3/8	9	11	897	896	115
2"	175	CT-851-200C	CT-850-200C	13	10 7/8	9	9	9	16	851	850	290
2-1/2"	210	CT-851-250C	CT-850-250C	13	10 7/8	9	9	9	15	851	850	290
3"	300	CT-235P-300C	CT-234P-300C	18 5/8	16 1/8	13 1/2	13	9	30	235P	234P	570
4"	520	CT-235P-400C	CT-234P-400C	18 5/8	16 1/8	13 1/2	13	9	26	235P	234P	570
6"	1100	CT-275P-600C	CT-274P-600C	18 1/4	14 1/2	19	9 7/8	10	45	275P	274P	1100

Note CT 2” & 2-1/2” models: Element seals on the base of the housing.

See Vacuum Filter Technical Data section for sizing guidelines.

Note: Model offerings and design parameters may change without notice. See www.solbergmfg.com for most current offering.

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HEAT EXCHANGERS

XCHANGER AA-1000

INDUSTRIAL HEAT EXCHANGERS
XCHANGER

1401 7th STREET S.
HOPKINS, MN 55343
952-933-2559
XCHANGER.COM

Heat Exchangers

Installation

Operation

Maintenance

The information supplied in this manual is based on over four decades of field experience with our heat exchangers. Following the instructions contained in this manual will extend the service life of your heat exchanger.

Please note that all heat exchangers will eventually fail, even if they have been properly installed and well maintained. Our experience shows that some of the most common reasons for failure are: erosion, corrosion, freezing, water hammer, over-pressurization, and metal fatigue induced by vibration, thermal cycling, and pressure cycling.

When a heat exchanger fails, the likely result is contamination of the process and/or service fluids. If this would be a serious problem for your system, steps should be taken to protect your system to eliminate or reduce the impact of such contamination. Depending on the type of failure, one or both fluids could leak into the atmosphere.

Should assistance in installation or repair of any equipment be required, please contact Xchanger at:

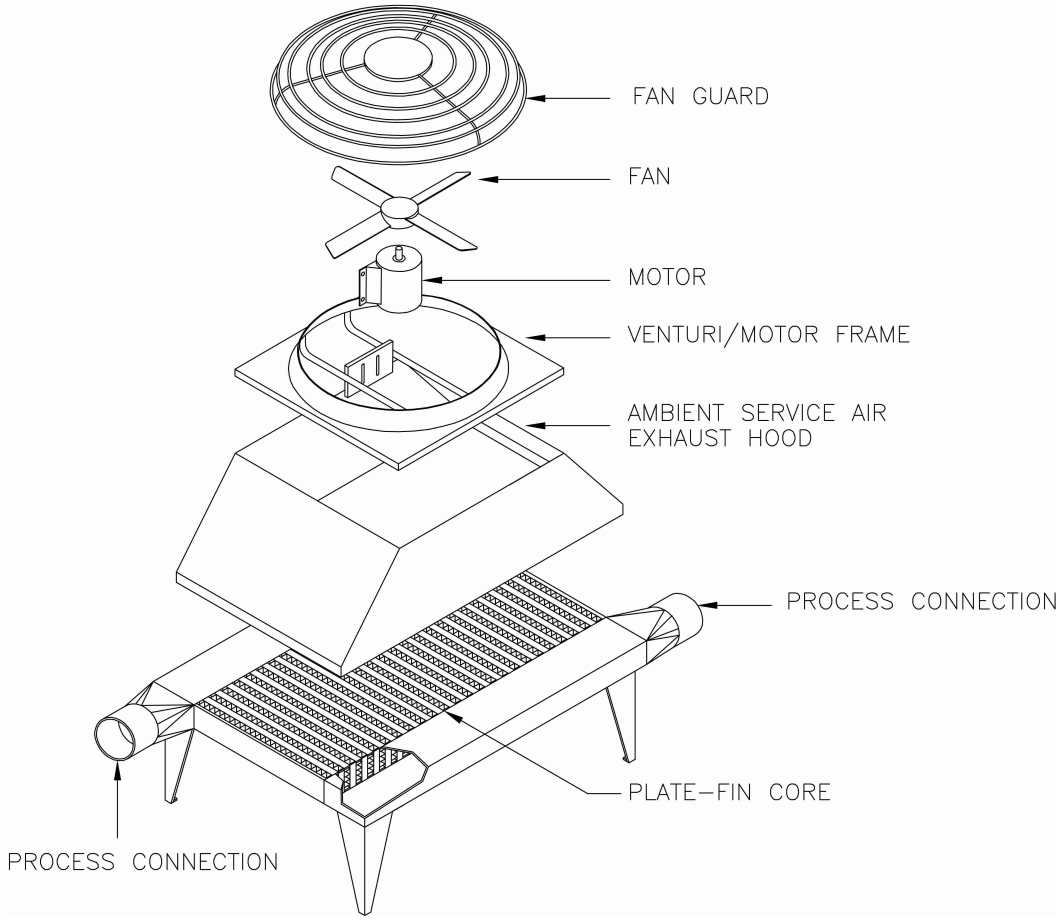
Mail: 1401 South 7th Street
Hopkins, MN 55343 USA
Ph: 952-933-2559
Fax: 952-933-5647
E-mail: info@xchanger.com
Web: xchanger.com

TABLE OF CONTENTS

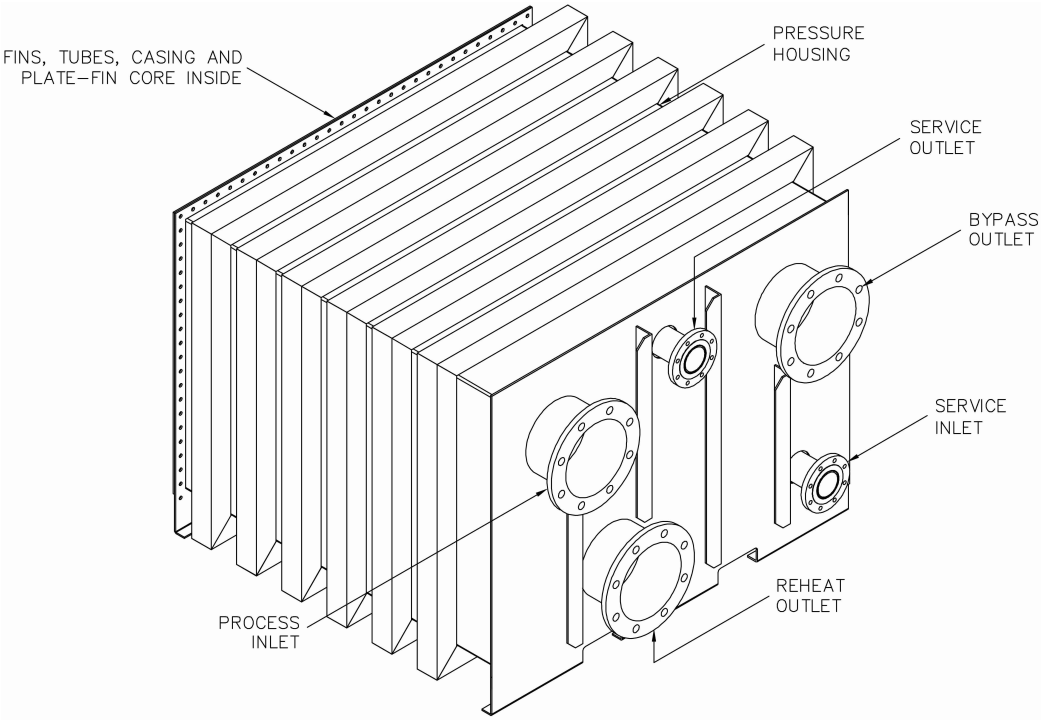
1.0 SCOPE OF THIS MANUAL

This manual describes the appropriate procedures for the use and care of Xchanger AA, BG, C, D, HP, HR, LC, and TV Series heat exchangers. Warranty and service contact information is also included.

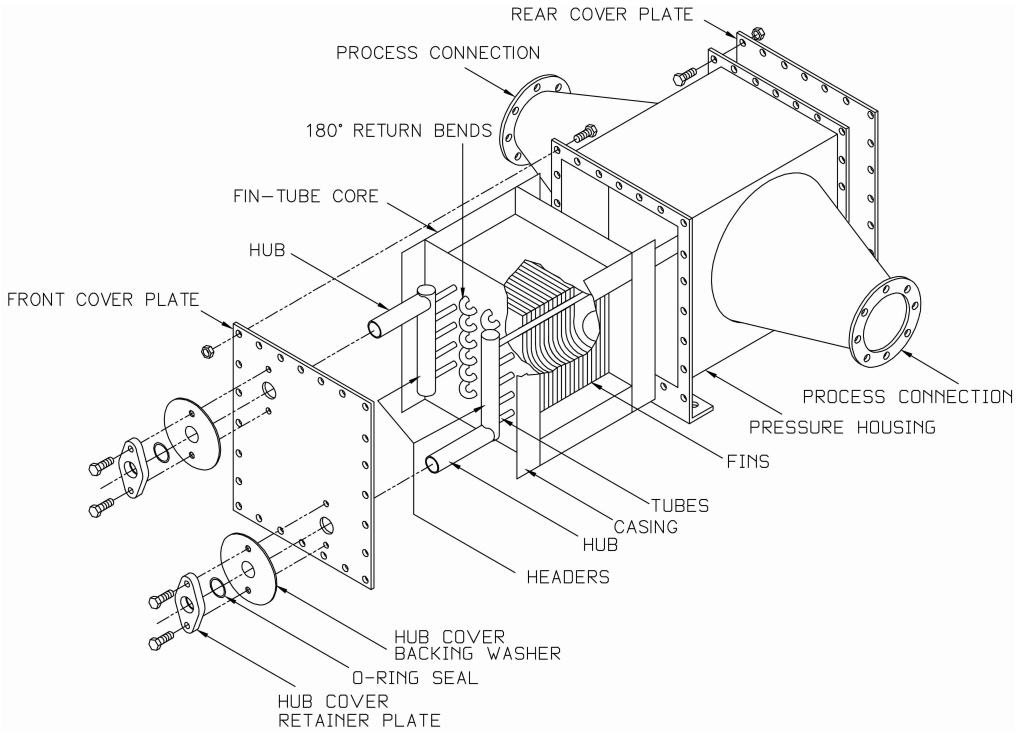
Due to the custom nature of all Xchanger heat exchangers, this manual discusses the characteristics and procedures that are common to all exchangers. It is imperative to carefully review all sections in this manual pertaining to the model and the service of your heat exchanger. Unit specific information not included in this manual will be shown on or included with the data sheet and certified drawing that characterize each distinct exchanger design. Information about motors and any accessories provided with an exchanger would also be separate from this manual.



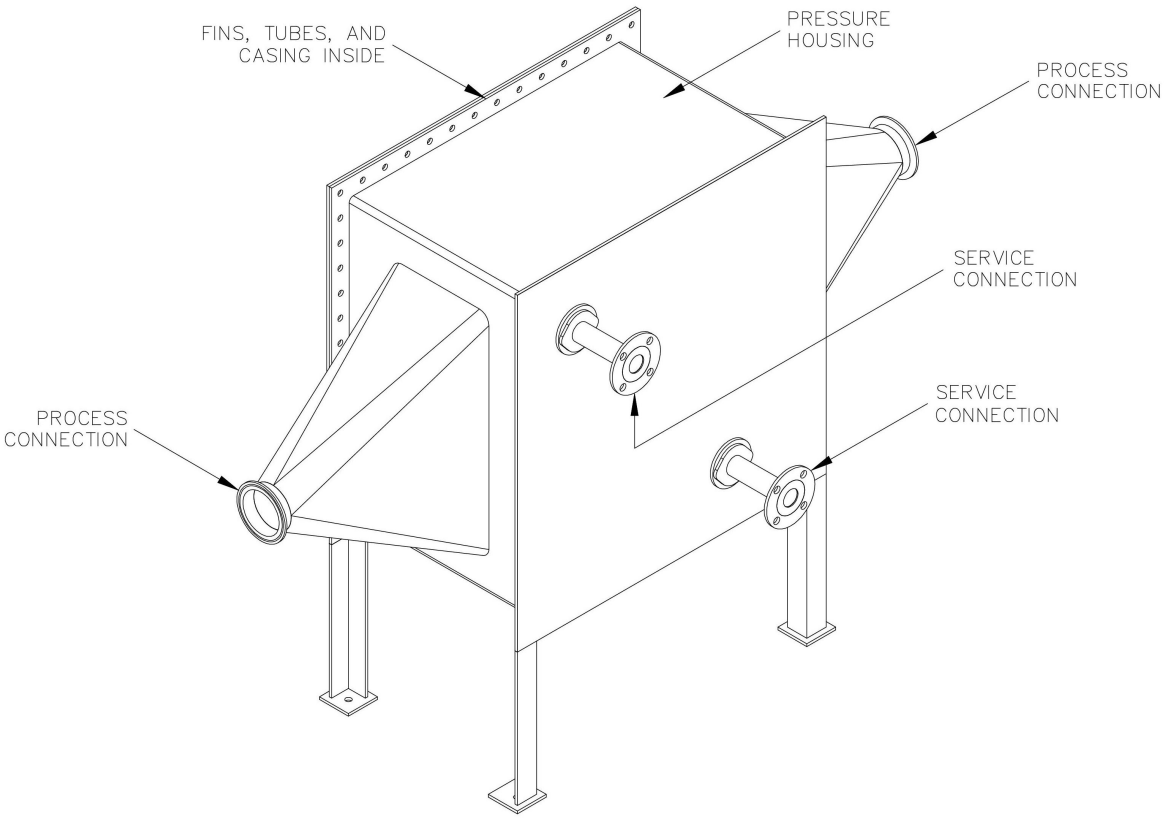
AA Series Heat Exchangers



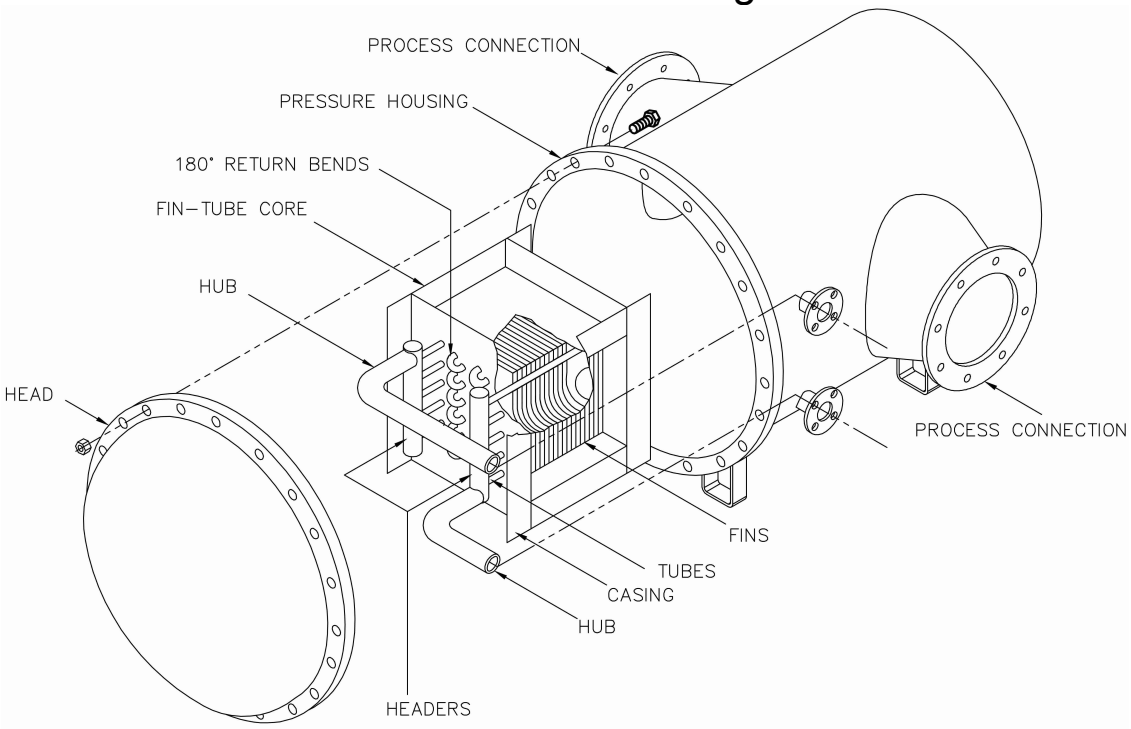
BG Series Heat Exchangers



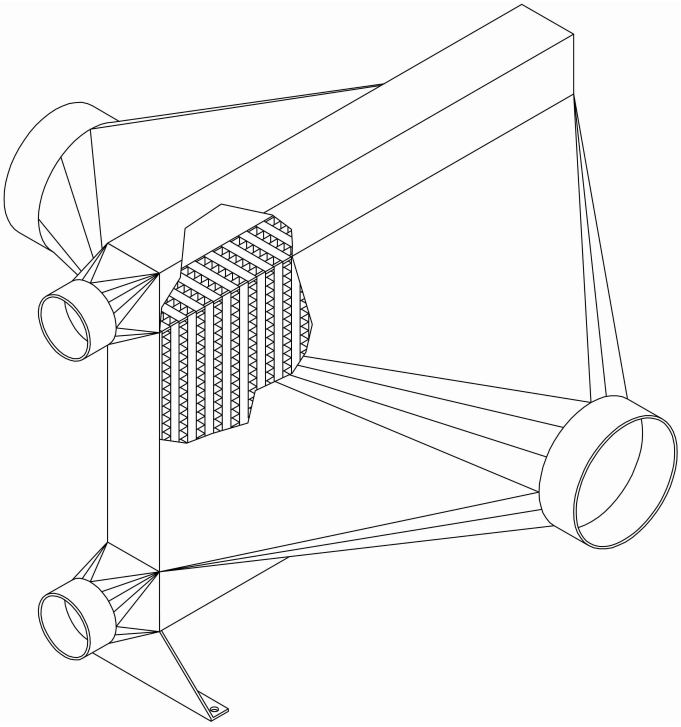
C/TV Series Heat Exchangers



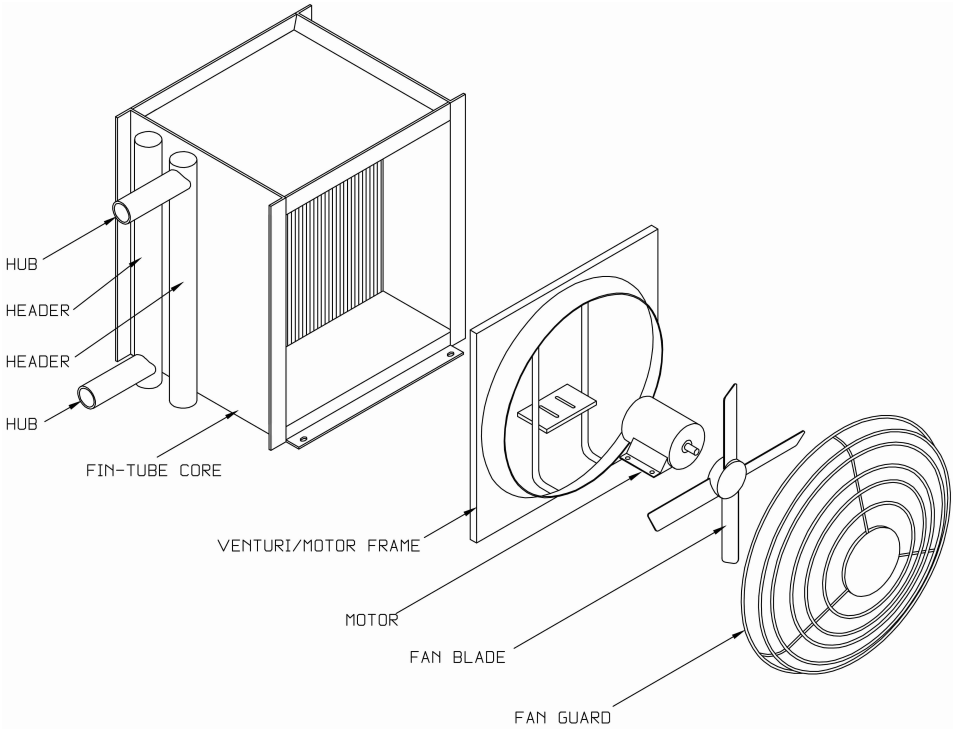
D Series Heat Exchangers



HP Series Heat Exchangers



HR Series Heat Exchangers



LC Series Heat Exchangers

2.0 RECEIVING THE HEAT EXCHANGER

The unit should be examined thoroughly upon receipt. The unit should have no cracks, dents or deformations.

Damage to either the unit or its crating should be immediately noted on the freight receipt. If the shipment was made F.O.B. our factory, damage claims should be filed with the responsible carrier.

Accessories are sometimes shipped loose on the same skid as the exchanger. If so, the Bill of Lading and/or Packing Slip would reflect the loose parts. Check for any accessories before discarding the skid. AA Series accessories may be shipped inside the exhaust hood of the heat exchanger.

2.1 STORAGE

If the unit will not be placed into operation for an extended period of time, it should be left on the shipping skid. Store in a clean, dry, and protected area. All openings should be covered to protect interior surfaces. Unprotected carbon steel should be sprayed with a light coating of a rust inhibitor.

3.0 MOUNTING LOCATION

If the heat exchanger is located at the inlet or discharge of a blower with a pulsating flow, such as a Roots type rotary lobe blower, the heat exchanger must be protected from the pulsation by a chambered silencer.

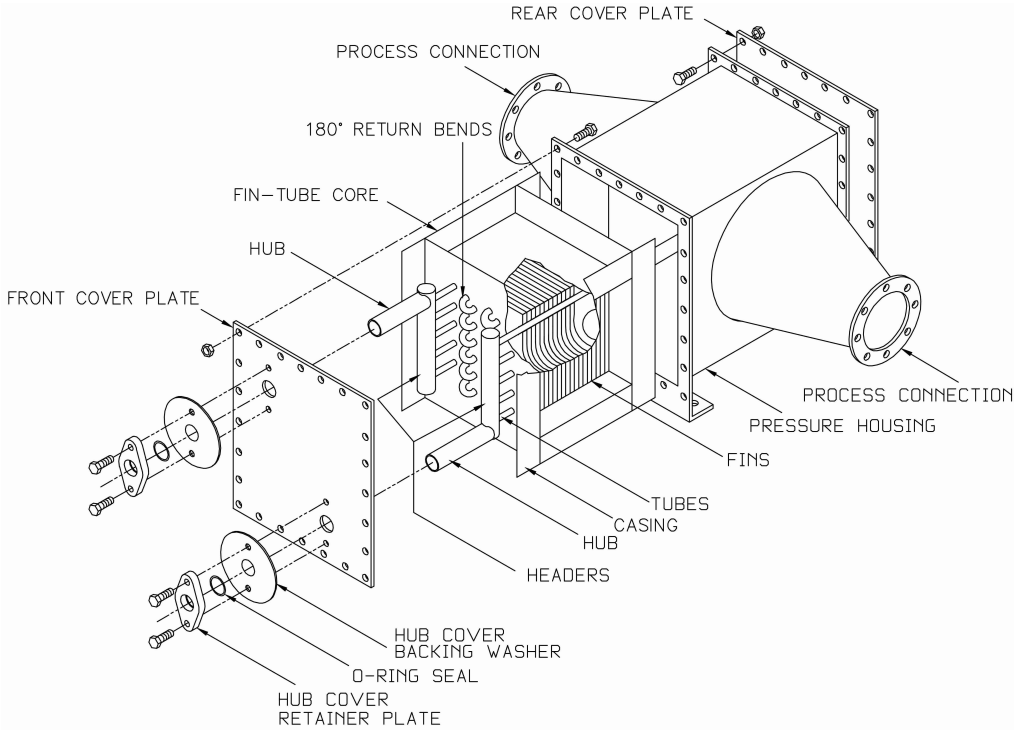
The heat exchanger must be isolated from system vibrations using flexible piping connections and isolation pads on the mounting feet. Vibration can cause work-hardening and failure of the heat exchanger.

The process gas stream should be free of particulate. If there is a possibility of particulate passing through the heat exchanger, a filter should be installed upstream of the heat exchanger.

Ample space should be provided on all sides to allow servicing when required.

3.1 BG/C/D/HP/TV SERIES

To facilitate servicing a unit with a removable core, provide enough clear space to remove the core through the bolted access panel.



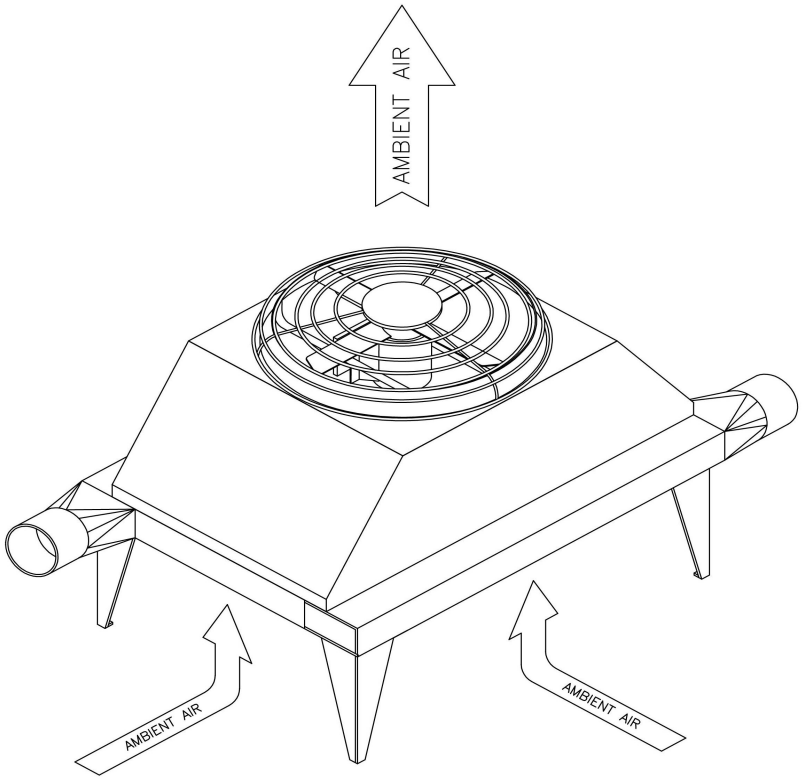
For cooling applications where vapors may condense from the gas stream, a proper drain trap arrangement is necessary (see section 4.1.5 titled BG/C/D/HP/TV SERIES Housing Drain Trap for more information).

The service fluid must not be allowed to freeze or damage to the core will result (see section 6.4 titled FREEZING PROTECTION – BG/C/D/HP/TV SERIES for more information). With the exception of exchangers designed for evaporative heat transfer, heating of the service fluid beyond its boiling point may damage the core.

3.2 AA/LC SERIES

The heat exchanger should be mounted in a well ventilated area, preferably outdoors, as these units dissipate heat to the ambient air. If the unit is installed indoors and ducting of the service air is required, a booster fan should be used to convey the air through the duct.

The service airflow may be directed vertically or horizontally. A minimum clearance of 2 feet around the heat exchanger base is essential for proper cooling air flow. When designing the system layout, it is important not to restrict the intake or exhaust air flow, or the exchanger may not perform as rated.



3.3 HR SERIES

If installed in a very warm or very cool location, the ambient conditions could interfere with the intended heat transfer. The effects of the ambient conditions can be mitigated by insulating the exchanger after installation.

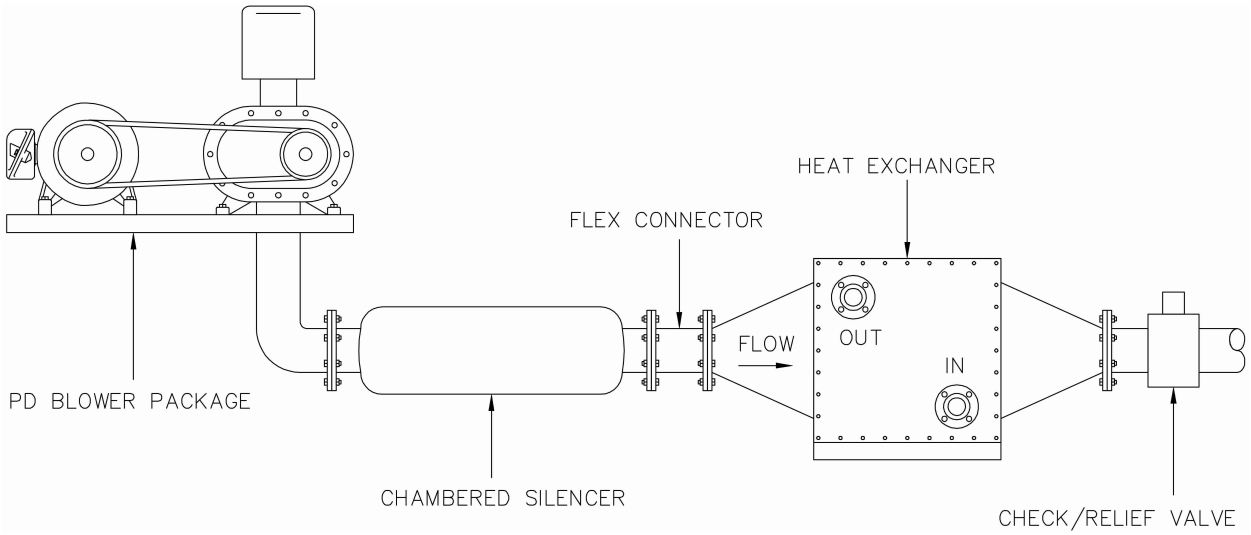
4.0 INSTALLATION

The heat exchanger should be supported and secured by the mounting feet. The heat exchanger nozzles are not designed for external loading or moments. All piping should be supported independently of the heat exchanger, and any flex connectors present should not add loads or moments to the heat exchanger connections. Any debris in the piping should be removed before the heat exchanger is installed, as the core of the exchanger could trap any particles, causing reduced performance and/or damage to the core.

The unit is equipped with labels indicating gas flow direction and service fluid inlets and outlets. Connections must be installed as labeled. The certified drawing also indicates the flow direction and should be consulted during installation.

If pulsating gas flow is supplied to the unit, a chambered silencer must be installed between the blower and the exchanger. Flex connectors should be used to absorb vibration and thermal loading from the system piping. If vibrations may pass through the mounting skid, isolation pads should be used between the skid and the mounting feet of the heat exchanger. Pulsation and/or vibration can cause metal fatigue and lead to failure of the heat exchanger.

If the heat exchanger is used in a pneumatic conveying system, a check valve should be placed between the air lock and the heat exchanger. This will help to prevent clogging the heat exchanger with the product being conveyed.



4.1 BG/C/D/HP/TV SERIES

The orientation for which the heat exchanger is designed is noted on the certified drawing. A unit that is designed for horizontal gas flow may not perform to specification if it is installed in a vertical flow orientation, and a unit that is designed for counter flow heat transfer may not perform to specification if piping is installed in a parallel flow orientation.

Attachment to the service connections should be made using industry standard practices. If special valves, controls, traps, etc., are provided by Xchanger, separate instructions may be attached. If shut off valves are installed on both of the service lines, a pressure relief valve should be installed on the heat exchanger side of one of the shut off valves to prevent over pressurizing the unit. If required, a pressure relief valve should be selected per industry standard practices.

On standard heat exchangers, there is a 3/4 or 1 inch female NPT drain coupling either on the bottom of the front cover or the bottom of the housing. Condensate that forms on the outside of the fins can be drained though this coupling to a drain leg or trap.

4.1.1 Drainable Tube Circuits

These units should be installed with a slight slope toward the service connection side of the exchanger.

4.1.2 Steam Piping

Proper installation, piping, and trapping is necessary to ensure satisfactory operation and prevent damage under normal operating conditions. These installation requirements must be followed to prevent common failures and performance problems:

- Provide swing joints or flexible fittings in all piping connections adjacent to the heat exchanger. This absorbs the thermal expansion and contraction of the piping.

- Condensate must flow freely from the heat exchanger at all times to prevent physical damage to the core caused by water hammer, unequal thermal stresses, freeze-up, or corrosion.

- Do not pitch the heat exchanger. The mounting position should be level.

- Control each heat exchanger core separately when installing multiple cores.

- Do not modulate systems with overhead or pressurized returns unless the condensate is drained by gravity to a receiver, vented to atmosphere, and returned to the condensate main by a condensate pump.

- Pitch all supply and return piping down a minimum of 1 inch per 10 feet in the direction of steam flow.

- Do not drain steam mains or take-offs through the heat exchanger. Drain steam mains ahead of the heat exchanger through a steam trap into the condensate return line.

- Do not bush or reduce the steam condensate return piping smaller than the heat exchanger connection. Run return pipe full size to a steam trap (except for a short nipple screwed directly into the condensate connection of the steam trap).

- Overhead condensate return lines require 1 PSIG pressure at the steam trap inlet for each 2 feet of elevation to assure continuous condensate removal.

- When an overhead condensate return line is installed, provisions should be incorporated into the piping system to allow condensate to drain from the heat exchanger during down time.

- The end of the steam supply main must be trapped.

- A vacuum breaker must be installed downstream of the control valve or shut off valve.

4.1.3 Steam Trap Selection

Proper steam trap selection and installation is necessary for satisfactory heat exchanger performance and service life:

- Select a steam trap based on the maximum possible condensate flow rate along with the recommended load factors.

- Locate the steam trap discharge at least 12 inches below the heat exchanger condensate return connection. This will provide sufficient hydrostatic head pressure to overcome trap losses and assure complete removal of the condensate from the heat exchanger.

- Float and thermostatic type steam traps are preferred because of their gravity drain and continuous discharge operation.

- Use a float and thermostatic type steam trap with gravity condensate return and automatic controls where there is a possibility of a low pressure steam supply.

- Use bucket traps only when steam supply is not modulated and is over 25 PSIG.

- When installed for series airflow, size steam traps for each heat exchanger core using the capacity of the first heat exchanger core (in airflow direction).

- Trap each heat exchanger separately. This will prevent condensate holdup in the heat exchanger cores.

- Install strainers as close as possible to the inlet side of a steam trap.

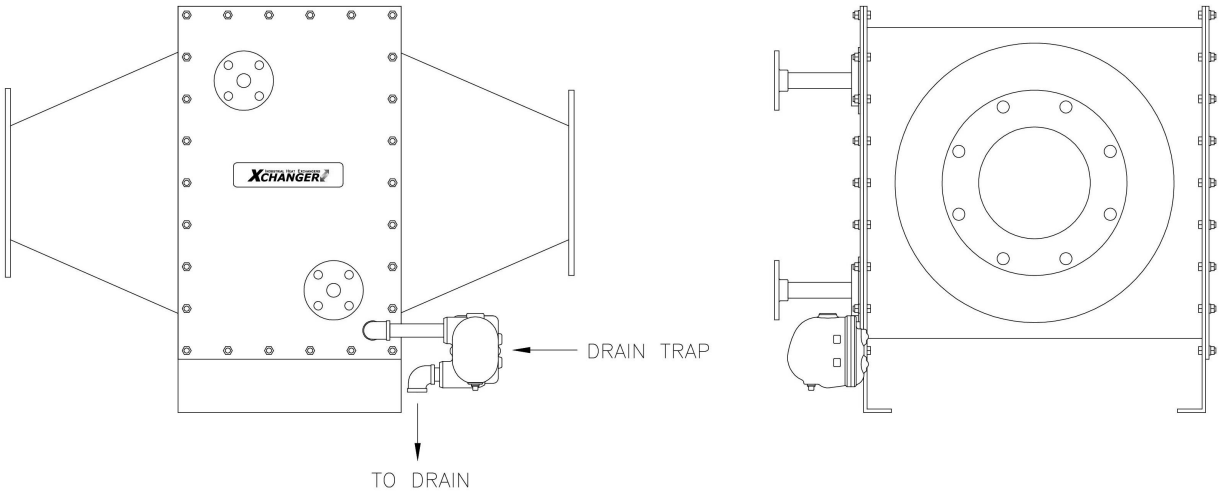
4.1.4 Refrigerant Circuit

Direct expansion refrigerant circuits are shipped open and uncharged. They must be evacuated and charged. If you need assistance, contact a local refrigeration contractor.

4.1.5 Housing Drain Trap

In applications where vapors are expected to condense from a horizontal gas flow, an automatic drain trap should be installed. Approximately 12 inches total clearance under the housing box is required, or 9 inches below the standard mounting feet.

For installations where the gas flow is vertical, any condensed vapors will fall out of the low side transition, due to gravity.



4.2 AA/LC SERIES

The electric motor must be wired on site. On many air cooled heat exchangers, the electrical service must be brought through the exhaust hood. Any holes in the exhaust hood should be sealed to prevent air that has not passed through the core from entering, thereby short-circuiting the core. Refer to the motor nameplate and motor manual for electrical requirements and installation instructions.

5.0 START-UP

After carefully observing all the points listed under Section 4.0 INSTALLATION, the unit is ready for start-up.

5.1 BG/C/D/HP/TV SERIES

The service fluid should be supplied to the equipment at 100% of the design flow rate before the process gas is directed to the equipment. For steam applications, the steam should be turned on full for at least ten minutes before the airflow is started to prevent water hammer, freezing, and excessive thermal stresses. After the process and service fluids have been supplied to the unit, check for leaks.

5.2 AA/LC SERIES

Before starting the electric fan, the following checklist should be used:

- The impeller hub should be secure on the motor shaft.
- The impeller should rotate freely.
- Electrical wiring should be safely secured.
- The air flow path should be open (i.e. packing material removed).

After starting the motor, verify that the impeller is rotating in the proper direction. The data sheet and certified drawing should state the design flow direction for the ambient air.

6.0 MAINTENANCE

Depending on the model and your operating environment, the maintenance requirements may vary.

6.1 LUBRICATION

6.1.1 BG/C/D/HP/HR/TV SERIES

No lubrication is required for the heat exchangers. Accessories may require lubrication per their manuals.

6.1.2 AA/LC SERIES

Refer to the maintenance instructions provided with the motor(s).

6.2 BG/C/D/HP/TV SERIES CORE REMOVAL AND INSTALLATION

It may be necessary to occasionally remove the fin-tube core from the housing for inspection and cleaning.

For units with removable cores, the following steps describe the procedure for removing the fin-tube core from the heat exchanger housing. Units that are fully-welded will need to be returned to the factory for service. [Reference pages 2 and 3 for component terminology.]

6.2.1 BG/C/D/TV SERIES Core Removal

1. Disconnect the service fluid and remove any connections from the service hubs (i.e. sweat on copper flanges, screwed on threaded flanges, etc.). Some units have welded service connections that may need to be cut off to remove the core. If the core and cover are welded together, the flanges do not need to be removed, as the cover will remain with the core.
2. Remove the bolts securing the hub plate assemblies to the front cover.
3. Remove the hub plate assembly (hub plate, O-ring, and backing washer). Some prying with a screwdriver or similar tool may be required to break the bond of the sealant.
4. Remove the bolts securing the front and rear housing covers to the housing. Some units with removable cores may only have one removable cover.
5. Remove the bolted covers. Some prying with a screwdriver or similar tool may be required to break the bond of the sealant. Exercise caution to avoid dropping the removable covers.
6. Remove the bolts securing the core to the housing. Check both sides.
7. Remove the core from the housing by pulling evenly on accessible headers, 180° tube return bends, or the casing. Take care not to damage the headers or return bends.

6.2.2 HP SERIES Core Removal

1. Remove the flange bolts around the removable dished head cover.
2. Disconnect the core connections from the internal service connections.
3. Remove the bolts holding the core to the side of the housing.
4. Remove the core from the housing by pulling evenly on the headers.

6.2.3 BG/C/D/HP/TV SERIES Core Installation

Install the core in the reverse order of removal, noting the following:

1. Slide the core into the housing and attach the casing to the side of the housing with weld nuts, bolt holes, and/or positioning tabs.

   For replacement cores, the holes in the casing which hold the core against the side of the housing may not match the holes on the original core. If not, new holes will need to be drilled as follows:

   a. Slide the core into the housing such that the core face is centered in the transition opening.
   b. Mark the locations of the housing holes on the casing.
   c. Remove the core and drill the holes where marked. When drilling the holes, place a wooden block between the casing and the return bends to prevent damage to the core's tubing.
   d. Reinstall the core into the housing.

2. For HP Series exchangers, the internal service connections must be reattached prior to reinstalling the dished head cover.

3. Clean the sealing surfaces on the covers and housing flanges with solvent to remove any oils or residue.

4. Apply new gasket material to the housing flange as needed. Refer to the design data sheet supplied with the certified drawing for proper gasket material selection.

5. Install covers, cover fastener assemblies, and, for BG/C/D/TV Series exchangers, the hub cover assemblies. To facilitate installing the hub cover assemblies, do not tighten the cover bolts until after the hub cover assemblies are installed. All bolts should be finger tight at this point. Units with covers welded to the internal core hubs will not have hub cover assemblies.

   For C/TV Series replacement cores, the hub locations may not be identical to those of the original core. To check for proper alignment, install the front cover with the four corner bolts. Slide on the hub cover assemblies to check for alignment over the hubs of the replacement core. If the hub and cover bolt holes or welded studs do not match, new holes must be drilled and tapped into the cover and any studs must be removed and ground flush. The hub covers may be rotated such that the old bolt holes will not interfere with the new holes. Fill in the old holes to prevent gas leakage.

6. Tighten cover bolts.

7. Tighten the hub cover assembly bolts.

8. Refer to Section 5.0 for recommended start-up procedures.

6.3 CLEANING

Xchanger heat exchangers perform best when clean. It is recommended that they be prevented from becoming fouled since their design is such that once plugged or coated, it may not be possible to fully clean them. The sections below offer suggestions, where applicable, if cleaning is attempted.

6.3.1 AA/HR SERIES Internal Gas Passages

The internal process gas passages in these heat exchangers are not cleanable unless the units are provided with bolted access panels. Filtered air is absolutely required for these units. If plugging does occur, core replacement is recommended.

6.3.2 AA/HR/LC SERIES Service Gas Passages

For dirt/dust contamination, a soap and water wash is usually adequate to clean the service side of these units. If not, the use of an appropriate solvent or compressed air is recommended. Exercise caution when selecting a solvent to avoid corroding contact materials. Pressure washers can damage the fins, and should not be used.

6.3.3 BG/C/D/HP/TV SERIES Gas Passages

These heat exchangers may require disassembly for cleaning. See Section 6.2 for disassembly instructions. Once access is obtained, the cleaning options described in Section 6.3.2 can be used.

6.3.4 BG/C/D/HP/LC/TV SERIES Fluid Passages

An appropriate solvent or cleaner compatible with the tube material can be circulated through the internal core tubes to attempt to restore a fouled heat exchanger to its original capacity.

6.4 FREEZING PROTECTION – BG/C/D/HP/LC/TV SERIES

6.4.1 Drainable Circuits

If the heat exchanger is equipped with a drainable tube circuit, the tubes can be drained by simply opening the service inlet and outlet to atmosphere. These units should be installed with a slight slope toward the service connection end to facilitate complete drainage.

6.4.2 Non-trapped Circuits

These tube circuits run horizontally and downward across the exchanger. If the exchanger is installed level, when the service inlet and outlet are opened to atmosphere, the service fluid may drain out of the low connection sufficiently to prevent freezing damage. If the exchanger is installed out of level, some service fluid will hang up in the now trapped points of the core. In this case, antifreeze should be added as discussed on the following page.

6.4.3 Trapped Circuits

These circuits run downward and upward, like the trap under a sink, and therefore are not drainable. Antifreeze should be added as discussed below.

Antifreeze should be added to the core to provide freezing protection, per the following procedure.

1. Open the water inlet and outlet to atmosphere and allow the core to drain as completely as possible.

2. Add antifreeze to the core and circulate the solution through the core for approximately fifteen minutes.

3. Check the concentration for adequate freeze protection for your area. If the concentration is not sufficient, repeat steps 1 & 2 as necessary.

7.0 SPARE PARTS

7.1 BG/C/D/HP/TV SERIES

Typically, no spare parts are recommended. Any special parts or accessories would be noted on the data sheet, certified drawing, or on accompanying documentation.

Please note that the manufacturing and shipping time for replacement cores is often 6 weeks. If this length of downtime would present a significant problem, it is advisable to stock a spare core.

7.2 AA/LC SERIES

A spare electric motor is recommended. Similar to the BG/C/D/HP/TV Series above, any special parts would be noted on a case by case basis.

7.3 HR SERIES

Typically, no spare parts are recommended. Similar to the BG/C/D/HP/TV Series above, any special parts would be noted on a case by case basis.

8.0 LIMITED WARRANTY

8.1 LIMITED WARRANTY PERIOD

The sooner of either:

- 12 months from date of start-up
- 18 months from date of shipment from Xchanger

8.2 TERMS

Xchanger warrants only to the original non-consumer Customer during the Limited Warranty Period that the Product will be free from defects in material and workmanship under intended use and service.

Provided our examination shows the item to be defective, Xchanger, at its exclusive option, will repair the defective Product at our facility, provide a replacement Product, or refund 100% of Xchanger's original selling price. In order to make use of Xchanger's Limited Warranty, the Customer must have delivered the Product to our facility at the Customer's expense. Under no circumstances should the allegedly defective Product be returned unless the Customer has written permission from Xchanger to do so.

The part or parts must have been used as intended and in accordance with our instructions. No allowance will be made for repairs or alterations made without the written consent of an Xchanger representative.

8.3 DISCLAIMER OF IMPLIED AND OTHER WARRANTIES

THE PRECEDING EXPRESS LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY PROVIDED BY XCHANGER, WITH RESPECT TO THE PRODUCT, IN LIEU OF ALL OTHER REPRESENTATIONS AND WARRANTIES, EXPRESS OR IMPLIED. XCHANGER PROVIDES NO REPRESENTATION OR WARRANTY OF MERCHANTABILITY OR FITNESS OF THE PRODUCT FOR A PARTICULAR PURPOSE.

While Xchanger may assist the Customer with Product selection or provide opinions with regard to a proposed application, Xchanger does not assume any responsibility for suitability of the Customer's Product with respect to the proposed application, operating environment, or the Customer's methods or system design. The Customer is solely responsible for making the determination that an Xchanger Product is suitable for the Customer's application and any associated requirements.

8.4 LIMITATIONS ON LIABILITY

The Limited Warranty is provided only to the original non-consumer purchaser of the Product and not to any subsequent owners or users. The Limited Warranty does not cover performance degradation or damages resulting from plugging, fouling, improper installation, improper handling, failure to adhere to applicable instructions, erosion, corrosion, freezing, water hammer, system induced metal fatigue, misuse, neglect, alteration, accident, operating at temperatures or pressures in excess of those for which the equipment was specified and furnished or any other reason not related to defects in material or workmanship of the Product.

The liability of Xchanger is limited to our option of the repair, replacement, or refund of any Product which has been found defective by our examination after it has been returned F.O.B. our factory. Such repair, replacement, or refund shall constitute the extent of our obligation.

In the event that Xchanger manufactures a Product based on information provided by the Customer or on the Customer's behalf and such information is inaccurate or excludes relevant facts necessary to offering a Product selection including, but not limited to, those pertaining to operating, design, and environmental conditions, then Xchanger will not have any responsibility to the Customer under this Limited Warranty or otherwise.

XCHANGER'S LIABILITY ON ANY CLAIM OF ANY KIND RESULTING FROM ANY CAUSE WHATSOEVER, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FOR ANY LOSSES OR DAMAGES ASSOCIATED WITH AN ORDER OR WITH THE PERFORMANCE, OPERATION, OR USE OF A PRODUCT ASSOCIATED WITH AN ORDER SHALL UNDER NO CIRCUMSTANCES EXCEED THE PRICE ALLOCABLE TO THE EQUIPMENT OR UNIT THEREOF WHICH GIVES RISE TO THE CLAIM AND SHALL TERMINATE THE SOONER OF EITHER 1 YEAR AFTER THE COMPLETION OF INSTALLATION OF THE EQUIPMENT OR 18 MONTHS AFTER THE SHIPMENT OF THE EQUIPMENT FROM XCHANGER'S FACILITY. XCHANGER WILL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR REVENUE, LOSS OF USE OF THE EQUIPMENT OR ANY ASSOCIATED EQUIPMENT, COST OF CAPITAL, COST OF SUBSTITUTE EQUIPMENT, FACILITIES OR SERVICES, DOWNTIME COSTS, OR CLAIMS OF SUBSEQUENT OWNERS FOR SUCH DAMAGES.

Motors, controls, accessories, instruments, and other purchased parts are warranted by their original manufacturers. Such warranties will be carried out in accordance with the usual terms thereof.

UPON DELIVERY

Upon receipt of your motor, visually inspect it for damage that may have occurred in shipment or storage. Turn the shaft manually to be sure that it runs freely, and check the nameplate data to be sure that specifications are in accordance with your order.

MOTOR CONTROL DEVICES

Use of a suitable motor starter, either manual or magnetic, incorporating thermal overload protection is advisable and usually required by local electrical codes. Power supply must have fuses or circuit breakers to provided short circuit protection for the motor and controller. Follow the control manufacturer's recommendations on overload heater selection or setting. If an existing controller is to be used with a replacement motor, new heaters may be required.

MOTOR MOUNTING

Motor must be securely fastened to a rigid, flat surface to prevent vibration and minimize noise. For secure mounting use high-quality bolts of the largest possible diameter. Belt-drive sheaves must be in-line. Use a straight edge to check. Do not over-tighten belts. Direct-coupled installations require a careful check of shaft and coupling alignment, shaft offset and/or angular misalignment should be less than .002". Shim motor bases as necessary. Do not depend on a flexible coupling to compensate for misalignment.

TO REDUCE MAINTENANCE REQUIREMENTS

To reduce maintenance requirement and extend motor life, protect your motor from:

1. Excessive moisture;
2. Excessive dirt which can reduce cooling effectiveness;
3. Overheating due to ambient temperature in excess of 40ºC
4. Inaccessible position that makes regular maintenance difficult.

CONNECTING POWER TO MOTOR

To connect motor for proper voltage and rotation, refer to the connection diagram on the nameplate or inside the terminal/conduit box.

ELEKTRIM MOTORS
2015 S. Mitchell Blvd., Schaumburg, IL 60193
855-Go-Elektrim or 847-524-1074 | Fax 847-524-9996
www.elektrimmotors.com | support@elektrimmotors.com

40 YEARS OF MANUFACTURING EXCELLENCE

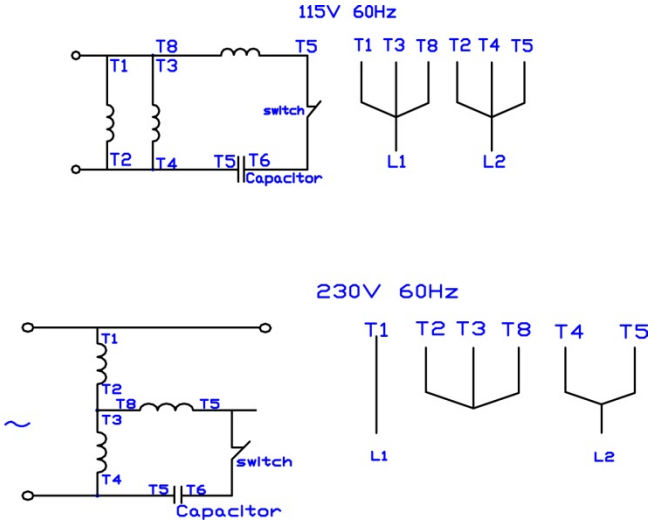
Elektrim® Motors

56C FRAME 1PH AND 3PH MOTOR T-FRAME STAINLESS STEEL INSTALLATION AND MAINTENANCE INSTRUCTIONS

The purpose of this booklet is to help you install, operate and maintain ELEKTRIM Motors to assure that you will get full advantage of their built-in efficiency and reliability. Following the recommended installation and maintenance procedures will extend the service life of the motor and minimize downtime.

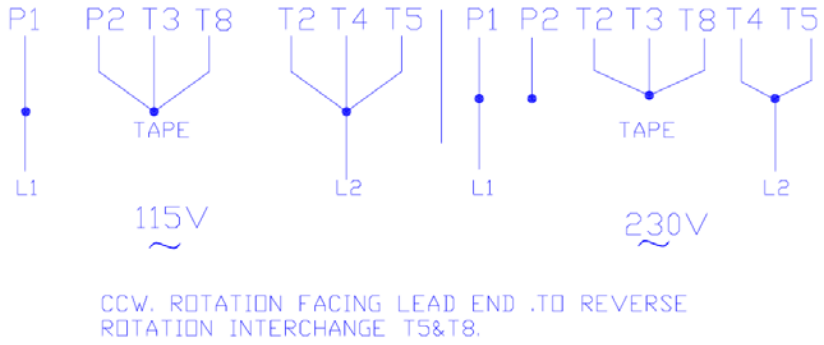
Carefully read and fully understand the Owner's Manual prior to installation, operation and maintenance of your motor.

WIRING DIAGRAM FOR 1 PHASE-CAPACITOR STARTING WITHOUT THERMAL PROTECTION 115/230V ONLY

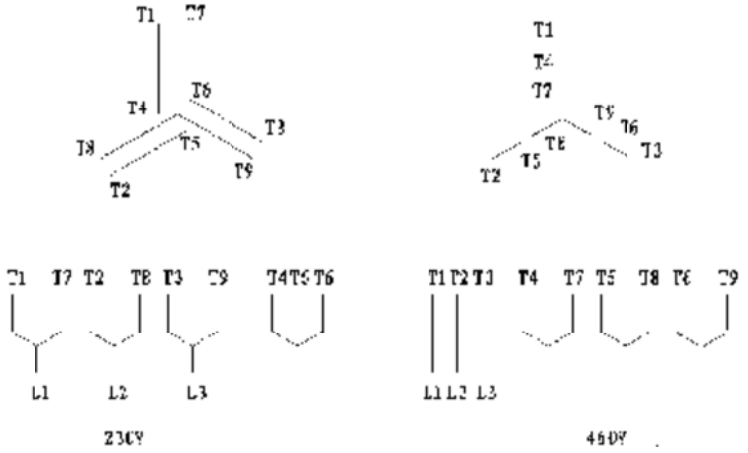


NOTE: 1) CCW rotation facing lead end as shown. 2) Interchange T5&T8 for CW facing lead end.

WIRING DIAGRAM FOR 1 PHASE-CAPACITOR STARTING WITH THERMAL PROTECTION 115/230V ONLY

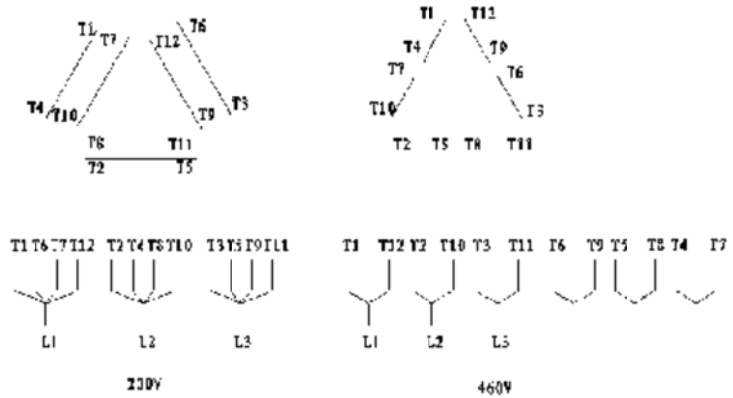


WIRING DIAGRAM FOR 3 PHASE MOTOR (UP TO 5HP) 230/460V ONLY



NOTE: 1) Connect lead L1-L2-L3 to line. 2) To reverse rotation interchange any two line lead.

WIRING DIAGRAM FOR 3 PHASE MOTOR (7.5HP and up) 230/460V ONLY



NOTE: 1) Connect lead L1-L2-L3 to line. 2) To reverse rotation interchange any two line lead.

POWER SOURCE

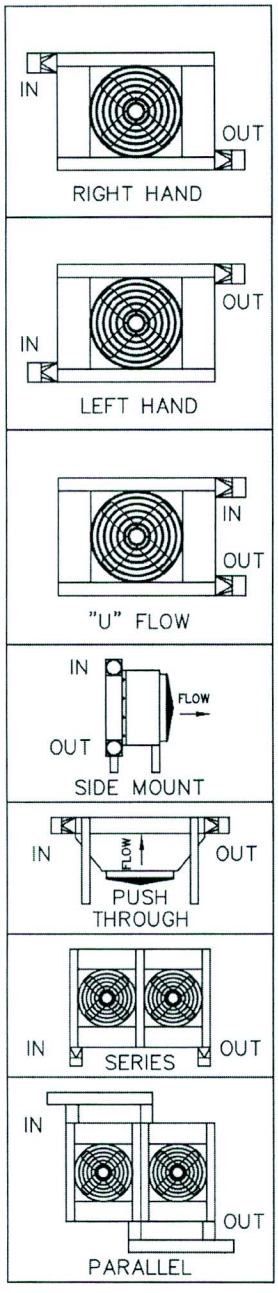
Voltage, frequency and phase of the power supply must correspond to that shown on the motor nameplate. Low voltage can reduce performance and cause overheating. Line voltages on all three lines should be balanced within 1%. Unbalanced voltages cause motor overheating and poor performance.

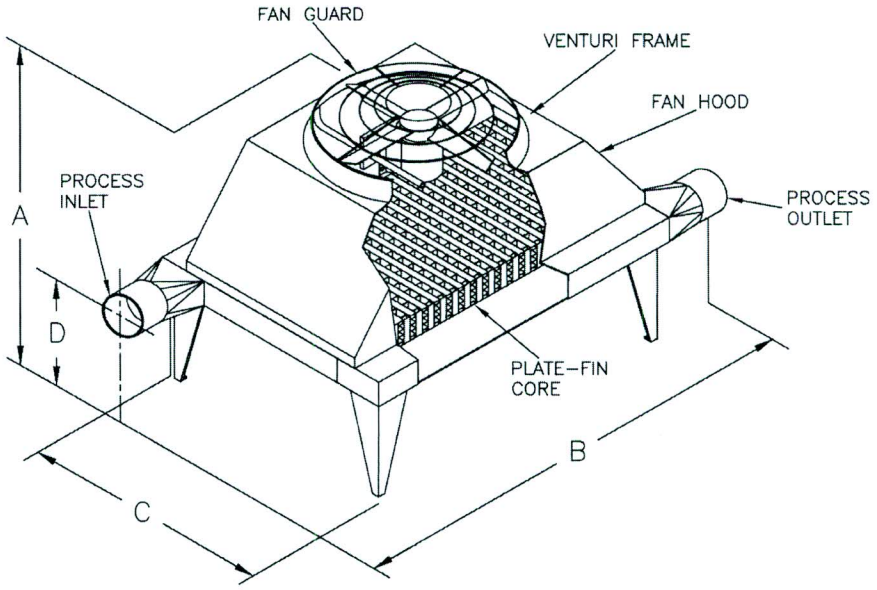
INDUSTRIAL HEAT EXCHANGERS
XCHANGER

1401 7th STREET S.
HOPKINS, MN 55343
952-933-2559
XCHANGER.COM

AA Series Heat Exchanger

AA Series exchangers cool low pressure air streams using fan-drafted ambient air. Air flows to 3,500 CFM from vacuum to 75 PSI can be cooled near ambient, with under 0.2 PSI pressure loss. AA Series exchangers are ideal for installation outdoors where cooling water is unavailable or undesirable due to freezing temperatures. Indoor installations should be well ventilated. The process air should be filtered and pulsating flow, such as that produced by rotary lobe blowers, should be dampened by a chambered silencer prior to entering the heat exchanger.





SEE LINE #55 OF DATA SHEET FOR APPROXIMATE DIMENSIONS

Design Options:

- Connection types: tube, pipe, flange, NPT, ferrule, etc
- Materials of construction:
  Core: aluminum (others available with our LC series)
  Propeller, venturi, and shroud: aluminum, painted, galvanized, or stainless steel
- Motors: any available
- Epoxy phenolic coating for corrosion protection of the core
- Units can be built to required dimensions
- Multiple cores combined together to make a single unit

Accessories:

• Instrument Coupling	$ 60
• Thermometer (Includes Coupling)	$ 90
• Differential Pressure Gauge	$ 280
• Service side filters	Ask
• Others available upon request	

Xchanger, Inc. **Rating for Model AA-1000 ref #126480**

Engineer: Patrick Casey — February 8, 2016

Prepared for:

Hydra Flow West

PERFORMANCE	**HOT SIDE**	**COLD SIDE**
Fluid Circulated	Air	Air
Volumetric Flow Rate	932.0 Std. ft^3/min	5,449.4 Std. ft^3/min
Total Fluid Entering	4,194.1 lb/hr	24,523.3 lb/hr
Liquid		
Vapor		
Non-Condensibles	4,194.1 lb/hr	24,523.3 lb/hr
Vaporized or (Cond.)		
Temperature In	230.0 °F	95.0 °F
Temperature Out	107.6 °F	116.0 °F
Inlet Pressure (Absolute)	23.696 lb/in^2	14.696 lb/in^2
Velocity (Standard)	2,538 ft/min	1,287 ft/min
Pressure Loss	0.19 lb/in^2	0.02 lb/in^2
Fouling Factor	0.0001 ft^2-°F-hr/BTU	0.0001 ft^2-°F-hr/BTU

Total Heat Exchanged: 123,272 BTU/hr

AVERAGE MEDIA PROPERTIES		
Thermal Conductivity	0.017 BTU/hr-ft-°F	0.016 BTU/hr-ft-°F
Specific Heat	0.240 BTU/lb-°F	0.240 BTU/lb-°F
Viscosity	0.050 lb/ft-hr	0.046 lb/ft-hr
Density (MW)	(29.0)	(29.0)
Latent Heat of Vapor		

CONSTRUCTION		
Design Temperature	250 °F	Not Applicable
Design Pressure (Gauge)	15 lb/in^2	Not Applicable
Test Pressure (Gauge)	15 lb/in^2	Not Applicable
Cyclic Pressure	No	Not Applicable
Flow Direction	Right Hand Horizontal	Vertical Up/Pull Through
Passes	One	One
Coating	None	None

Plate-Fin Core	: Aluminum	Fan Hood	: Galvanized Steel
Fan Guard	: Coated Carbon Steel	Venturi Frame	: Galvanized Steel
Drawing Number	:	Weight	: 250 lb

CONNECTIONS

Process Inlet : 6 inch dia. tube stub
Process Outlet : 6 inch dia. tube stub
Instrument :

MECHANICAL EQUIPMENT

Fan Diameter	: 24 inch	Motor	: 2.00 HP TEFC
Fan Qty/Speed	: 1 / 1725 RPM	Motor Qty/Speed	: 1 / 1725 RPM
Fan Type	: 4 Blade Mill Galv. St	Motor Electrical	: 208-230/460/3/60

NOTES

Approximate unit dimensions (inches): A = 35, B = 66, C = 36, D = 16
Construction material suitability must be determined by customer.
The process flow must be uniform, smooth and free of pulsation.
This unit is not designed for cycling process gas pressure.
A motor access panel is included in the fan hood.

FOR APPROVAL

FABRICATION WILL NOT PROCEED UNTIL PRINTS ARE APPROVED

- [x] APPROVED – PROCEED
- [ ] APPROVED AS NOTED – PROCEED
- [ ] NOT APPROVED – RESUBMIT

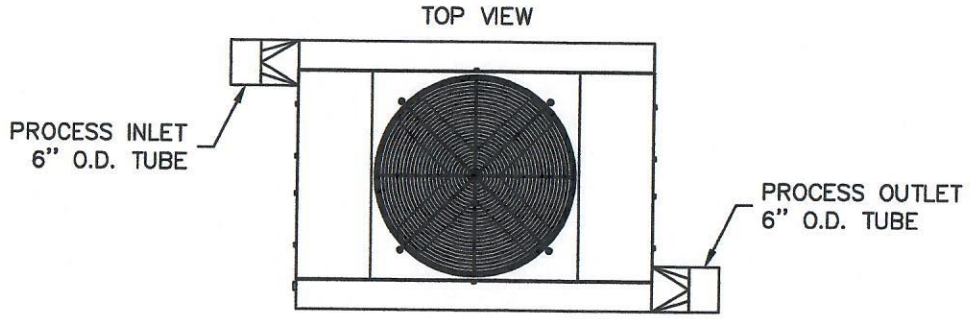
BY BRINSON DATE 2/15/16

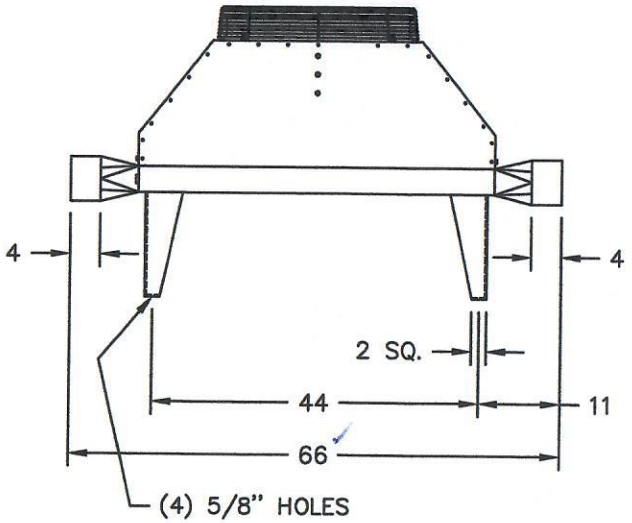
PERFORMANCE AND CONSTRUCTION PER DATA SHEET #126480
QUANTITY OF – 3 – REQUIRED

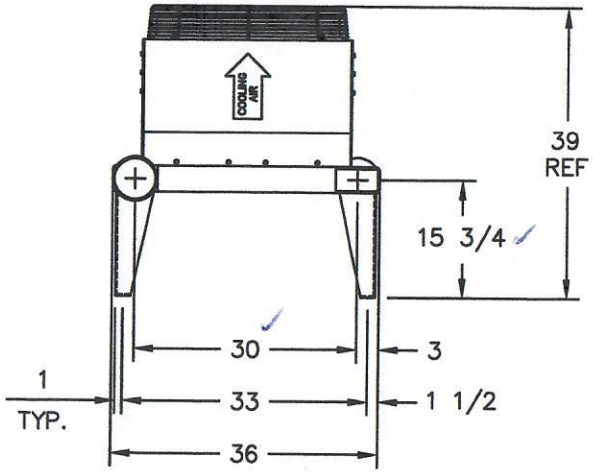
INDUSTRIAL HEAT EXCHANGERS XCHANGER

Xchanger, Inc. / 952-933-2559
IOM Manual: xchanger.com
Made in the U.S.A.

CUSTOMER	Hydro Flow West		
CUSTOMER P.O.	00051115		
MODEL NUMBER	AA–1000	P/N	53470
SERIAL NUMBER	0216–B15362		







TOLERANCES (UNLESS OTHERWISE NOTED)		INDUSTRIAL HEAT EXCHANGERS XCHANGER 1401 SOUTH 7TH ST HOPKINS, MN 55343		MODEL AA–1000 HEAT EXCHANGER ASSEMBLY			
DECIMAL ± .25	FRACTIONAL ± 1/4	DRAWN BY: MHA ENGINEER: POC	SCALE: NONE DATE: 02/11/16	JOB NUMBER B15362	SHEET 1 OF 1	DRAWING NUMBER 53470	REV.

Xchanger, Inc. **Rating for Model AA-1000 ref #126480**

Engineer: Patrick Casey

Prepared for: February 8, 2016

Hydra Flow West

PERFORMANCE	**HOT SIDE**	**COLD SIDE**
Fluid Circulated	Air	Air
Volumetric Flow Rate	932.0 Std. ft^3/min	5,449.4 Std. ft^3/min
Total Fluid Entering	4,194.1 lb/hr	24,523.3 lb/hr
Liquid		
Vapor		
Non-Condensibles	4,194.1 lb/hr	24,523.3 lb/hr
Vaporized or (Cond.)		
Temperature In	230.0 °F	95.0 °F
Temperature Out	107.6 °F	116.0 °F
Inlet Pressure (Absolute)	23.696 lb/in^2	14.696 lb/in^2
Velocity (Standard)	2,538 ft/min	1,287 ft/min
Pressure Loss	0.19 lb/in^2	0.02 lb/in^2
Fouling Factor	0.0001 ft^2-°F-hr/BTU	0.0001 ft^2-°F-hr/BTU

Total Heat Exchanged: 123,272 BTU/hr

AVERAGE MEDIA PROPERTIES		
Thermal Conductivity	0.017 BTU/hr-ft-°F	0.016 BTU/hr-ft-°F
Specific Heat	0.240 BTU/lb-°F	0.240 BTU/lb-°F
Viscosity	0.050 lb/ft-hr	0.046 lb/ft-hr
Density (MW)	(29.0)	(29.0)
Latent Heat of Vapor		

CONSTRUCTION		
Design Temperature	250 °F	Not Applicable
Design Pressure (Gauge)	15 lb/in^2	Not Applicable
Test Pressure (Gauge)	15 lb/in^2	Not Applicable
Cyclic Pressure	No	Not Applicable
Flow Direction	Right Hand Horizontal	Vertical Up/Pull Through
Passes	One	One
Coating	None	None

Plate-Fin Core	: Aluminum	Fan Hood	: Galvanized Steel
Fan Guard	: Coated Carbon Steel	Venturi Frame	: Galvanized Steel
Drawing Number	:	Weight	: 250 lb

CONNECTIONS

Process Inlet : 6 inch dia. tube stub

Process Outlet : 6 inch dia. tube stub

Instrument :

MECHANICAL EQUIPMENT

Fan Diameter	: 24 inch	Motor	: 2.00 HP TEFC ✓
Fan Qty/Speed	: 1 / 1725 RPM	Motor Qty/Speed	: 1 / 1725 RPM ✓
Fan Type	: 4 Blade Mill Galv. St	Motor Electrical	: 208-230/460/3/60 ✓

NOTES

Approximate unit dimensions (inches): A = 35, B = 66, C = 36, D = 16

Construction material suitability must be determined by customer.

The process flow must be uniform, smooth and free of pulsation.

This unit is not designed for cycling process gas pressure.

A motor access panel is included in the fan hood.

2/15/16

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THERMOCOUPLES AND TRANSMITTERS

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(562) 695-2323 (fax)
la.sales@mcmaster.com
Text 75930

Thermocouple Connector

Round-Pin Male, Screw Terminal, Type K, 400°F Maximum

Type	K
Connection Type	Round Pin
Connection Gender	Male
Number of Connections	1
For Maximum Wire Gauge	14
Maximum Temperature	400° F
Wire Connection Type	Screw Terminals
Color	Yellow
Pin Length	9/16"
Distance Between Pins	0.438"
Material	
Body	Plastic
Contact	Nickel

Add these connectors to thermocouple wire for easy attachment to thermometers and control panels.

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Text 75930

Thermocouple Probe for Liquids and Gases

Type K, 32° to 900°F, 6" Length x 1/4" Diameter Probe

Type	K
Temperature Range	32° to 900° F
Probe	
Length	6"
Diameter	1/4"
Accuracy	±0.75%
Response Time	Not Rated
Cable Length	4 ft.
For Use With	Liquids, Gases
Connection Type	Wire Leads
Sensor Type	Grounded
Cable Material	Fiberglass
Probe Material	Stainless Steel
Maximum Cable Temperature	900° F
Wire	
Lead Length	1 3/4"
Gauge	20

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(562) 695-2323 (fax)
la.sales@mcmaster.com
Text 75930

Thermocouple Connector

Round-Pin Female, Screw Terminals, Type K, 400°F Maximum

Type	K
Connection Type	Round Pin
Connection Gender	Female
Number of Connections	1
For Maximum Wire Gauge	14
Maximum Temperature	400° F
Wire Connection Type	Screw Terminals
Color	Yellow
Distance Between Pins	0.438"
Material	
Body	Plastic
Contact	Nickel

Add these connectors to thermocouple wire for easy attachment to thermometers and control panels.

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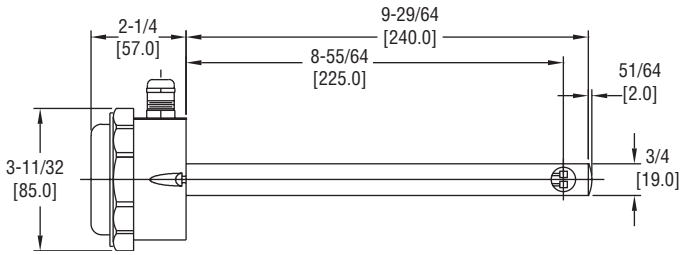
TRANSMITTERS

AVU-3-A

Series AVU Air Velocity Transmitter

Specifications - Installation and Operating Instructions



The Series AVU Air Velocity Transmitters from Dwyer Instruments are suitable for measuring air velocity within a duct and giving 4-20 mA or 0-10 V linear outputs. A typical application would be in a VAV air conditioning system.

The transmitters operate by measuring the heat loss from one of two sensing elements in the airstream and hence calculating the air velocity. The special design of these elements makes the transmitter accurate over the whole air velocity range and gives excellent immunity to drift.

The sensing elements are clad in metal ensuring a long service life and enabling the sensors to be cleaned easily.

INSTALLATION

Electromagnetic Compatibility

Series AVU Air Velocity Transmitters have built in immunity to electrical interference. However, to achieve full immunity meeting the standards described below, a screened cable must be used correctly. The cable screen must be earthed at the enclosure of the controller/power supply and connected to the screen inside the AVU casing using the procedure described on the back page. The inside of the transmitter and the sensing elements near the end of the probe must be protected from electrostatic discharge at all times.

EMC Standards:

Immunity: BS EN 50082-1: 1992
Emissions: BS EN 50081-1: 1992

SPECIFICATIONS

Service: Clean air and compatible, non-combustible gases.

Accuracy: ±5% of full scale.

Response Time (90%): 5 sec (typical).

Temperature Limits: 32 to 122°F (0 to 50°C).

Humidity Limit: 0-90% RH, non-condensing.

Power Requirements: -A models 24 VDC +10% -15%;
-V models 24 VDC or 24 VAC +10% - 15%.

Output Signal: -A models 4-20 mA current loop;
-V models 0-10 VDC.

Loop Resistance: (-A models) 700 ohms.

Current Consumption: 60 mA + output current.

Max. Start Up Current: 85 mA; 10 V.

Output Current Limit: (-V models) >10 mA.

Electrical Connections: Screw terminal. Cable gland for 4-8 mm wire (16 gauge wire).

Enclosure Rating: NEMA 6 (IP67) except sensing point.

Probe Dimensions: 9.45 x .75˝ (240 x 19 mm).

Mounting Orientation: Unit not position sensitive. Probe must be aligned with airflow.

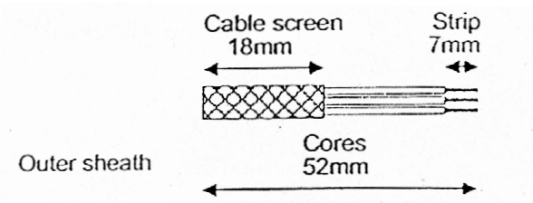
Weight: 8.8 oz (250 g).

Agency Approvals: CE.

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

Attaching the Cable and Cable Screen

The cable gland contains a rubber insert and a plastic insert. Remove these inserts. Strip back the cable as shown below. Pass the cable through the gland outer and rubber and plastic inserts. Fold the screen back over the plastic insert evenly taking care to remove any pieces of the screen that detach. Feed the cores through into the AVU and push the inserts back into the gland noting the orientation of the 3 pipes. Tighten the gland outer in place. Finally connect the cores to the removable 3-way connector.

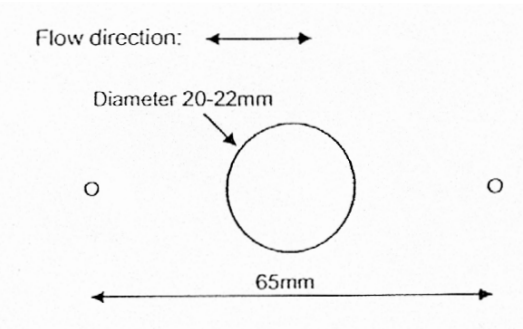


Duct Details

The Series AVU Air Velocity Transmitter will achieve its stated accuracy when mounted in a long straight circular duct with the sensing elements 0.242 radius in from the duct wall and the view through the large holes parallel to the flow direction (the flow at a point 0.242 radius in from the wall is close to the average flow through the whole duct section for a wide range of flows).

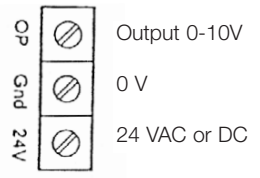
In less critical applications, it is recommended that it be mounted at least 6.6 feet (2 meters) downstream of any heating or cooling devices and at least 6 duct-diameters downstream of any bends or other flow disturbances. Deviation from ideal mounting is likely to reduce stability and accuracy but should not affect repeatability. In many HVAC applications, simply screwing directly to the duct and sealing with the gasket supplied will suffice.

Mounting Hole Details

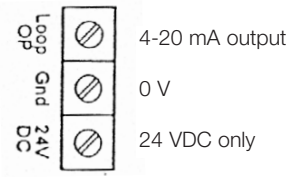


Connection Diagrams

For 0-10 VDC output versions



For 4-20 mA output versions



MAINTENANCE

The transmitter may read low if the sensing elements are very dirty. To clean the sensing elements, disconnect the transmitter from power and dip the end of the probe in water and swirl around. If necessary, use detergent but do not apply force to the elements. Rinse and allow to dry thoroughly before reconnecting power.

The body is dustproof and should not need cleaning. If cosmetic cleaning is required, use a damp cloth with water or isopropyl alcohol.

The Series AVU Air Velocity Transmitters are not field repairable 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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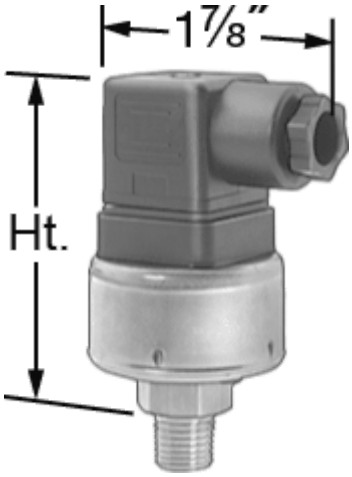
Pressure Transmitter

Standard, 4-20 MA Output, 1/4 NPT



Output Signal	4-20 mA
DC Voltage	8-30
Pipe Size	1/4
Height	2 3/8"
Pressure Range	0-15 psi, 0-25 psi, 0-50 psi, 0-60 psi, 0-100 psi, 0-200 psi, 0-300 psi, 0-500 psi, 0-1,000 psi, 0-1,500 psi, 0-3,000 psi, 0-5,000 psi, 0-10,000 psi
RoHS	Compliant

Get remote pressure monitoring for automated applications—transmitters convert pressure to an electrical signal. They have screw terminals with a DIN electrical connection. Housing is stainless steel. Temperature range is 32° to 176° F. All are CE approved.

To Order: Select pressure range from the chart.

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ADDITIONAL ITEMS

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40' HIGH CUBE CONTAINER

COMPRESSOR DESIGN AND SERVICES, INC.

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40' HIGH CUBE CONTAINER - ONE TRIP STEEL FLOORS

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- 8' Width
- 40' Long
- 2,694 Cubic Feet
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- Traditional Cargo Doors

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EXHAUST AND LOUVER SYSTEM

FIXED LOUVERS

HVAC/R fact sheet

FIXED INTAKE/EXHAUST LOUVERS

Modular louvers provide good protection from rain and weather at an economical price. The channel frame is 4" deep with K-style non-drainable 45 degree blades. Available in Aluminum or Galvaneal and comes standard with a birdscreen on the back.

Single Panel Sizes – 12"W x 12"H to 48"W x 72"H

4FZG4

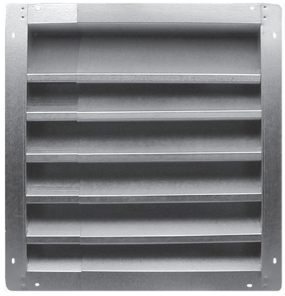
OUTSIDE H (In.)	OUTSIDE W (In.)	MIN. WALL OPENING (In.)	GALVANEALED STEEL ITEM NO.	ALUMINUM ITEM NO.
17 1/2	17 1/2	18H x 18W	**4FZG3**	**4FZF3**
23 1/2	23 1/2	24H x 24W	**4FZG4**	**4FZF4**
23 1/2	35 1/2	24H x 36W	**4FZG7**	**4FZF7**
29 1/2	29 1/2	30H X 30W	**4FZG6**	**4FZF6**
35 1/2	23 1/2	36H X 24W	**4FZG5**	**4FZF5**

OUTSIDE H (IN.)	OUTSIDE W (IN.)	MIN. WALL OPENING (IN.)	GALVANEALED STEEL ITEM NO.	ALUMINUM ITEM NO.
35 1/2	35 1/2	36H X 36W	**4FZG8**	**4FZF8**
35 1/2	47 1/2	36H X 48W	**4FZH1**	**4FZG1**
47 1/2	35 1/2	48H X 36W	**4FZG9**	**4FZF9**
47 1/2	47 1/2	48H X 48W	**4FZH2**	**4FZG2**

FIXED-HEIGHT ADJUSTABLE-WIDTH INTAKE/EXHAUST LOUVERS

Adjustable-Width Louvers are a unique design that provides good protection from rain and weather but also gives you the flexibility to adjust the louver width during installation. The height remains fixed while the width can be adjusted to your opening size. The frame is 4" deep with 2" flanges and utilizes J-style non-drainable 45 degree blades. Available in Aluminum or Galvanized Steel and comes standard with a birdscreen.

Single Panel Sizes - 12"W x 14"H to 48"W x 48"H



4F422

OUTSIDE H (IN.)	OUTSIDE W (IN.)	MIN. WALL OPENING (IN.)	GALVANIZED STEEL ITEM NO.	ALUMINUM ITEM NO.
18	16 TO 22	14H X 12W	**4F421**	**4F951**
18	28 TO 46	14H X 24W	**2FTV2**	**2FTV4**
22	22 TO 28	18H X 18W	**3C972**	**4F952**
22	28 TO 46	18H X 24W	**2FTV5**	**2FTV9**
28	22 TO 34	24H X 18W	**3C973**	**4F953**
28	40 TO 52	24H X 36W	**2FTY1**	**2FTX2**

OUTSIDE H (IN.)	OUTSIDE W (IN.)	MIN. WALL OPENING (IN.)	GALVANIZED STEEL ITEM NO.	ALUMINUM ITEM NO.
34	25 TO 40	30H X 21W	**4F422**	**4F954**
40	28 TO 40	36H X 24W	**3C974**	**4F955**
40	40 TO 52	36H X 36W	**3C975**	**4F956**
46	28 TO 46	42H X 24W	**4F423**	**4F957**
52	28 TO 40	48H X 24W	**3C976**	**4F958**
52	40 TO 52	48H X 36W	**3C977**	**4F959**

DRAINABLE BLADE FIXED INTAKE/EXHAUST LOUVERS

Drainable Blade Louvers offer excellent resistance to rain and weather. The drainable blade design channels water away from the blades and down the jambs. This eliminates water cascading from blade to blade. The channel frame is 4" deep with drainable 45 degree blades. This model is only available in extruded aluminum and comes standard with a birdscreen on the back. A 1-1/2" Flanged Frame Kit is available as an optional accessory.

Single Panel Sizes - 12"W x 12"H to 60"W x 96"H

5NKJ3

OUTSIDE H (IN.)	OUTSIDE W (IN.)	MIN. WALL OPENING (IN.)	ALUMINUM ITEM NO.
11 1/2	11 1/2	12H X 12W	**45C669**
17 1/2	17 1/2	18H X 18W	**5NKJ2**
23 1/2	23 1/2	24H X 24W	**5NKJ3**
23 1/2	35 1/2	24H X 36W	**5NKJ6**
29 1/2	29 1/2	30H X 30W	**5NKJ5**
35 1/2	23 1/2	36H X 24W	**5NKJ4**
35 1/2	35 1/2	36H X 36W	**5NKJ7**

OUTSIDE H (IN.)	OUTSIDE W (IN.)	MIN. WALL OPENING (IN.)	ALUMINUM ITEM NO.
35 1/2	47 1/2	36H X 48W	**5NKJ9**
41 1/2	41 1/2	42H X 42W	**45C678**
47 1/2	35 1/2	48H X 36W	**5NKJ8**
47 1/2	47 1/2	48H X 48W	**5NKK0**
53 1/2	53 1/2	54H X 54W	**45C670**
59 1/2	59 1/2	60H X 60W	**45C671**

Call or visit your local branch or go to **grainger.com/dayton** for complete product line information.

COMBINATION LOUVER DAMPERS

Combination Fixed and Adjustable Blade Louvers offer superior resistance to rain and weather while also offering you the ability to completely close the opening off if needed. The channel frame is 4" deep with drainable 45 degree fixed blades in the front with adjustable blades with seals for tight shutoff in the back all within one frame. The adjustable rear blades are operated with a thumb screw. This model is only available in extruded aluminum and comes standard with a birscreen on the back. A 1-1/2" Flanged Frame Kit is available as an optional accessory.

Single Panel Sizes - 12"W x 12"H to 60"W x 96"H.

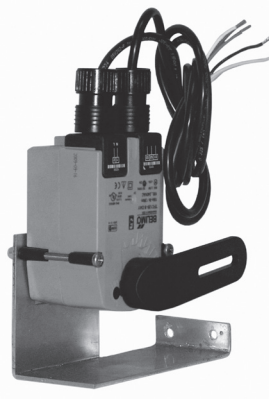
OUTSIDE H (IN.)	OUTSIDE W (IN.)	MIN. WALL OPENING (IN.)	ALUMINUM ITEM NO.
11 1/2	11 1/2	12H X 12W	**45C672**
17 1/2	17 1/2	18H X 18W	**5NKH6**
23 1/2	23 1/2	24H X 24W	**5NKH7**
23 1/2	35 1/2	24H X 36W	**45C680**
29 1/2	29 1/2	30H X 30W	**5NKH8**
35 1/2	23 1/2	36H X 24W	**45C679**
35 1/2	35 1/2	36H X 36W	**5NKH9**

OUTSIDE H (IN.)	OUTSIDE W (IN.)	MIN. WALL OPENING (IN.)	ALUMINUM ITEM NO.
35 1/2	47 1/2	36H X 48W	**45C682**
41 1/2	41 1/2	42H X 42W	**5NKJ0**
47 1/2	35 1/2	48H X 36W	**45C681**
47 1/2	47 1/2	48H X 48W	**5NKJ1**
53 1/2	53 1/2	54H X 54W	**45C673**
59 1/2	59 1/2	60H X 60W	**45C674**

5NKH7 (rear view)

OPTIONAL MOTOR KIT FOR COMBINATION LOUVERS

This is an optional 100-240 VAC 50/60 Hz power open spring return motor kit with an end switch. The adjustable rear blades will return to the closed position in the event of loss of power. The motor kit comes pre-assembled for easy installation.



5NKP0

OPTIONAL 1-1/2" FLANGE KIT FOR DRAINABLE BLADE FIXED INTAKE/ EXHAUST LOUVERS AND COMBINATION LOUVER DAMPERS

FOR MIN. WALL OPENING	FLANGE KIT ITEM NO.	FOR USE WITH: DRAINABLE LOUVER	FOR USE WITH: COMBINATION LOUVER DAMPERS
12H X 12W	**45C675**	**45C669**	**45C672**
18H X 18W	**33W754**	**5NKJ2**	**5NKH6**
24H X 24W	**33W755**	**5NKJ3**	**5NKH7**
24H X 36W	**33W758**	**5NKJ6**	**45C680**
30H X 30W	**33W757**	**5NKJ5**	**5NKH8**
36H X 24W	**33W756**	**5NKJ4**	**45C679**
36H X 36W	**33W759**	**5NKJ7**	**5NKH9**
36H X 48W	**33W762**	**5NKJ9**	**45C682**
42H X 42W	**33W761**	**45C678**	**5NKJ0**
48H X 36W	**33W760**	**5NKJ8**	**45C681**
48H X 48W	**33W763**	**5NKK0**	**5NKJ1**
54H X 54W	**45C676**	**45C670**	**45C673**
60H X 60W	**45C677**	**45C671**	**45C674**

5NKJ3
(with optional flange)

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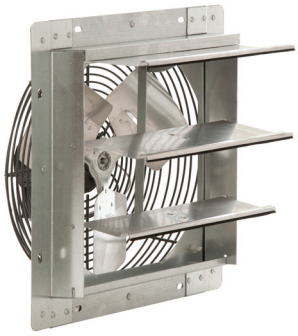
EXHAUST FANS

HVAC/R fact sheet

SHUTTER-MOUNT EXHAUST FANS

These easy-to-install, highly efficient exhaust fans have automatic shutters, making them ideal for use in ventilating retail stores, offices, factories, work shops, garages and farm buildings. They are shipped fully assembled with 115 Volt totally enclosed motors and an OSHA-compliant gray polyester powder-coated wire guards. UL and C-UL Listed.

PROPELLER DIA. (IN.)	CFM @ 0.000" SP	CFM @ 0.125" SP	MOTOR RPM	MOTOR HP	SQ. OPENING REQ. (IN.)	ITEM NO.
SPEED CONTROLLABLE						
7	140	–	1550	1/25	8-1/2	**1HKL9**
10	585	285	1550	1/25	10-1/2	**1HLA1**
12	800	470	1550	1/25	13	**1HLA2**
16	1095	720	1550	1/20	17	**1HLA3**
18	1860	850	1075	1/15	19	**1HLA4**
20	2830	2255	1100	1/4	21	**1HLA9**
24	3240	2485	1075	1/4	25	**1HLB3**
SINGLE-SPEED						
18	2590	2190	1725	1/4	19	**1HLA5**
20	2955	2450	1725	1/4	21	**1HLA8**
20	3635	3115	1725	1/3	21	**1HLA7**
24	3270	2515	1075	1/4	25	**1HLB2**
24	3970	3240	1075	1/3	25	**1HLB4**
30	6075	4195	825	1/3	31	**1HLB5**
36	8225	6480	825	1/2	37	**1HLB6**
TWO-SPEED						
24	3985/3760	3255/2995	1075	1/3	25	**1HLB1**

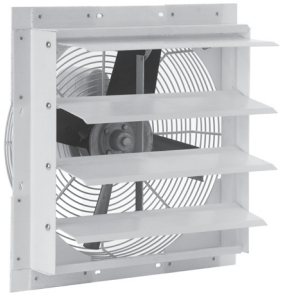


1HLA2

CORROSION-RESISTANT SHUTTER-MOUNT EXHAUST FANS

These easy-to-install exhaust fans are constructed with a fiberglass automatic shutter and frame with stainless steel hardware for superior resistance to corrosive gases and vapors. The propellers are fiberglass-reinforced polypropylene. They are shipped fully assembled with 115 Volt totally enclosed motors and an OSHA-compliant epoxy-coated wire guard. UL and C-UL Listed.

PROPELLER DIA. (IN.)	CFM @ 0.000" SP	CFM @ 0.125" SP	MOTOR RPM	MOTOR HP	SQ. OPENING REQ. (IN.)	ITEM NO.
10	524	379	1550	1/20	10-1/2	**1BLH6**
12	1100	799	1625	1/8	13	**1BLH8**
16	2005	1678	1625	1/6	17	**1BLJ1**
18	2790	1961	1075	1/4	19	**1BLJ3**
20	3642	2838	1075	1/3	21	**1BLJ5**
24	4876	4197	1075	1/2	25	**1BLJ7**

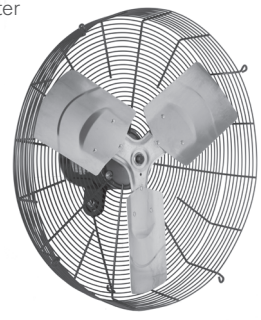


1BLJ1

GUARD-MOUNT EXHAUST FANS

Designed for low-pressure exhausting and cooling applications. Sturdy steel wire guards are OSHA-compliant with a gray polyester powder-coated finish with 4 mounting loops for easy installation. They are shipped fully assembled with 115 Volt totally enclosed motors. UL and C-UL listed.

PROPELLER DIA. (IN.)	CFM @ 0.000" SP	CFM @ 0.125" SP	MOTOR RPM	MOTOR HP	OUTSIDE DIA. (IN.)	ITEM NO.
7	230	–	1550	1/25	9-5/8	**1HKL2**
10	595	405	1550	1/25	11-11/16	**1HKL3**
12	820	535	1550	1/25	13-1/2	**1HKL4**
16	1060	585	1550	1/20	17-3/8	**1HKL5**
18	2515	1780	1725	1/4	20-13/16	**1HKL6**
20	2600	1685	1725	1/4	22-3/4	**1HKL7**
24	3840	2690	1075	1/3	26-7/8	**1HKL8**



1HKL4

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LIQUID STORAGE TANK

Norwesco 500 Gallon Plastic Water Storage Tank

500 Gallon Plastic Water Storage Tank

Part Number:	N-43101
Mfr. Part Number:	43101
Capacity:	500 Gallons
Dimensions:	48" dia. x 73"H
Weight:	94 lbs.
Ships From:	CA, GA, NY, OK, TX, UT, WA
PDF Drawing:	View Technical Drawing
Manufacturer:	Norwesco
Material:	Polyethylene
Warranty:	3 Years

500 Gallon Above Ground Potable Water Storage Tank

Made From: Food Grade Safe FDA Approved Polyethylene Plastic

Your 500 Gallon Water Tank Features:

- 16" Vented Manway
- 1 1/2" Female NPT Standard Threaded Bulkhead Inlet Fitting.
- 2" Female NPT Standard Threaded Bulkhead Outlet Fitting

Common Uses:

- Fresh Safe Potable Water Storage
- Emergency Water Storage
- Rainwater Collection Systems
- Garden Rainwater Collection Barrels

Colors:

- Black = Part # 43101
- Green = Part # 43103 (California Location Only)
- Green = Part # 43105

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CHECK VALVES

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Text 75930

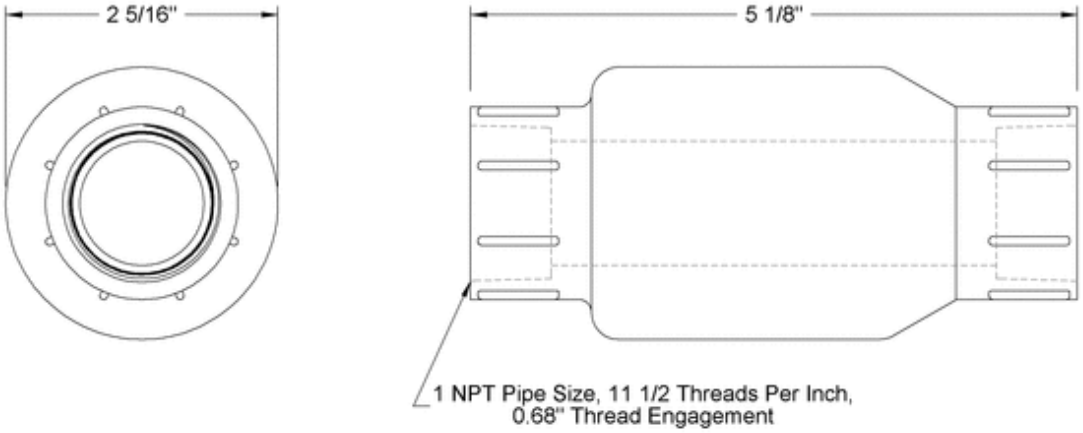
White PVC Check Valve for Drinking Water

High Flow, White, 1 NPT Female

Valve Function	Backflow Prevention
For Use With	Drinking Water
Activation	Pressure Driven
Connection Type	Pipe
Connection	Threaded NPT Female
Pipe Size	1
For Pipe Schedule	40
Maximum Pressure	150 psi @ 70° F
Minimum Opening Pressure	0.5 psi
Temperature Range	33° to 140° F
Shape	Straight
End-to-End Length	5 1/8"
Check Valve Type	Swing
Mounting Orientation	Horizontal, Vertical
Material	
Body	PVC
Seal	EPDM
Flow Coefficient (Cv)	Not Rated
Valve Type	Check
Specifications Met	NSF/ANSI Standard 61 for Drinking Water
Color	White

Prevent backflow in plastic pipelines for drinking water with these valves that meet NSF/ANSI Standard 61. They open to allow flow in one direction and close when flow stops or reverses.

Swing valves provide reduced resistance to flow in your pipeline.



McMASTER-CARR® CAD	PART NUMBER 45275K44
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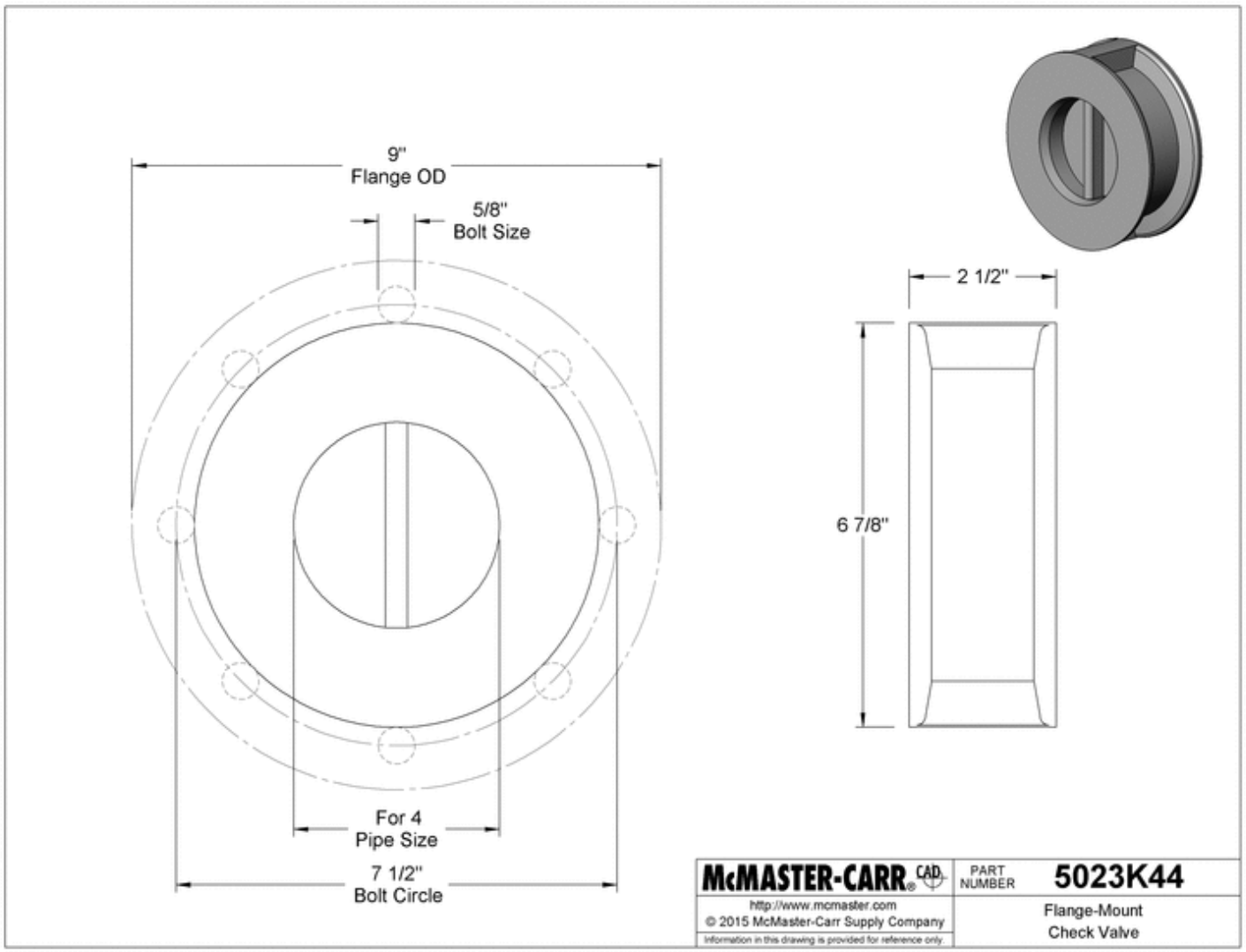
Cast-Iron Flange-Mount Check Valve

4 Pipe Size, Class 125 & Class 150 Flange

Valve Function	Backflow Prevention
For Use With	Air, Diesel Fuel, Gasoline, Inert Gas, Oil, Water
Activation	Pressure Driven
Connection Type	Pipe
Pipe Connection Type	Flanged
Pipe Size	4
Maximum Pressure	200 psi @ 70° F
Minimum Opening Pressure	1.25 psi
Temperature Range	-20° to 250° F
Shape	Straight
End-to-End Length	2 1/2"
Flange OD	9"
Bolts Included	No
Number of Bolt Holes	8
Bolt Hole Size	5/8"
Bolt Circle Diameter	7 1/2"
For Flange ANSI Class	125, 150
Mounting Orientation	Horizontal, Vertical
Material	
Body	Cast Iron
Seal	Buna-N
Valve Type	Check
Check Valve Type	Swing
Flow Coefficient (Cv)	340
Specifications Met	FM Approved

Sandwich these valves between two flanges for backflow prevention at a fraction of the weight of flanged backflow-prevention valves and a reduced pipeline footprint. They fit ANSI flanges of the same class and pipe size. All open to allow flow in one direction and close when flow stops or reverses.



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CLAMPS AND FITTINGS

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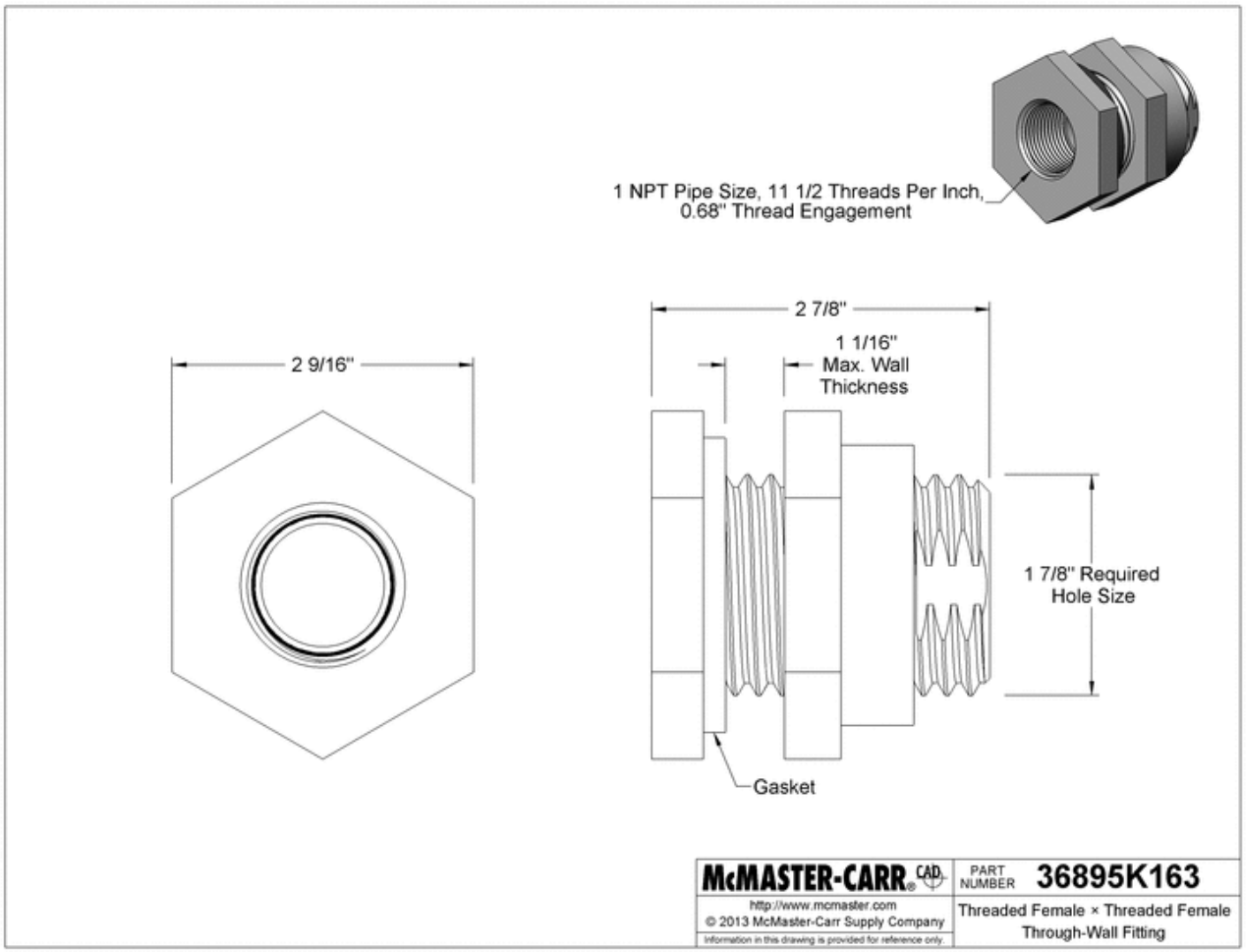
Through-Wall Fitting

PVC, NPT Female on Both Ends, 1 Pipe Size, 2-7/8" Long

Pipe Size	1
Wall Requirements	
Hole Size	1 7/8"
Maximum Thickness	1 1/16"
Length	2 7/8"
Maximum psi @ 72° F	150
Temperature Range	40° to 140° F
Additional Specifications	Cold Water PVC—Dark Gray Female NPT Threaded Ends

Mount these fittings through a hole in your wall, tank, or panel to serve as an inlet or outlet for faucets, pipes, and spigots. They're for use on curved and flat surfaces. Each comes with an EPDM gasket, except the PTFE fittings have an FEP-encapsulated silicone O-ring. They are vacuum rated to 29" Hg @ 72° F, except polyethylene and Type 316 stainless steel are not rated for vacuum.

Connections: NPT threaded or unthreaded socket end (female).



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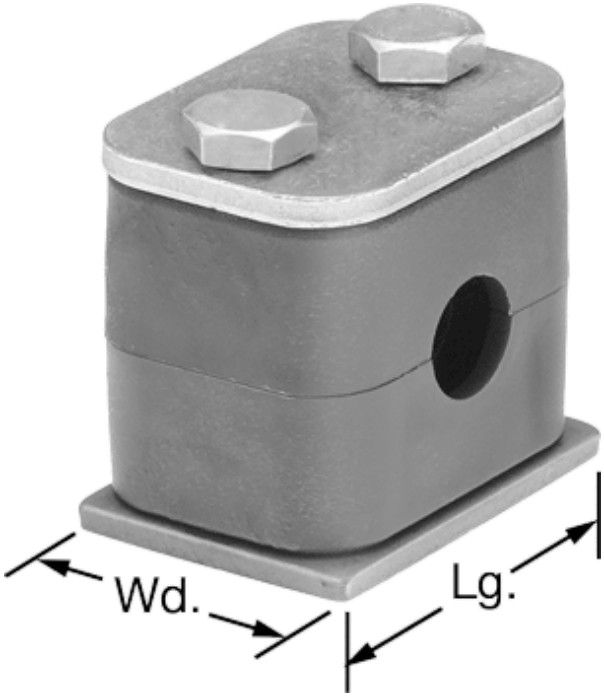
One Line Polypropylene Vibration-Damping Clamp

Weld-Mount, Zinc-Plated Steel Hardware, 1/2" ID

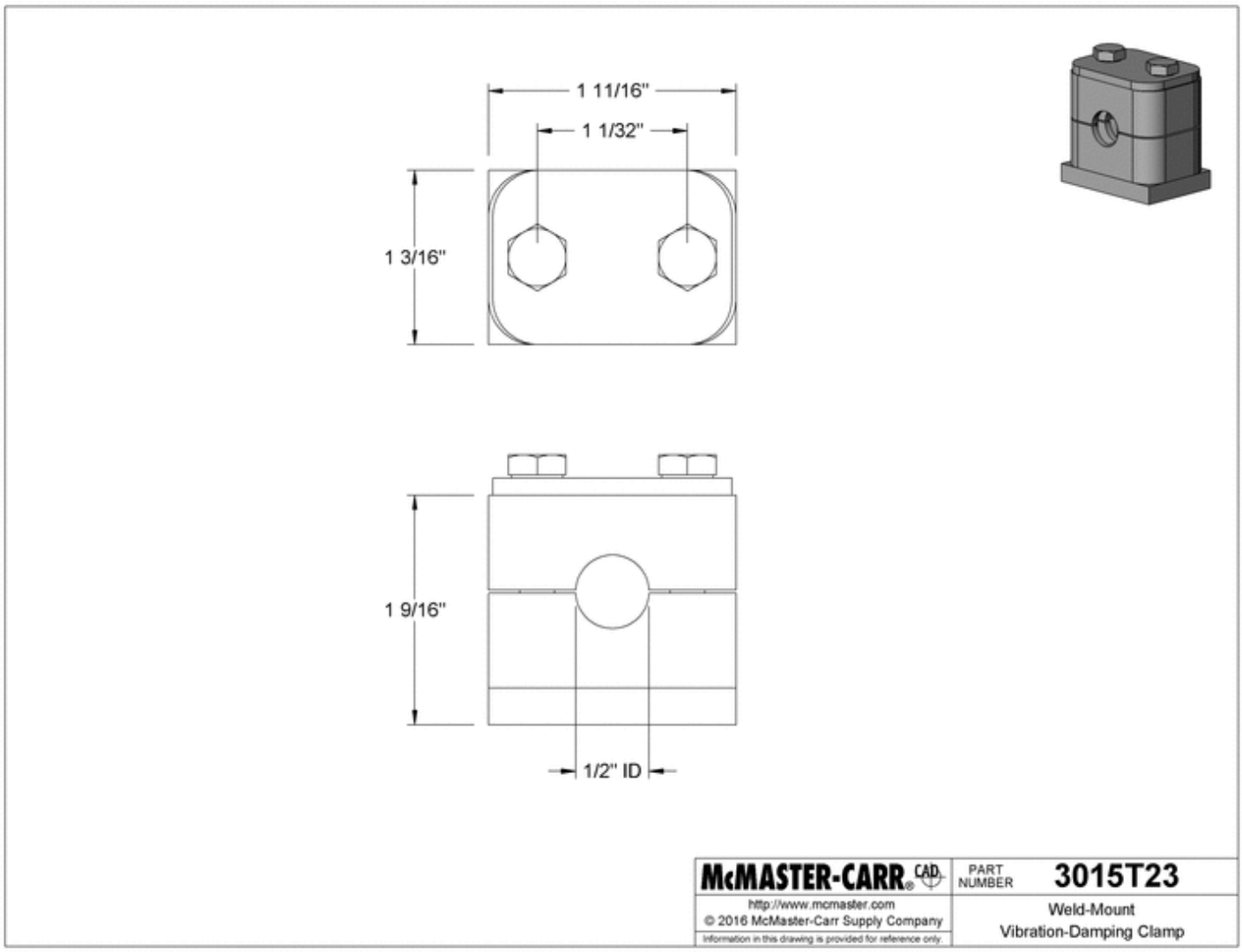


Clamp Material	Polypropylene
Number of Lines	One
For Maximum Pressure	2,000 psi
ID	1/2"
For Pipe Size	1/4
For Rigid Conduit Trade Size	1/4
For Copper Tube Size	3/8
Length	1 11/16"
Width	1 3/16"
Height	1 9/16"
Color	Green
Temperature Range	-20° to 190° F
Hardware Material	Zinc-Plated Steel
RoHS	Compliant

For a more secure connection than rail-mount clamps, weld the bottom plate of these clamps onto your rails. They fit tightly around pressurized lines in hydraulic systems to lessen vibration.

Zinc-plated steel hardware has good corrosion resistance in most environments. Clamps have a zinc-plated steel top plate and a zinc-phosphate-coated steel bottom plate.

Use with lines that have a max. pressure of 2,000 psi. Clamps with 4" ID and smaller are green. Temperature range is -20° to 190° F.



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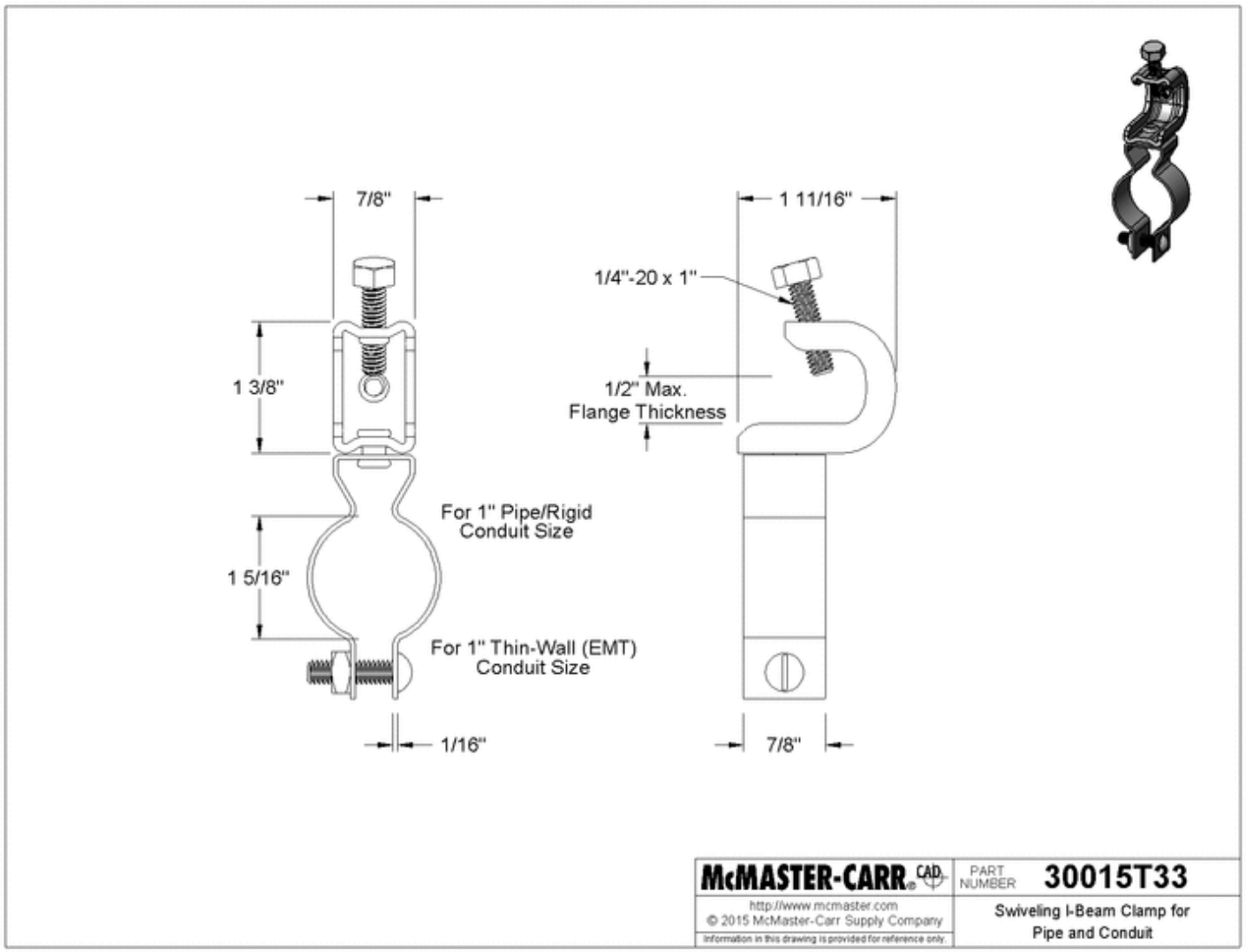
Easy-Position Beam Clamp

for Pipe, Tube & Conduit, Bottom Mount, 1-3/16"-1-5/16" OD

Mount Type	Clamp-On
For Beam Shape	Flat, Tapered
Mounting Location	Beam
Beam Location	Bottom
For Suspending	Pipe
Material	Zinc-Plated Steel
For OD	1 3/16"-1 5/16"
For Pipe Size	1
For Rigid Conduit Trade Size	1
For EMT Conduit Trade Size	1
For Copper Tube Size	1
For Beam Thickness Maximum	1/2"
Capacity	60 lbs.
Range of Motion	360°
Threaded Hole Size	1/4"-20
Throat Depth	1/2"
Surface to Pipe Center	1 1/2"
Length	1 3/4"
Width	1"
Height	1 1/2"
For Mounting Orientation	Perpendicular, Parallel

Clamps have a swiveling hanger for easy positioning once installed.

Clamp-on clamps have a threaded hole on the side for supporting a hanger or routing ring.



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CEILING LIGHTING

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Text 75930

Plug-in Enclosed-Bulb Ceiling Light

Mounting Location	Ceiling
Mount Type	Suspension
For Bulb Type	LED
Overall	
Length	46 5/8"
Width	3 3/4"
Height	2 3/8"
AC Voltage	120
Specifications Met	UL Listed; C-UL Listed
Wattage	25W
Minimum Start Temperature	0° F
Power Source	Plug In
Plug Type	Three Prong
Cord Length	5 ft.
Switch Type	Pull String
Lens	
Type	Parabolic
Material	Acrylic
Clarity	Semi Clear
Housing	
Material	Steel
Color	White
Mounting Hardware Included	Yes

Ready-to-use lights offer plug-in convenience and have a lens that reduces glare and protects the bulb from damage. The lens is also parabolic to direct light downward.

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PIPING COUPLINGS

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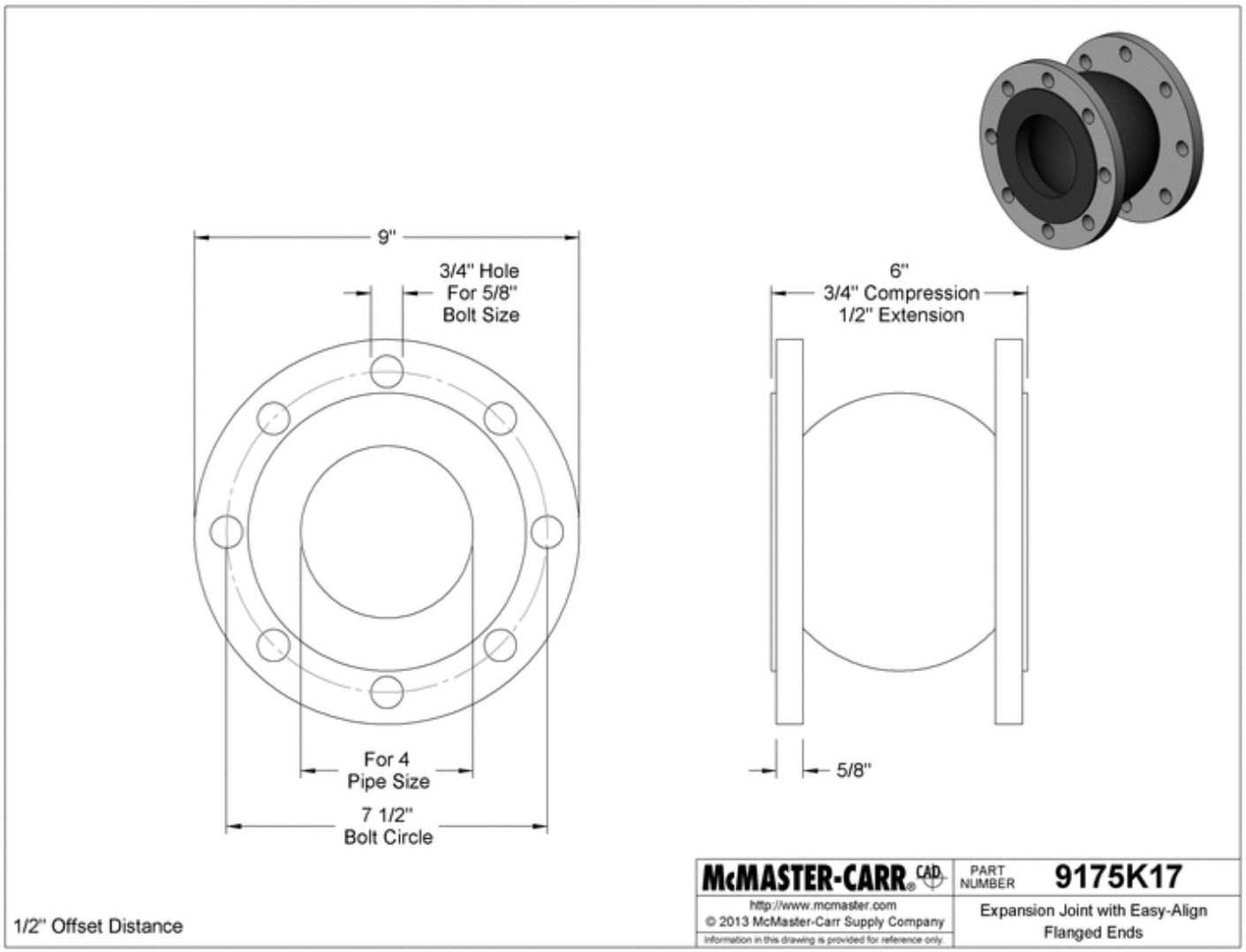
Expansion Joint with Easy-Align Flanged Ends

Neoprene, with Unthreaded Bolt Holes, 9" Flange OD

Flange OD	9"
Pipe Size	4
Overall Length	6"
Number of Bolt Holes	8
Bolt Hole Size	3/4"
Maximum Movement	
Compress	3/4"
Expand	1/2"
Offset	1/2"
Temperature Range	–10° to 225° F
Maximum Pressure	225 psi @ 72° F
Vacuum	26" Hg @ 72° F
Additional Specifications	General Purpose Neoprene Standard—Unthreaded Bolt Holes Use with water, grain alcohol, non-abrasive slurry

The flanged ends on these expansion joints rotate for easy bolt hole alignment during installation. The flanges are made of zinc-plated steel; they'll mate with a same-size flat-surface Class 150 flange without the need for a gasket. All have a flexible neoprene or EPDM body that's nylon-reinforced for added strength.

Standard joints have a single-bulb design, which is the most popular.



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Flexible Fittings for Pipe

Reducing Coupling, for 5" x 4" Pipe Size, 4" Long

For Pipe Size	5 × 4
Length	4"
Temperature Range	-40° to 120° F
Maximum Pressure @ 72° F	4.3 psi
Pipe	Use on unthreaded aluminum, cast iron, rigid PVC, rigid CPVC, ductile iron, steel, and stainless steel.
Additional Specifications	Reducing Couplings With 300 Series Stainless Steel Bands Use with air and water in drain, waste, and vent applications

Use these couplings and fittings to connect rigid pipes of the same or different materials. Body is flexible PVC and bands are 300 series stainless steel bands. All couplings and fittings meet ASTM D5926 and the codes set by ICC-ES (International Code Council Evaluation Service).

Couplings and reducing couplings are CSA certified and meet ASTM C1173 for underground use. Vacuum rating is 30" Hg @ 72° F.

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Flexible Fittings for Pipe

Straight, for 8" Pipe Size, 6" Long

For Pipe OD	8.625"
For Pipe Size	8
Length	6"
Temperature Range	-40° to 120° F
Maximum Pressure @ 72° F	4.3 psi
Pipe	Use on unthreaded aluminum, cast iron, rigid PVC, rigid CPVC, ductile iron, steel, and stainless steel.
Additional Specifications	Couplings With 300 Series Stainless Steel Bands Use with air and water in drain, waste, and vent applications

Use these couplings and fittings to connect rigid pipes of the same or different materials. Body is flexible PVC and bands are 300 series stainless steel bands. All couplings and fittings meet ASTM D5926 and the codes set by ICC-ES (International Code Council Evaluation Service).

Couplings and reducing couplings are CSA certified and meet ASTM C1173 for underground use. Vacuum rating is 30" Hg @ 72° F.

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Low-Pressure Slip-on Expansion Joint with Clamps

for 4.5" Pipe OD

For Pipe OD	4.5"
Pipe Size	4
Overall Length	4"
Maximum Movement	
Compress	1/2"
Expand	1 1/2"
Temperature Range	–30° to 130° F intermittent
Maximum Pressure	4.3 psi @ 72° F
Additional Specifications	Use with water and air in drain, waste, and vent systems

Designed for vertical use in drain, waste, and vent systems, these PVC joints slip over the ends of pipes. They have a single-bulb design and internal stops that ensure pipe is in the proper position. The band clamps are corrosion-resistant Type 301 stainless steel.

McMASTER-CARR®

Terms and Conditions of Use and Sale and the Privacy Policy

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(viii) use a denial-of-service attack or a distributed denial-of-service attack against any of the McMaster-Carr Properties;

(ix) reverse engineer or attempt to extract the source code of any software that comprises any part of the McMaster-Carr Properties or the Content;

(x) display or use any Content for any commercial purpose in any publications, audiovisual works, public performances, or on websites or other applications, including but not limited to in connection with products other than our Products, in any other manner likely to cause confusion, to disparage or discredit us or our licensors, to dilute the strength of the intellectual property owned by us or our licensors, or to otherwise infringe the intellectual property rights of McMaster-Carr or any third party;

(xi) frame or use framing techniques to enclose any trademark, logo, intellectual property or other proprietary information (including images, text, page layout or form) of McMaster-Carr without our express written consent;

(xii) use any metatag or any other "hidden text" utilizing our name or trademarks without our express written consent; or

(xiii) use any technology or other means to hide your identity.

Use of CAD Models.
The CAD models on the McMaster-Carr Properties ("CAD Models") are being made available to help you decide whether to purchase Products from us. You may download the CAD Models and share them with others in your organization or with third parties acting on behalf of or rendering services to you or your organization (including your data center or cloud service providers), but only for purposes of deciding whether to purchase Products from us or in order to develop design drawings and prototypes for use by you or your organization in connection with a decision regarding whether to

purchase Products from us. You shall not use the CAD Models to engage in 3D printing or other fabrication of the objects depicted in the CAD Models for any other purpose, and you shall not otherwise redistribute or make available the CAD Models (or any design drawings or prototypes that incorporate them) to any third parties, including third parties in the business of selling products similar to the Products.

The CAD Models do not contain any technical information other than what is readily observable, specified by industry standards or provided to us by our suppliers. The dimensions and other technical specifications of Products may vary from those shown in the CAD Models, due among other reasons to tolerances associated with manufacturing processes. Manufacturing tolerance information is considered proprietary by many of our suppliers and is not always provided to us. Thus tolerance information may not be reflected in the CAD Models. You acknowledge and agree as follows: (i) your use of the CAD Models is at your own risk and you are solely responsible for any use you make or permit others to make of the CAD Models; (ii) McMaster-Carr makes no representation or warranty (express or implied) with respect to the CAD Models, including but not limited to the accuracy or completeness of Product dimensions or any other technical specifications contained in or accompanying the CAD Models, non-infringement of third party rights, and quality, suitability, fitness for purpose or title; (iii) McMaster-Carr may terminate or limit your access to the CAD Models for any reason at any time; and (iv) you shall indemnify us and hold us harmless from and against any and all liabilities, losses, damages, costs and other expenses (including court costs and reasonable attorneys' fees) resulting from claims asserted by you or others as a result of your use of the CAD Models.

User Content

Submission of User Content to Us. We are pleased to hear from our customers. We may from time to time seek feedback from our customers and other users of the McMaster-Carr Properties and we may enable them to submit, post or upload reviews, comments, suggestions, messages, photographs, videos and other content (collectively, "User Content").

Disclaimer of Liability for User Content. We do not control, endorse or verify any User Content and we make no representation or warranty concerning its authenticity, integrity or accuracy. Reliance on or use of any User Content is solely at your own risk. We are not responsible or liable for any User Content or for any claims, damages or losses resulting from the use or appearance of any User Content on the McMaster-Carr Properties.

User Content You Submit. You are solely responsible for all User Content you submit to us. You agree that you will not submit to us any User Content that (i) infringes or otherwise violates the rights of others, including patents, copyrights, trademarks, trade secrets, publicity or privacy rights, (ii) violates any local, state, national, or regional laws of the United States or any other jurisdiction, (iii) is unlawful, obscene, derogatory, threatening, harassing, hateful, racist, defamatory or otherwise objectionable, (iv) uses a false e-mail address, impersonates any person or entity or is otherwise misleading as to its origin, or (v) contains viruses or corrupted files that may adversely affect the Content or the operation of the McMaster-Carr Properties. We reserve the right to remove or edit any User Content and to terminate or suspend your account at any time and without notice.

Your Grant of a License and Other Rights to User Content You Submit. By submitting User Content to us, you grant to us a non-exclusive, royalty-free, sub-licensable, perpetual, fully-paid, worldwide license (i) to use, reproduce, modify, publish, perform, create derivative works from, distribute and display such User Content in any media, and you hereby waive all "moral rights" with respect to our use of that User Content, and (ii) to use the names, images and likenesses that you submit to us in connection with that User Content. If and to the extent User Content that you submit to us contains ideas, suggestions, documents or proposals relating to us and our business ("Suggestions"), you acknowledge and agree as follows: (i) your Suggestions do not contain confidential or proprietary information; (ii) we are not obligated to keep your Suggestions confidential and we may use or disclose them in any media worldwide; (iii) we receive submissions from many parties that are similar to the Suggestions, or we may have ideas, concepts or processes similar to the Suggestions already under consideration or in development; (iv) your Suggestions shall be deemed the property of McMaster-Carr, which we will be free (but not required) to evaluate, develop and exploit at our discretion, without any obligation to compensate you or to credit you, and without any other obligation to you; and (v) you hereby assign all right, title and interest in the Suggestions, and any inventions, works, or other subject matter or rights contained in them, to McMaster-Carr.

Consent to Electronic Communication

When you use the McMaster-Carr Properties to purchase products, request information or otherwise solicit an electronic communication from us, or to send e-mails, text messages or other electronic communications to us for any of these purposes, you consent to receive electronic communications from us in response. You may withdraw your consent to receive electronic communications from us at any time. We may communicate electronically with you in a

variety of ways, including by e-mail, text message, in-app push notices, posting notices and messages on the McMaster-Carr Properties or by other means. You agree that all notices, disclosures, agreements and other communications that we provide to you electronically satisfy any legal requirement that those communications be in writing. You agree that we may preserve any communication by you to us through any of the McMaster-Carr Properties and that we may disclose the data contained in any communication from you if we are required to do so by law or if we determine that preserving or disclosing that data is necessary to (i) comply with legal process, (ii) enforce the Terms and Conditions, (iii) respond to claims that the data you submitted violates the rights of others, or (iv) protect the rights, property or personal safety of McMaster-Carr, our employees, users of the McMaster-Carr Properties or the public.

Links and Other Third-Party Applications

No Endorsement by Us of Third-Party Websites. The existence on third-party websites or applications of hypertext links to any of the McMaster-Carr Properties does not imply or signify any relationship, endorsement or other connection between McMaster-Carr and the owner or operator of the website or application containing the links. McMaster-Carr is not responsible for inaccuracies in information or for any representations and express or implied warranties, including those of fitness for purpose or merchantability, which may be contained on or implied from any third-party websites or applications containing hyperlinks to mcmaster.com. McMaster-Carr does not authorize any other parties to make representations or warranties on our behalf.

Limited Permission to Link to Our Homepage. You may link to the homepage of mcmaster.com only if (i) the link or the manner of linking does not damage or take advantage of our reputation, (ii) you do not by such linkage suggest that we approve, endorse or are in any other way associated with your activities, products or services, and (iii) you immediately remove any links to mcmaster.com at our request.

Disclaimers Relating to Third-Party Applications Included by Us. The McMaster-Carr Properties may include third-party technology, software, applications and links to other websites and resources provided by third parties. Any such links are provided for your convenience only. We do not have any control over the content of those third-party websites or resources. You therefore acknowledge and agree as follows: (i) we are not responsible for the practices or policies of third parties or for any loss or damage that may arise from your use of any third-party technology, services, software or applications or any linked third-party website or resource; and (ii) if you use any third-party technology, services or software or access any website or resource linked to the McMaster-Carr Properties, you do so at your own risk and subject to the terms and conditions of use of any such third-party technologies, websites or resources.

Disclaimer of Warranties Relating to Use

THE MCMASTER-CARR PROPERTIES ARE PROVIDED ON AN “AS-IS” AND “AS-AVAILABLE” BASIS AND YOUR USE OF THEM IS AT YOUR OWN RISK. ACCORDINGLY, THE MCMASTER-CARR PROPERTIES AND ALL CONTENT PROVIDED THEREIN ARE SUBJECT TO CHANGE AT ANY TIME WITHOUT NOTICE AND NO WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, ARE MADE WITH RESPECT TO THE MCMASTER-CARR PROPERTIES OR ANY CONTENT OR TECHNOLOGY INCLUDED IN THEM, INCLUDING WITHOUT LIMITATION (i) WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT OF THIRD-PARTY RIGHTS, ACCURACY, COMPLETENESS, QUALITY, SUITABILITY, TITLE AND FITNESS FOR A PARTICULAR PURPOSE, AND (ii) WARRANTIES THAT THE MCMASTER-CARR PROPERTIES WILL BE UNINTERRUPTED, TIMELY, SECURE OR ERROR-FREE. YOU THEREFORE ACKNOWLEDGE AND AGREE THAT YOU ARE SOLELY RESPONSIBLE FOR ADEQUATE PROTECTION AND BACKUP OF YOUR DATA AND/OR EQUIPMENT IN CONNECTION WITH YOUR USE OF THE MCMASTER-CARR PROPERTIES. YOU SHALL HOLD MCMASTER-CARR HARMLESS FROM AND YOU SHALL NOT SUE MCMASTER-CARR FOR ANY CLAIMS BASED ON YOUR USE OF OR INABILITY TO USE THE MCMASTER-CARR PROPERTIES OR THE CONTENT.

Limitation of Liability Relating to Use

IN NO EVENT WILL MCMASTER-CARR OR ITS EMPLOYEES, AGENTS, OFFICERS OR DIRECTORS BE LIABLE IN CONTRACT, WARRANTY, TORT OR UNDER ANY OTHER LEGAL THEORY FOR DAMAGES OF ANY KIND, INCLUDING DIRECT, INDIRECT, INCIDENTAL, SPECIAL, PUNITIVE, EXEMPLARY OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, GOODWILL, LOSS OF DATA OR ANY OTHER LOSSES ARISING FROM YOUR USE OF OR INABILITY TO USE THE MCMASTER-CARR PROPERTIES OR THE CONTENT, OR FOR YOUR RELIANCE ON THE CONTENT IN THE MCMASTER-CARR PROPERTIES, EVEN IF WE HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Indemnification Relating to Use

As a condition to your use of the McMaster-Carr Properties, you agree to defend, indemnify and hold harmless McMaster-Carr and its respective officers, directors, employees, agents, contractors, vendors and suppliers from and against any liabilities, losses, damages, costs and other expenses (including court costs and reasonable attorneys’ fees) arising or resulting directly or indirectly out of (i) any breach by you of the Terms and Conditions, (ii) your use of the McMaster-Carr Properties, (iii) User Content submitted by you, and (iv) your use of the CAD Models.

Limitations on International Users

Export Control Laws. Certain Content that may be downloaded by you or is otherwise made available on the McMaster-Carr Properties may be subject to United States export control laws. These laws prohibit the export of certain information, software and other technology to certain restricted localities, persons and entities. You agree and acknowledge that no Content, software or other technology may be used, downloaded or exported from the McMaster-Carr Properties (i) in or into any country against which the United States maintains a trade embargo, (ii) by or to a person or entity designated on the U.S. Treasury Department's List of Specially Designated Nationals or the U.S. Commerce Department's Denied Persons List or Entity List, or (iii) otherwise in violation of any applicable United States export control law.

Compliance with Laws of Other Countries. McMaster-Carr operates the McMaster-Carr Properties from the United States and does not warrant or represent that they are appropriate for use in or otherwise comply with the laws of any jurisdiction outside the United States. You acknowledge and agree that you are solely responsible for ensuring that your use of the McMaster-Carr Properties is lawful in any jurisdiction in which you use them.

TERMS AND CONDITIONS OF SALE

Prices and Payment Terms

Published prices don't include taxes, duties, brokerage or shipping costs, and they may be changed without notice. All payments must be in U.S. Dollars. Open accounts may be available on terms approved by us. Payment terms on open accounts are net 30 days, less two percent for payment within 10 days of shipment or pick-up of the Products. Visa, MasterCard and American Express will generally be accepted for orders, but credit card arrangements are subject to change.

Right to Correct, Reject or Cancel Orders

We reserve the right to correct typographic errors and reject or cancel orders because applicable law prevents the sale of the Products in your area or for any other reason.

Other Charges

In addition to the published price, we may charge you for shipping, freight, taxes and all other expenses that we incur in connection with the shipping of your order.

Taxes and Governmental Charges

You are responsible for all applicable national, state, provincial and local sales and use taxes, value added taxes, duties, tariffs and other governmental fees which may be imposed in connection with your purchase of Products from us. When we collect taxes and other governmental fees from you, the amount collected will be stated separately on the invoice. If you are claiming exemption from sales tax, you are responsible for providing a valid sales tax exemption certificate and you agree that you will not claim a sales tax exemption for purchases that do not qualify as exempt. If your claim of exemption for any purchase is deemed invalid by the taxing jurisdiction, you will upon request reimburse us for any and all taxes due on that purchase from us. If any Product which you purchase for resale is subsequently used by you, you will pay the use tax directly to the taxing authority if required by law. Please reference www.mcmaster.com/#tax or the appropriate department in your State, if applicable.

Delivery, Title and Risk of Loss

Delivery. Delivery occurs at McMaster-Carr's warehouse when the Product is tendered to the carrier or is picked up by the customer, except for those sales into Canada as to which we agree to act as importer of record in the documentation you receive from us relating to your purchase of Products. With respect to sales into Canada as to which we agree to act as importer of record in the documentation you receive from us relating to your purchase of Products, the place of delivery is the destination in Canada to which we have prepaid the shipping charges.

Title and Risk of Loss. Title and risk of loss pass to the customer at McMaster-Carr's warehouse when the Product is tendered to the carrier or is picked up by the customer. For sales as to which we have agreed in the documentation you receive from us relating to your purchase of Products to prepay the shipping charges, we may elect at our sole option to replace or refund the purchase price of a Product damaged in transit.

Product Returns

To return a Product, send it to the nearest McMaster-Carr location. To exchange a Product, return it to us and place a new order. No return authorization is required. We do not take title to returned Products until the Product arrives at our

facility. You will be given credit upon our receipt of the returned Product. We reserve the right to reject returns of Products used or damaged by the customer or designated as non-cancellable or non-returnable.

Limited Product Warranty

Because we don't make the Products we sell, our only warranty or other obligation and your only remedy against us with respect to our Products is for us to replace any Product which is defective in material or workmanship when sold and which you return to us. ALL OTHER WARRANTIES AND REMEDIES WITH RESPECT TO THE PRODUCTS WE SELL, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE, ARE DISCLAIMED. SOME JURISDICTIONS DO NOT ALLOW EXCLUSIONS OR LIMITATIONS OF IMPLIED WARRANTIES, SO THE FOREGOING LIMITATION MAY NOT APPLY TO YOU AND YOU MAY HAVE ADDITIONAL RIGHTS. HOWEVER, YOU ACKNOWLEDGE AND AGREE THAT IN ALL JURISDICTIONS WE DISCLAIM IMPLIED WARRANTIES TO THE FULLEST EXTENT PERMITTED BY LAW.

Limitation of Liability and Remedies Concerning Products

IN NO EVENT WILL MCMASTER-CARR OR ITS EMPLOYEES, AGENTS, OFFICERS OR DIRECTORS BE LIABLE IN CONTRACT, WARRANTY, TORT OR OTHERWISE FOR ANY INDIRECT, INCIDENTAL, SPECIAL, PUNITIVE, EXEMPLARY OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS, GOODWILL, BUSINESS INTERRUPTION OR ANY OTHER LOSSES (OTHER THAN THE COST OF THE PRODUCT OR ITS REPLACEMENT OR REPAIR) THAT ARISE DIRECTLY OR INDIRECTLY OUT OF YOUR PURCHASE OF ANY PRODUCT FROM US, EVEN IF WE HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. WE ALSO DISCLAIM ANY LIABILITY FOR CLAIMS ARISING OUT OF THE MISUSE, IMPROPER SELECTION, FAULTY REPAIR OR IMPROPER MODIFICATION OF A PRODUCT. YOUR ONLY RECOURSE AND EXCLUSIVE REMEDY WITH RESPECT TO ANY CLAIMS RELATED TO THE PRODUCTS WE SELL IS THE RIGHT TO RETURN THE PRODUCTS AND OBTAIN AT OUR OPTION A REFUND OF THE PURCHASE PRICE OR REPLACEMENT OF THE PRODUCT. IN NO EVENT SHALL OUR TOTAL LIABILITY TO YOU FOR ALL DAMAGES, LOSSES AND CAUSES OF ACTION (WHETHER IN CONTRACT, WARRANTY, TORT OR OTHERWISE) EXCEED THE PURCHASE PRICE OF THE PRODUCT THAT GIVES RISE TO THE CLAIM. BECAUSE SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF CERTAIN CATEGORIES OF DAMAGES, THE LIMITATIONS OF LIABILITY DESCRIBED ABOVE MAY NOT APPLY TO YOU AND YOU MAY HAVE ADDITIONAL RIGHTS. YOU AGREE THAT IN ALL JURISDICTIONS, OUR LIABILITY FOR YOUR PURCHASE AND USE OF THE PRODUCTS IS LIMITED TO THE FULLEST EXTENT PERMITTED BY LAW TO THE PURCHASE PRICE OF THE PRODUCT. ANY CLAIM OR ACTION BROUGHT AGAINST US ARISING OUT OF ANY PRODUCT WE SELL TO YOU MUST BE BROUGHT WITHIN ONE YEAR AFTER THE PRODUCT HAS BEEN DELIVERED TO YOU.

Limits on Use of and Reliance on Information We Make Available to You

Warnings, Information and Instructions. We do not manufacture any of the Products we sell. We rely entirely on our suppliers to provide all necessary warnings, instructions, chemical content and other information regarding the purchase, installation, use, handling, storage, resale, transportation and disposal of or relating to the Products, including but not limited to any warnings required by California Proposition 65 for Products containing chemicals known to the State of California to cause cancer, birth defects or other reproductive harm. A list of these chemicals is available online from the California Office of Environmental Health Hazard Assessment at http://oehha.ca.gov/prop65.html. The dimensions and other technical specifications of Products may vary from those shown in the CAD Models due to tolerances associated with manufacturing processes. Because manufacturing tolerance information is considered proprietary by many manufacturers and is not provided to us, tolerance information may not be reflected in the CAD Models. WE MAKE NO REPRESENTATION OR WARRANTY (EXPRESS OR IMPLIED) CONCERNING AND WE HAVE NO LIABILITY FOR THE ACCURACY OR COMPLETENESS OF ANY WARNINGS, INFORMATION (INCLUDING BUT NOT LIMITED TO PRODUCT DIMENSIONS OR ANY OTHER TECHNICAL SPECIFICATIONS INCLUDED IN THE CAD MODELS) OR INSTRUCTIONS PROVIDED BY OUR SUPPLIERS.

Safety Data Sheets. Safety Data Sheets (SDS) for certain Products are available to you online at www.mcmaster.com or by calling our sales desk. Any SDS we make available to you has been prepared and provided to us by the manufacturer or the supplier of the Product. WE MAKE NO REPRESENTATION OR WARRANTY (EXPRESS OR IMPLIED) CONCERNING AND WE HAVE NO LIABILITY FOR THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED IN AN SDS.

Your Responsibilities to Us

Assumption of Risk for Product Information. McMaster-Carr is solely a reseller of Products manufactured by others. Information about the Products in the McMaster-Carr Properties is provided by or is dependent upon information provided by our suppliers ("Product Information"). WE MAKE NO REPRESENTATION OR WARRANTY (EXPRESS OR IMPLIED) CONCERNING AND WE HAVE NO LIABILITY FOR THE ACCURACY OR COMPLETENESS OF THE PRODUCT INFORMATION. You assume the risk that the Product Information may be incomplete, inaccurate or out of date. We may add, change, discontinue, remove or suspend any of the Product Information or other information included in the

Content at any time, without notice or liability. We reserve the right to correct any publishing errors in the Content, including pricing errors.

Compliance with Laws. WE MAKE NO REPRESENTATION OR WARRANTY (EXPRESS OR IMPLIED) THAT PRODUCTS OFFERED FOR SALE BY US COMPLY WITH ANY LAWS, CODES OR REGULATIONS GOVERNING THEIR PURCHASE, INSTALLATION, USE, HANDLING, STORAGE, RESALE, TRANSPORTATION, DISPOSAL, EXPORT OR IMPORT, THAT THEY ARE AVAILABLE FOR SALE OR USE IN YOUR JURISDICTION, OR THAT THEY ARE APPROPRIATE OR SUITABLE FOR YOUR PURPOSES OR USE. You are solely responsible for ensuring your compliance, and that of any third party to whom you resell the Products, with all applicable laws governing purchase, installation, use, handling, storage, resale, transportation, disposal, export and import of the Products you purchase from us.

Your Representations and Warranties. You are responsible for familiarizing yourself with all other available information about the Products prior to your purchase and use of them to determine their suitability for and any limitations on your intended use. In connection with any purchase of Products from us, you warrant, represent, acknowledge and agree as follows: (i) the purchase, installation, use, handling, storage, resale, transportation, disposal, export or import of the Products by you and any third party to whom you resell them is and will be in compliance with all applicable laws and regulations and will conform to generally recognized industry and professional standards; (ii) you and any third party to whom you resell the Products are or will be knowledgeable concerning the laws and other practices relating to the safe and lawful purchase, installation, use, resale, handling, storage, transportation, and disposal of the Products; (iii) you have used your own skill and judgment in selecting and you are solely responsible for the determination and selection of suitable Products for your contemplated use and the use contemplated by any third party to whom you resell the products; (iv) you have the legal right and are authorized to purchase the Products; (v) you understand any and all hazards associated with the storage, use, handling and transportation of the Products; and (vi) you are solely responsible for protecting and/or warning all parties who may be exposed to those hazards as a result of your use or resale of the Products.

Your Indemnification of Us. Your purchase, use and resale of the Products is at your own risk. Except to the extent caused by our gross negligence or willful misconduct, you agree to defend, indemnify and hold harmless McMaster-Carr and its respective officers, directors, employees, agents, contractors, vendors and suppliers from and against any liabilities, losses, damages, costs and other expenses (including court costs and reasonable attorneys' fees) arising or resulting (directly or indirectly) out of your (i) breach of any of the Terms and Conditions, (ii) negligence, misuse or other wrongful conduct related to a Product, or (iii) violation of any applicable law related to any Product. To the extent they are inconsistent with the U.S. federal Anti-Deficiency Act, the indemnification provisions in the Terms and Conditions will not apply to any sale made by us to a U.S. federal government agency to which the Anti-Deficiency Act applies.

Government Procurement

Items sold by us may not meet certain government procurement requirements (such as those imposed by the Buy American Act). Upon request, we will provide you with origin information. If you require other information or have other special needs, please contact our Sales Department.

Electronic Commerce / EDI

If you purchase Products through our website, or by e-mail, facsimile or an electronic data interchange or EDI system (collectively, "e-commerce"), you agree that (i) any contract of sale resulting from an e-commerce transaction is legally binding and enforceable, notwithstanding the provisions of any law relating to whether agreements must be in writing or signed by the parties to be bound thereby; and (ii) copies of our e-commerce records are admissible in any legal proceeding under the business records exception to the hearsay rule, the best evidence rule or any other rule of evidence, notwithstanding that such records were not originated or maintained in documentary form. As provided in the Uniform Commercial Code, we adopt as our signature on e-commerce communications the electronic identification of McMaster-Carr affixed to or contained in each electronic record transmitted in connection with a transmission. In the event of a dispute, the business records maintained by us regarding your e-commerce purchases with us shall be deemed to be the governing records for purposes of establishing the terms of those purchases.

Additional Terms Applicable to the Export of Products

U.S. Export Controls. Our Products are subject to U.S. export control laws and regulations. You acknowledge and agree that you are responsible for and shall comply with all laws, regulations and orders of the United States applicable to the export of Products you purchase from us. Without limiting the foregoing, you represent and warrant as follows: (i) you are not designated on or associated with any party named on any of the restricted parties lists published by the U.S. government, including the Denied Persons List, the Entity List, the Unverified List of the Bureau of Industry and Security of the Department of Commerce, or the Specially Designated Nationals and Blocked Persons List of the Office of Foreign

Assets Control of the Treasury Department; (ii) you shall not engage in the export, reexport, diversion, transfer or other disposition of any Product in violation of any laws of the United States, including but not limited to laws administered by the Treasury Department and the Department of Commerce pursuant to which the United States maintains trade embargoes and sanctions against certain countries; (iii) you are purchasing the Products to be exported from the United States and imported to the destination identified in the documentation relating to your purchase of Products in compliance with the laws of the United States and that destination; (iv) you understand and acknowledge that a license or other authorization may be required from the Bureau of Industry and Security, the Office of Foreign Assets Control or other U.S. government agency before exporting or reexporting Products from the United States; (v) unless otherwise expressly agreed by us in the documentation you receive from us relating to your purchase of Products, you are responsible for obtaining and paying for any licenses, permits or other authorizations required for exporting or reexporting our Products; and (vi) all other costs associated with exporting the Products shall be your responsibility.

Your Import of Products Into a Foreign Country. We do not serve as the importer of Products into any country, except to the extent, and then only to the extent that we agree in the documentation the customer receives from us relating to the purchase of Products to serve as importer of record for certain sales to customers in Canada. In all other cases, when the Products you purchase from us are imported into another country, you are solely responsible for (i) compliance with all laws governing that country's importation process, (ii) obtaining and paying for all necessary licenses, permits, customs clearances and all other authorizations, and (iii) paying all applicable duties, tariffs and other taxes and government charges imposed by that country upon import, and any brokerage, storage, any other fees or costs associated with the import of the Products.

Acknowledgement of Independent Contractor Status. In exporting the Products from the United States, importing them into another country, or reselling them following your purchase from us, you acknowledge that you are an independent contractor and that you shall not hold yourself out as an agent or otherwise cause others to believe that you are authorized to act on behalf of McMaster-Carr.

GENERALLY APPLICABLE TERMS

Jurisdiction, Choice of Law and Jury Trial Waiver

The Terms and Conditions (including the breach, termination and validity thereof), sales of our Products, use of the McMaster-Carr Properties, any personal information you submit to us and any disputes arising out of or relating to any of the foregoing (i) shall be governed entirely by and interpreted in accordance with the laws of the State of Illinois and applicable U.S. federal law, without giving effect to conflict of law principles of any jurisdiction, and (ii) shall not be governed in any manner by the United Nations Convention on Contracts for the International Sale of Goods, which is hereby expressly excluded, or the laws of any jurisdiction outside the United States. Except as otherwise expressly provided respecting the resolution of any controversy or claim between McMaster-Carr and a party domiciled outside the United States, you irrevocably consent to the exclusive jurisdiction of the courts located in Chicago, Illinois in connection with any action by or against McMaster-Carr to which you are a party. Proceedings to enforce the result of any such adjudication, however, may be brought in any applicable forum. WE BOTH KNOWINGLY AND VOLUNTARILY WAIVE TRIAL BY JURY IN ANY SUCH ACTION.

Resolution of International Disputes

Any controversy or claim between McMaster-Carr and a party domiciled outside the United States arising out of or relating to the Terms and Conditions, including but not limited to, the breach, termination or validity of the Terms and Conditions, sales of our Products, use of the McMaster-Carr Properties and any personal information submitted to us shall be determined and resolved exclusively by arbitration administered by the International Centre for Dispute Resolution in accordance with its International Arbitration Rules. In connection with any such arbitration, the place of the arbitration shall exclusively be Chicago, Illinois, the language of the arbitration shall be English, and Illinois law shall be applied to the dispute submitted to arbitration, without giving effect to any conflict of law principles of any jurisdiction. The arbitration award shall be final and binding, and judgment on the award may be entered and enforced in any court having jurisdiction over the parties. Except as may be required by law or for the purposes of entering, challenging or enforcing an arbitration award in a court having jurisdiction over the parties and subject matter, no party or its representatives may disclose the existence, content, or results of any arbitration hereunder, or any other matter relating to the arbitration or the award, without the prior written consent of all parties.

Force Majeure

We are not liable for any delay in or impairment of our performance caused in whole or in part by acts of God, labor disruptions, acts of war, terrorists, criminals, hackers or vandals, governmental decrees or controls, riots, epidemics and quarantines, communications disruptions, power failures, accidents, explosions, fires, inability to obtain or ship products, inability to obtain licenses or permits, shortages or inability to obtain supplies or raw materials, severe

weather, natural disasters and catastrophic events, or any other occurrence which is beyond our reasonable control in the conduct of business.

Waiver

The failure (with or without intent) of any party to insist upon the strict performance by the other party of any provision of the Terms and Conditions shall not be deemed to constitute a modification of, or a waiver of the right to insist at any time thereafter upon performance strictly in accordance with, any of the provisions of the Terms and Conditions. No waiver of any provision of the Terms and Conditions shall operate as a waiver of any other provision of the Terms and Conditions, and no waiver of any provision of the Terms and Conditions shall operate as a continuing waiver of that provision.

Severability

In the event that any provision of the Terms and Conditions is held illegal, invalid or unenforceable for any reason, that illegality, invalidity or unenforceability shall not affect the remaining provisions of the Terms and Conditions, in which event they shall be construed and enforced as if that illegal, invalid or unenforceable provision had never been inserted in them.

Assignment; No Third Party Benefit

No benefits or duties under the Terms and Conditions may be assigned without our prior written consent, except that a merger or consolidation of any party with another entity shall not constitute a violation of this provision. The Terms and Conditions are intended for the sole and exclusive benefit of the parties thereto and their respective permitted assignees thereunder. Nothing in the Terms and Conditions shall give any other person any legal or equitable right, remedy or claim under or in respect of the matters covered in them.

Independent Relationship

Nothing provided in the Terms and Conditions shall be deemed to create any relationship between us of employment, partnership, joint venture, agency or representation with respect to the use of the McMaster-Carr Properties or sales of Products by us.

PRIVACY POLICY

Application of Privacy Policy

This Privacy Policy is intended to help you understand how McMaster-Carr collects, uses and safeguards the personal and other information you provide through our website and our mobile applications. It does not apply to the use or disclosure of personal and other information that is collected or obtained by us through other means.

Your Account

Your Responsibilities. To protect your account from unauthorized activity, you should keep your password confidential and restrict access to your computer and any mobile devices through which your account may be accessed. You are responsible for all activity on or through your account. We will not be liable for damages or loss arising from your failure to maintain the confidentiality of your password or to adequately restrict access to your account. You represent and warrant that all information that you provide in connection with your account is and shall be accurate, truthful, current and complete. We reserve the right to deny, deactivate or terminate your account at our discretion.

Breach of Security. You accept all risk that your account may be accessed without your permission. If you discover or suspect that the security of your account has been breached, please let us know as soon as possible.

Information We Collect and Use

Your Personal Information. When you place an order for a Product, we need to know your name, e-mail and mailing addresses, and your billing information so that we can fill, confirm and ship your order, notify you of your order status and process your payment. We may also request some of this same information from you when you ask a question or make a comment through our website or mobile applications in order for us to respond appropriately. For administration purposes, our website or mobile applications may collect your IP address or domain name, referring web page, browser type, mobile device type, device operating system, device settings, and non-personal information about the way you use your device or this site (such as the length of time spent or the pages accessed while visiting this site). We may use third-party website analytics tools and embedded tracking codes that collect information about visitor traffic on our sites and mobile applications to collect information about you.

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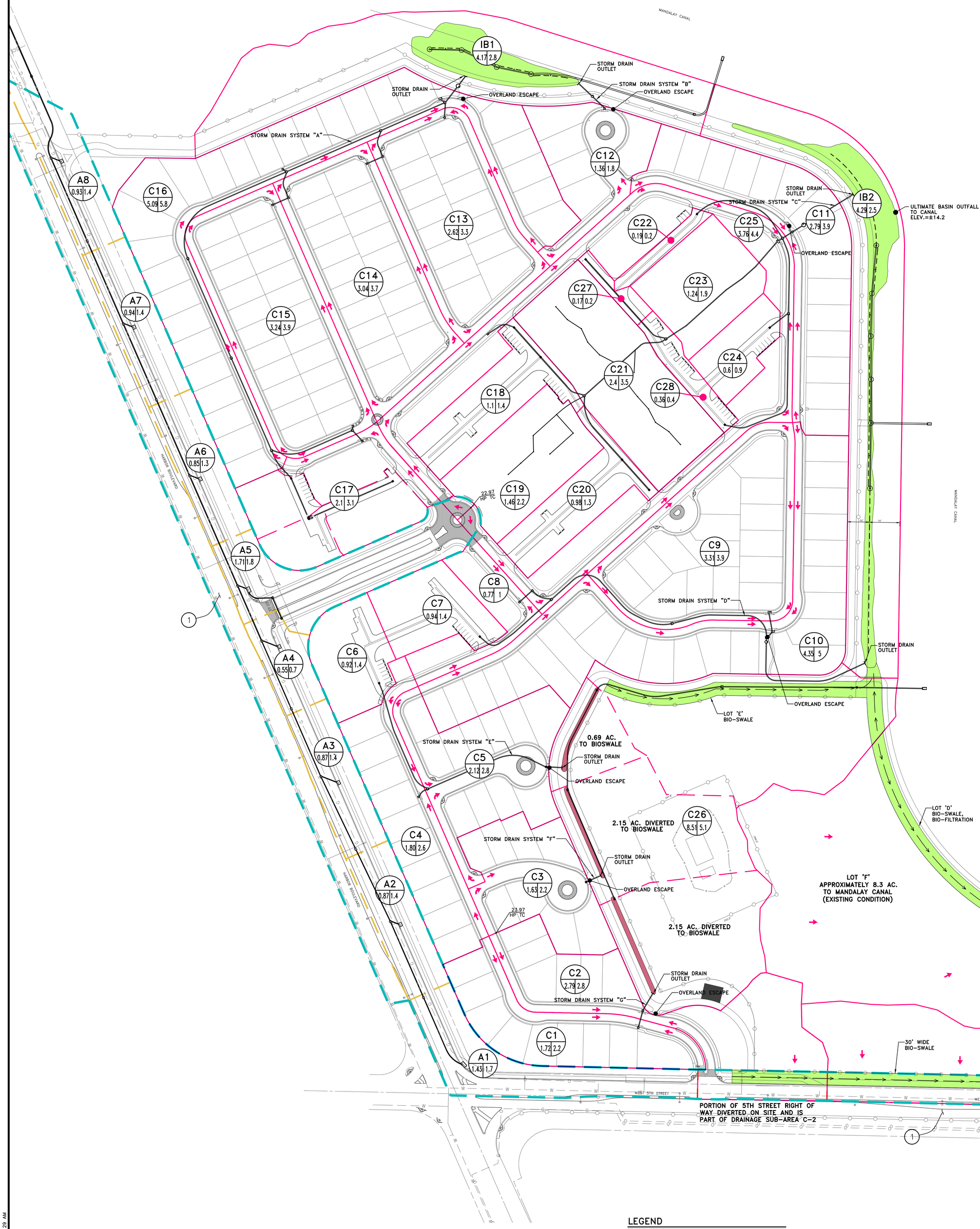
VERSION DATE: MAY 23, 2016

APPENDIX I
STORMWATER QUALITY CONTROLS AND MAINTENANCE MEASURES



LEGEND

C17 — WATERSHED/TRIBUTARY DESIGNATION
0.09 | 0.15 — Q10 = (cfs); AREA (ACRES)

- DRAINAGE SUB-AREA BOUNDARY
- BIOREMEDIATION BASIN
- BIOSWALE
- INDICATES DIRECTION OF SURFACE FLOW
- INDICATES OFFSITE DRAINAGE AREA BOUNDARY (SHOWN FOR INFORMATIONAL PURPOSES)
- INDICATES OFFSITE DRAINAGE SUB-AREA BOUNDARY (SHOWN FOR INFORMATIONAL PURPOSES)

ASSUMPTIONS:

(1) RUNOFF ABSORBED BY SANDY SHOULDER OF ROADWAY

GENERAL NOTES:

1. SUB-AREAS "A" AND "B" ARE SHOWN FOR INFORMATIONAL PURPOSES ONLY. REFER TO OFFSITE IMPROVEMENTS DRAINAGE REPORT.

N

SCALE: 1"=80'
0 80 160 240

TRACT 5592
ONSITE IMPROVEMENTS
DRAINAGE AREA MAP

W.O. 11811.05

Penfield & Smith
Engineers · Surveyors · Planners · Construction Management ·
111 East Victoria Street, Santa Barbara, CA 93101
Phone: (805) 963-9532 Fax: (805) 966-9801

48-EXB SAVE DATE: 7/20/2017 8:29:23 AM PLOT BY:Bowman, Katie PLOT DATE:7/20/2017 8:51:29 AM
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Operation and Maintenance Plan

beachwalk
On the Mandalay Coast

Oxnard, California

MPL Property Holdings, LLC

Prepared for:
MPL Property Holdings, LLC
2392 Morse Avenue
Irvine, CA 92614

Prepared by:
Storm Water Resources
28005 Smyth Drive
Valencia, CA 91355
661.295.3013

Table of Contents

Section 1 - Introduction

Beachwalk on the Mandalay Coast occupies a 90.31-acre site located in the City of Oxnard, California, north and east of the intersection of Harbor Boulevard and West Fifth Street and south and west of the Mandalay/MRT Canal. The project is permitted by City of Oxnard TTM 5592 (PZ 05-300-08) and CDP (PZ 05-400-4) and provides for 292 homes and approximately 24 acres of open space. Stormwater runoff from the site will be conveyed to bioswales or to bioremediation basins for treatment before being discharged to the Mandalay/MRT Canal.

MPL Property Holdings, LLC (Bruce Cook, Authorized Signatory, 2392 Morse Ave, Irvine, CA 92614, 949-777-4081) is the owner of the site and shall be responsible for the maintenance and operation of all onsite stormwater quality BMPs until a successor entity has been properly established and assumes the management and maintenance responsibility for the BMPs.

Post construction sources of pollution for this residential development are expected to be litter, paints, solvents, fertilizers, detergents, fuel, oil, grease, pesticides and herbicides. The owner will conduct an annual review of activities at Beachwalk Mandalay Bay and potential sources of stormwater constituent loading in an effort to identify any potential pollution generation operation and its location within the drainage system.

The Beachwalk on the Mandalay Coast Homeowners Association (HOA) will be ultimately responsible for financial assurance for operations and maintenance of all post-construction BMPs. During construction, and until such time that the responsibility is transferred to the HOA, the project developer, MPL Property Holdings, LLC will be responsible for all operations and maintenance of the BMPs. MPL Property Holdings, LLC will contract with a Stormwater Quality Control Operations & Maintenance Manager (currently: Storm Water Resources, Inc., 28005 Smyth Drive, Valencia, CA 91355, Jeanne Duarte, 661-510-3428).

Inspection and maintenance of project storm water quality control measures shall be performed by the responsible party identified as Stormwater Quality Control Operations & Maintenance Manager at a minimum as indicated below and in Section 7 of this plan. Additional inspection and maintenance may be required to assure peak performance of control measures at all times.

Section 2 - Site Map

Section 3 - Site Control Measure Descriptions and Operational/Maintenance Requirements

3.1 – General Stormwater Quality Controls and Maintenance Measures

A. - Onsite storm drain system to be kept clean and clear of obstructions

This Plan includes a requirement to clean on-site storm drain system a minimum of twice a year: once immediately before the first of October (the beginning of the rainy season) and once in January.

Operation and Maintenance

Inspect and clean onsite catch basins and storm drain piping.

B. - "Don't dump – Drains to Ocean" Placard maintenance at all onsite catch basins/inlets.

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping.

Storm drain messages are designed to alert the public to the effects of and the prohibitions against waste disposal into the storm drain system. The signs are typically stenciled or affixed near the storm drain inlet. The message simply informs the pubic that dumping of wastes into the storm drain inlets is prohibited and/or the drain discharges to a receiving water.

Storm drain message markers are required at all storm drain inlets within the boundary of the development project. The marker should be placed in clear sight facing anyone approaching the inlet from either side. All storm drain inlet locations are identified on the development site map. Legibility of markers and signs must be maintained.

Operation and Maintenance

Replace placard if missing, defaced, or unreadable.

C. - Parking lot(s) and Streets will be maintained free of litter and debris.

These areas will be inspected at least once, prior to rainy season and at a minimum annually.

Operation and Maintenance

Sidewalks and parking lots are to be swept regularly to prevent accumulation of litter and debris. Litter, debris, and any cleaning agents will be trapped and collected to prevent entry into storm drain system.

3.2 - Infiltration Basin (INF-1)

An infiltration basin consists of an earthen basin constructed in naturally pervious soils (Type A or B soils) with a flat bottom and provided with an inlet structure to dissipate energy of incoming flow and raised grates for water ponding above design depth. An optional relief underdrain may be provided to drain the basin if standing water conditions occur. A forebay settling basin or separate Treatment Control Measure must be provided as pretreatment. An infiltration basin functions by retaining the SQDV in the basin and allowing the retained runoff to percolate into the underlying native soils over a specified period of time. The bottoms of infiltration basins are typically vegetated with dry-land grasses or irrigated turf grass. Infiltration facility maintenance should include frequent inspections to ensure that surface ponding infiltrates into the subsurface completely with the design infiltration time after a storm. Maintenance is of primary importance if extended detention basins are to continue to function as originally designed. Maintenance of the basin is the responsibility of the development, unless otherwise agreed upon.

Operations and Maintenance

The basin should be inspected semiannually or more frequently, and inspections after major storm events

are encouraged. Trash and debris should be removed as needed, but at least annually prior to the beginning of the wet season Site vegetation should be maintained as follows:

- Vegetation, large shrubs, or trees that limit access or interfere with basin operation should be pruned or removed.
- Slope areas that have become bare should be revegetated and eroded areas should be regraded prior to being revegetated.
- Grass should be mowed to 4 to 9 inch high and grass clippings should be removed.
- Fallen leaves and debris from deciduous plant foliage should be raked and removed.
- Invasive vegetation should be removed and replaced with non-invasive species. Invasive species should never contribute more than 25% of the vegetated area..
- Dead vegetation should be removed if it exceeds 10% of area coverage.
- Vegetation should be replaced immediately to maintain cover density and control erosion where soils are exposed.
- No herbicides or other chemicals should be used to control vegetation.
- Sediment buildup exceeding 50% of the forebay capacity should be removed. Sediment from the remainder of the basin should be removed when 6 inches of sediment accumulates. Sediments should be tested for toxic substance accumulation in compliance with current disposal requirements if visual or olfactory indications of pollution are noticed. If toxic substances are encountered at concentrations exceeding thresholds of Title 22, Section 66261 of the California Code of Regulations, the sediment must be disposed of in a hazardous waste landfill. It is recommended to clean the forebay frequently to reduce frequency of main basin cleaning.
- Remove sediment from basin when accumulation reaches 25% of original design depth. Cleaning is recommended to occur in early spring to allow vegetation to reestablish.
- Repair erosion to banks and bottom of basin as required.
- Following sediment removal activities, replanting, and/or reseeding of vegetation may be required for reestablishment.
- Control vectors as needed.

3.3 - Vegetated Swale (BIO-3)

Vegetated swales are open, shallow channels with low-lying vegetation covering the side slopes and bottom that collect and slowly convey runoff to downstream discharge points. Vegetated swales provide pollutant removal through settling and filtration in the vegetation (usually grasses) lining the channels, provide the opportunity for stormwater volume reduction through infiltration and evapotranspiration, reduce the flow velocity, and conveying stormwater runoff. An effective vegetated swale achieves uniform sheet flow through a densely vegetated area for a period of several minutes. The vegetation in the swale can vary depending on its location and is the choice of the designer, depending on the design criteria outlined in this section.

Operations and Maintenance

Inspect vegetated swales for erosion or damage to vegetation after every storm greater than 0.75 inches for on-line swales and at least twice annually for off-line swales, preferably at the end of the wet season to schedule summer maintenance and in the fall to ensure readiness for winter. Additional inspection after periods of heavy runoff is recommended. Each swale should be checked for debris and litter and areas of sediment accumulation (see Appendix I for a vegetated swale inspection and maintenance checklist).

Swale inlets should maintain a calm flow of water entering the swale. Remove sediment as needed at the

inlet, if vegetation growth is inhibited in greater than 10% of the swale or if the sediment is blocking even distribution and entry of the water. Following sediment removal activities, replanting and/or reseeding of vegetation may be required for reestablishment.

Flow spreaders should provide even dispersion of flows across the swale. Sediments and debris should be removed from the flow spreader if blocking flows. Splash pads should be repaired if needed to prevent erosion. Spreader level should be checked and releveled if necessary.

Side slopes should be maintained to prevent erosion that introduces sediment into the swale. Slopes should be stabilized and planted using appropriate erosion control measures when native soil is exposed or erosion channels are formed.

Swales should drain within 48 hours of the end of a storm. Till the swale if compaction or clogging occurs and revegetate. If a perforated underdrain pipe is present, it should be cleaned if necessary.

Vegetation should be healthy and dense enough to provide filtering, while protecting underlying soils from erosion:

- Mulch should be replenished as needed to ensure survival of vegetation.
- Vegetation, large shrubs or trees that interfere with landscape swale operation should be pruned.
- Fallen leaves and debris from deciduous plant foliage should be removed.
- Invasive vegetation should be removed and replaced with non-invasive species. Invasive species should never contribute more than 10% of the vegetated area.
- Dead vegetation should be removed if greater than 10% of area coverage or when swale function is impaired. Vegetation should be replaced and established before the wet season to maintain cover density and control erosion where soils are exposed.
- Check dams (if present) should control and distribute flow across the swale. Causes for altered water flow and/or channelization should be identified and obstructions cleared. Check dams and swale should be repaired if damaged.
- The vegetated swale should be well maintained. Trash and debris, sediment, visual contamination (e.g., oils), noxious or nuisance weeds, should all be removed.

3.4 – Hydrodynamic Separation Device (PT-1)

Hydrodynamic separation devices are devices that remove trash, debris, and coarse sediment from incoming flows using screening, gravity settling, and centrifugal forces generated by forcing the influent into a circular motion. By having the water move in a circular fashion, rather than a straight line, it is possible to obtain significant removal of suspended sediments and attached pollutants with less space as compared to wet vaults and other settling devices.

Operations and Maintenance (see Appendix 'A')

Hydrodynamic Separator maintenance mainly involves regular inspection and cleaning.

- Regular inspection and removal of sediment, debris, and trash from device. Initial inspection should be performed every 6 months. A revised inspection schedule should be determined based on the rate of sediment accumulation observed during initial inspections.
- Inspect inlet and outlet openings for clogging.
- Inspect and control for mosquitoes and other vectors as necessary.
- See attachment for Manufacturers Guidelines.

- Maintain records of completed inspections for a minimum of five years.

Section 4 - Spill Plan

Spills containing pollutants or hazardous materials, if allowed to enter the community storm drain system, can damage downstream waterways.
In the event of a spill:

- Make all reasonable attempts to contain the spill and prevent it from entering the storm drain system.
- Report spill to Stormwater Quality Control Operations & Maintenance Manager (Storm Water Resources 661-510-3428)
- Notify the City of Oxnard, Source Control Department at (805) 488-3517.
- If hazardous waste is involved, contact the Ventura County Fire Protection District by dialing either (805)-389-9710
- If life or structures are threatened dial 911

If it is suspected that illicit discharges into the storm drain system are occurring, a sampling program can be set up with samples taken at the suspected location and/or discharge outfalls to the Edison/Mandalay Canal, as directed by the Stormwater Quality Control Operations & Maintenance Manager. Samples shall be collected and analyzed in accordance to all sampling protocols and conducted by an accredited firm.

Section 5 - Facility Changes

Significant changes and/or modifications to the existing storm water facilities or operations, including treatment devices, shall be first approved by the City of Oxnard. To propose a change to the current storm water facilities contact the City of Oxnard Public Works Department at (805) 385-8280. Significant changes in treatment methods and/or maintenance requirements shall be logged into the plan by addendum once approved by the City of Oxnard.

Section 6 - Training

The Stormwater Quality Control Operations & Maintenance Manager will be responsible for operation and maintenance of the community storm water treatment facilities. The Stormwater Quality Control Operations & Maintenance Manager shall be properly trained in storm water pollution prevention and facility maintenance. The Stormwater Quality Control Operations & Maintenance Manager will be responsible for ensuring that all contractors hired to perform the actual maintenance are qualified and trained in each specific area.

Training shall include the following topics:

- Good housekeeping procedures defined in the plan.
- Proper maintenance of all pollution mitigation devices.
- Identification and cleanup procedures for spills and overflows.
- Large-scale spill or hazardous material response.
- Safety concerns when maintaining devices and cleaning spills
- Logging inspection and maintenance activities.
- Property maintenance of all pollution mitigation devices covered in this document.
- Inspection requirements of all pollution mitigation devices covered in this document.
- Spill control and notification procedures.
- Hazardous Material response and notification procedures.

- Maintenance personnel safety during inspection, maintenance and spill cleanup.
- If sampling is required, these individuals shall be properly trained in sampling procedures.

Section 7 - Basic Inspection and Maintenance Activities

7.1 - General Stormwater Quality Controls and Maintenance Measures

Storm Water Quality Control Measure or Pollutant Source	Inspection Frequency	Operations/Maintenance Activities
Onsite storm drain system to be kept clean and clear of obstructions.	Prior to Rainy Season (Oct 1st) End of Rainy Season (Apr 15th) After large Rain Events As Needed (Minimum of yearly)	Inspect and clean onsite catch basins and storm drain piping.
"Don't Dump – drains to Ocean" placard maintenance at all onsite catch basins/inlets	Yearly	Replace placard if missing, defaced, or unreadable
Parking lot(s) to be maintained free of litter and debris.	Prior to Rainy Season (Oct 1st) As Needed (Minimum of yearly)	Sidewalks and parking lots to be swept regularly to prevent accumulation of litter and debris. Litter, debris, and any cleaning agents will be trapped and collected to prevent entry into storm drain system.

7.2 – Infiltration Basin (INF-1)

Infiltration BMP Inspection and Maintenance Checklist

Date:_____Work Order:_____

Type of Inspection: __post storm __annual ___routine ___post rainy season __pre rainy season

Facility: _____ Inspector: _____

Defect	Conditions When Maintenance Is Needed	Inspection Results (0,1, or 2)	Date Maintenance Performed	Comments or Actions Taken to Resolve Issue
Appearance, vegetative health	Mowing and trimming vegetation is needed to prevent establishment of woody vegetation, and for aesthetic and vector reasons.			
Vegetation	Poisonous or nuisance vegetation or noxious weeds.			
	Excessive loss of turf or ground cover (if applicable)			
Trash & Debris	Trash and debris >5 cf/1,000 sf (one standard size garbage can)			
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.			
Erosion	Undercut or eroded areas at inlet or outlet structures.			

Sediment and Debris	Accumulation of sediment, debris and oil/grease on surface, inflow, outlet or overflow structures.			
Sediment and Debris	Accumulation of sediment and debris in sediment forebay and pretreatment devices.			
Water drainage rate	Standing water, or by visual inspection of wells (if available), indicates design drain times are not being achieved (i.e., within 72 hours)			
Media clogging surface layer	Lift surface layer (and filter fabric if installed) and check for media clogging with sediment (function may be able to be restored by replacing surface aggregate/filter cloth).			

Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day

7.3 – Vegetated Swale (BIO-3)

Vegetated Swale Filter Inspection and Maintenance Checklist

Date:_____ Work Order:_____

Type of Inspection: __post storm __annual ___routine ___post rainy season __pre rainy season

Facility: _____ Inspector: _____

Defect	Conditions When Maintenance Is Needed	Inspection Results (0,1, or 2)	Date Maintenance Performed	Comments or Actions Taken to Resolve Issue
Appearance	Untidy.			
Trash and Debris Accumulation	Trash and Debris accumulated in the swale.			
Vegetation	When the grass becomes excessively tall (greater than 10 inches); when nuisance weeds and other vegetation start to take over.			
Excessive Shading	Vegetation growth is poor because sunlight does not reach swale. Evaluate vegetation suitability.			
Poor Vegetation Cover	When vegetation is sparse or bare or eroded patches occur in more than 10% of the swale bottom. Evaluate vegetation suitability.			
Sediment Accumulation	Sediment depth exceeds 2 inches or covers more than 10% of the design area.			
Standing Water	When water stands in the swale between storms and does not drain freely.			

Flow spreader or Check Dams	Flow spreader or check dams uneven or clogged so that flows are not uniformly distributed through entire swale width.			
Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks and an eroded, muddy channel has formed in the swale bottom.			
Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.			
Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows. Eroded and rilled side slopes.			
	Eroded or undercut inlet/outlet structures.			

Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

7.4 – Contech CDS Hydrodynamic Separator (PT-1) (see Appendix 'A')

CDS Inspection and Maintenance Checklist

Date:_____ Work Order:_____

Type of Inspection: __post storm __annual ___routine ___post rainy season __pre rainy season

Facility: _____ Inspector: _____

CDS model _____ Location _____

Date	Water depth to sediment [1]	Floatable Layer Thickness [2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

Section 8 - Revisions of Pollution Mitigation Measures

If future correction or modification of stormwater control measures or procedures is required, the Stormwater Quality Control Operations & Maintenance Manager shall obtain approval from the governing stormwater agency prior to commencing any work. Contact the City of Oxnard Public Works Department at (805) 385-8280 for more information on approval requirements for any proposed modifications to this plan. Corrective measures or modifications shall not cause discharges to by-pass or otherwise impede existing stormwater control measures.

Section 9 - Monitoring & Reporting Program

A report shall be submitted annually to the City of Oxnard that demonstrates proper maintenance and operation of the project's Control Measures. Such report shall at a minimum comply with the requirements of Part 4, Section E.IV.2 (d) of the Ventura County MS4 permit.

Annual reports shall be transmitted to:

City of Oxnard Stormwater Program
Attn: Technical Services Manager
6001 Perkins Road
Oxnard, CA 93033

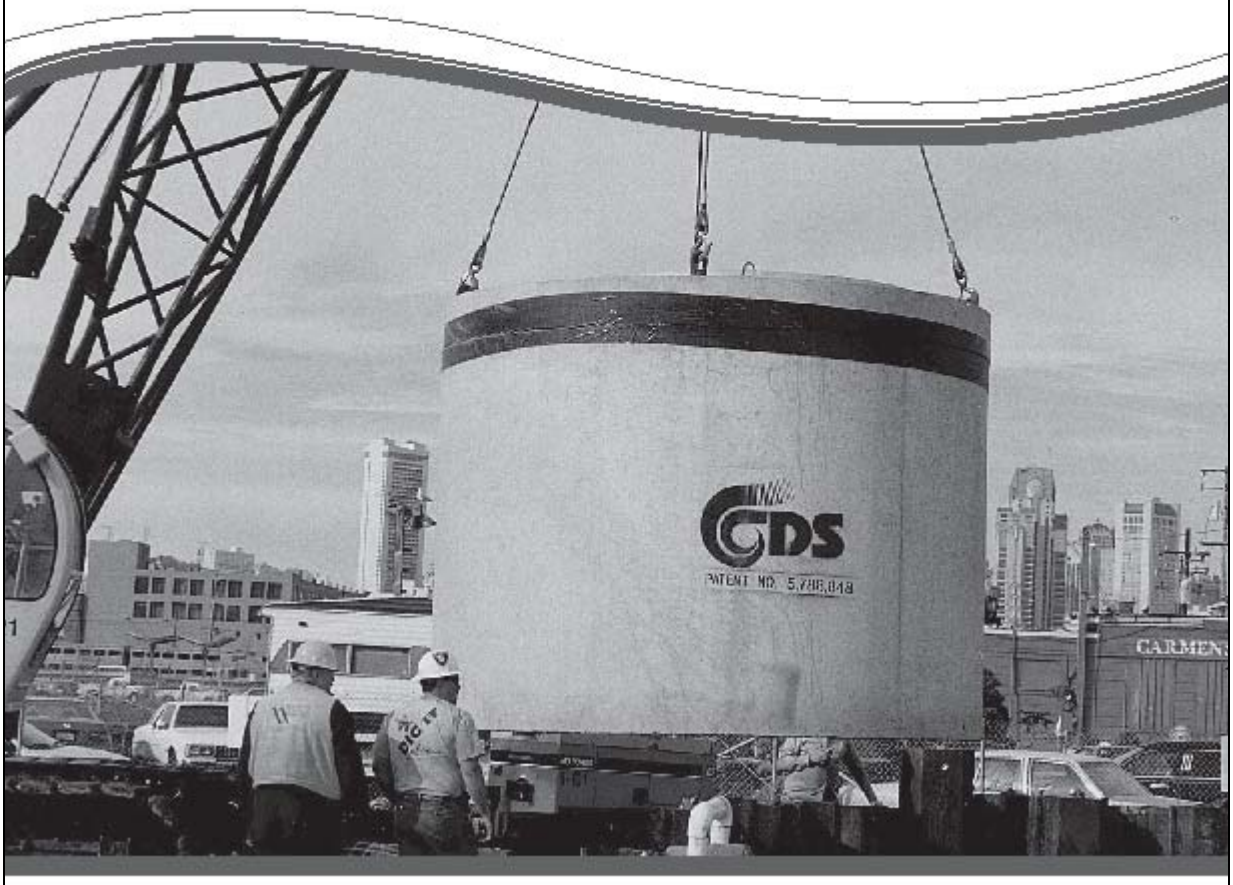
Monitoring shall include, but not limited to:

1. The requirement to clean on-site storm drain system a minimum of twice a year: once immediately before the first of October (the beginning of the rainy season) and once in January.
2. Performing inspections, cleanout and preventive maintenance of the first flush treatment facilities based on operating experience unless precise pollutant loadings have been determined by Declarant or an applicable agency. All bypass structures and treatment facilities shall be inspected and cleaned at least once each year prior to October 15th. In addition, a bypass structure or treatment facility shall be cleaned out when it is forty percent (40%) or more full of trash or debris. Maintain inspection and maintenance logs which shall be submitted to the City within thirty (30) days after written request.

Appendix 'A' (CONTECH CDS Guide)

CONTECH
ENGINEERED SOLUTIONS

CDS Guide
Operation, Design, Performance and Maintenance



APPENDIX J
SITE-SPECIFIC HEALTH AND SAFETY PLAN

SITE-SPECIFIC HEALTH AND SAFETY PLAN
NORTH SHORE AT MANDALAY BAY
198 SOUTH HARBOR BOULEVARD
OXNARD, CALIFORNIA

Prepared for

MPL Property Holdings, LLC
2392 Morse Avenue
Irvine, California 92614

Prepared by

Terraphase Engineering Inc.
18401 Von Karman Avenue, Suite 410
Irvine, California 92612

October 16, 2018

Project Number S041.001.0001

terraphase engineering

CONTENTS

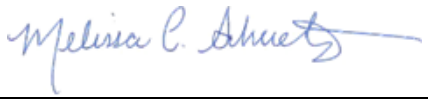
Figure

Appendices

Signature Sheet

This section provides a detailed listing of the individuals responsible for drafting, reviewing, implementing, and approving this HASP.

Project Manager



10/16/2018

Melissa Schuetz, Principal Geologist Date

Corporate Health and Safety Officer Approval

10/16/2018

Daren Roth, EH&S Manager/ Senior Project Geologist Date

1.0 INTRODUCTION

Terraphase Engineering Inc. has prepared this Site-Specific Health and Safety Plan (HASP) for the North Shore at Mandalay Bay development, located at 198 South Harbor Boulevard in Oxnard, California ("the Site"). The HASP was written in general accordance with Occupational Health and Safety Administration (OSHA) regulations as specified in Title 29, Code of Federal Regulations, Section 1910.120.

This document constitutes the HASP which is central to the safety and health program for the project. This document is considered a living document and can be amended as needed. A hardcopy of this HASP will remain on site at all times during the field work activities.

This HASP applies to all contractors, sub-contractors, and regulatory personnel on-site.

1.1 Field Work Activities

Field work activities that are planned or associated with the operations and maintenance and contingency plans for the Site include the following:

- Injection of a food-grade lecithin/iron/vitamin emulsion to groundwater.
- Installation of groundwater monitoring wells.
- Development of groundwater monitoring wells
- Sampling of groundwater monitoring wells
- Abandonment of groundwater monitoring wells
- Installation and sampling of vapor monitoring probes at various depths
- Installation and maintenance of residential vapor barriers for vapor intrusion mitigation with associated foundations and piping
- Installation or modification to soil vapor extraction remediation system, including:
    - Horizontal extraction wells, and associated trenches and vaults
    - Vertical extraction wells, and associated trenches and vaults
    - Blowers, cooling fans, associated fittings, and filtration vessels
    - SVE system piping, trenches, pads, buildings, and concrete pads
    - Utility connections
- SVE system operation maintenance and monitoring
- Soil vapor extraction (SVE) system inspections and equipment maintenance
- Sampling of SVE vapors and condensate
- Soil sampling using direct push or hand augering equipment to depths
- Limited source area soil excavation

Work will be conducted on the existing vacant property until future residential housing is constructed. Following development activities, work will either be conducted in and around the housing development or in the resource protection area (RPA). Terraphase will subcontract California-licensed drilling and excavation contractors to perform applicable work.

1.2 Corporate Policy

Safety should take the highest priority in any Terraphase project; as evident in Terraphase's corporate motto "Safety First." It is Terraphase's policy that its personnel and its sub-contractor(s) on site shall assume full responsibility and liability for compliance with all applicable Federal, State and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. Terraphase's hard-earned reputation as a successful consulting company directly correlates to our high standards for safety during our projects. The goal for safety is no illness or injuries with zero lost work days due to work conditions.

2.0 SITE BACKGROUND

The Site consists of an irregularly shaped area of approximately 90 acres of land situated at the northeastern corner of the intersection of Harbor Boulevard and West Fifth Street in Oxnard, CA. The site is relatively flat, with elevations ranging from 10 to 70 feet above mean sea level and is located approximately 1,700 feet from the Pacific Ocean. The Site is bordered on the northeast and east by a strip of property on which a canal (referred to herein as "the Mandalay Canal" and in some historical reports as "the Edison Canal"), owned by Reliant Energy, flows from an ocean inlet to the south with cooling water and discharges back to the ocean through a nearby electric generation power plant. An undeveloped tract of land, also owned by Reliant Energy, bounds the northwestern portion of the Site. The Site is currently owned by Mandalay Bay Development, LLC.

Prior to the remedial activities that commenced in 2004, approximately 50 percent of the Site was covered with various types of vegetation including poison oak, coyote brush, ice plant, and willow scrub. In 1997, the only known wild population of the Ventura marsh milk-vetch ("milk-vetch"; *Astragalus pycnostachys var. lanosissimus*), a plant species previously thought to be extinct, was discovered on the Site. The milk-vetch occurs on approximately 3,200 square feet (less than 1/10 of an acre) of the approximately 90-acre Site (Impact Science, Inc. 1998).

The Site currently consists of vacant undeveloped land. The Site includes a Resource Protection Area (RPA) which includes two landfills located within the soil consolidation areas (SCAs). The milk-vetch protection area is located within the south SCA. The remainder of the Site has been graded for site development and includes unpaved future roads and individual house pads.

3.0 HAZARDS

Hazards that could be encountered include chemical hazards, environmental hazards, biological hazards, and/or physical hazards. The sub-categories of these four types of hazards are explained in further detail below.

3.1 Chemical Hazards

Chemical hazards may be encountered during the field activities to be conducted at the Site. These hazards may be encountered through inhalation, absorption, or ingestion. Based on historical site usage and investigation activities, soil, soil-gas and groundwater impacted with volatile organic compounds (VOCs) (e.g. Tetrachloroethene [PCE], trichloroethene [TCE], 1,2-dicloroethane [1,2-DCA], 1,1-dichloroethane [1,1-DCA], 1,1-dichloroethene [1,1-DCE], and Vinyl Chloride) may be encountered during intrusive activities, including soil, water and soil-gas sampling, excavation, and drilling activities. Polychlorinated biphenyls (PCBs) may be encountered in soil. Silica dust may also be encountered when coring or drilling into concrete.

EHC® Liquid Reagent Mix may be temporarily stored at the site prior to the injection activities. It will be handled in accordance with the manufacturer recommendations and the attached Safety Data Sheet (Appendix F).

3.1.1 Absorption and Ingestion Risk

In general, the anticipated concentrations of chemicals or potential concern (COPCs) in soil, soil-gas,and groundwater are such that the absorption and ingestion risk can be minimized by proper personal hygiene and use of personal protective equipment (PPE). The PPE requirements are discussed further in Section 8.0. If work is anticipated in areas where one or more of the COPCs exceed acceptable risk-based screening levels; the work practices, engineering controls, and required PPE will be assessed and modified as necessary in an addendum to this HASP.

3.1.2 Inhalation Risk

3.1.2.1 Volatile Organic Compounds

Inhalation risk associated with VOCs is possible when disturbing the subsurface (e.g., soil borings and excavation). During the periods of field activities when the subsurface is disturbed, real-time air monitoring of the worker breathing zone will be conducted. Air monitoring is discussed further in section 9.0. If field personnel experience short-term health effects such as headaches, nausea, or eye and respiratory irritation that are often associated with VOCs, he or she will take a break to relieve symptoms and further assess the risk to other personnel in the immediate area.

3.1.2.2 Polychlorinated Biphenyls

Soil impacted with PCBs may be disturbed during excavation activities are the Site. Based on the detected concentrations and proposed size of the areas to be excavated, exposure to PCBs is unlikely to meet or exceed the Cal/OSHA PEL (0.5 mg/m^3 for 54% chlorine content [as a PCB] and 1.0 mg/m^3 for 42% chlorine content [as a PCB]). The inhalation risk can be further mitigated by implementing dust control measured during excavation activities at the Site. The need for air monitoring for dust or PCBs is not anticipated but will be assessed prior to excavations at the Site. Action levels will be developed as necessary based on soil analytical data in the proposed excavation areas.

3.1.2.3 Silica Dust

Silica dust may be generated during the coring or drilling of concrete prior to the advancement of soil borings or during the installation of sub-slab sampling points. OSHA recommends engineering controls be implemented during all concrete coring to minimize inhalation risk to field personnel from silica dust. Engineering controls can substantially reduce the potential for exposure from silica dust.

The required engineering controls include the following:

- Core saws will be equipped with an integrated water delivery system with water flow rates sufficient to minimize the release of visible dust. The resulting slurry will be cleaned up (most likely with a wet/dry vacuum) to prevent the slurry from drying and releasing silica dust into the air.

- When using a handheld drill (e.g., rotary hammer, hammer drill, etc.), a vacuum dust collection system (e.g., hammer drill collection attachment) will be used to reduce exposure to silica dust. The vacuum must provide adequate airflow to remove dust at the drilling point and be equipped with a HEPA filter.

Air monitoring for silica dust is not necessary if the above engineering controls are implemented. The OSHA AL for respirable silica is 0.025 mg/m^3 and the PEL is 0.05 mg/m^3.

3.2 Environmental Hazards

The Los Angeles Area has a Mediterranean-type climate characterized by mild temperatures. The average wind speed is 11 miles per hour. Average summer temperatures in the City of Oxnard average around 71 degrees Fahrenheit (°F). Winter averages temperatures are in the upper 40s °F.. The average annual precipitation is approximately 15.5 inches. However, all field personnel should be prepared for a change in weather conditions.

3.2.1 Heat Stress

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. All employees must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress disorders.

Heat stress monitoring and work rest cycle implementation must commence when the ambient temperatures exceed 80°F. The SSHO, project manager, and/or task manager should monitor the anticipated high temperatures prior to the start of work, as well and monitor real-time temperatures during the work day using a reputable website (i.e. http://www.weather.gov/) or onsite weather station.

The following control measures can be used to help control heat stress:

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day. Potable water must be provided at the jobsite in sufficient quantities (at least one quart per employee per hour for the entire shift).
- Onsite drinking water will be kept cool (below the ambient temperature, but not so cool that it causes discomfort).
- A work regimen that will provide adequate rest periods for cooling down will be established, and based on the work activities, level of PPE, and anticipated daily temperatures.
- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.
- Cooling devices (i.e. cooling vests) should be used when personnel must wear impermeable clothing in conditions of extreme heat (>95°F).
- Employees should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary. If an employee is working alone in hot weather, the PM/TM should schedule regular check-ins with the employee.
- A shaded rest area must be available near the job site. The site workers will either utilize natural shade (i.e. building structures, trees, etc.), or temporary a shade structure will be erected. The shaded area must be large enough to accommodate the number of employees on rest or recovery periods. The interior of cars or trucks are not considered shade unless the vehicles are air conditioned or kept from heating up in the sun in some other way.
- All breaks should take place in the shaded rest area and the employees must not be assigned to other tasks during breaks.
- Employees must remove impermeable garments during rest periods. This includes white Tyvek-type garments.

Employees shall be allowed and encouraged to take a preventative cool-down rest in the shade at a time when they feel the need to do so to protect themselves from overheating. Such access to shade shall be permitted at all times. An individual employee who takes a preventative cool-down rest (A) shall be monitored and asked if he or she is experiencing symptoms of heat illness; (B) shall be encouraged to remain in the shade; and (C) shall not be ordered back to work until any signs or symptoms of heat illness have abated, but in no event less than 5 minutes in addition to the time needed to access the shade.

High Heat Procedures will be implemented in accordance with the Cal/OSHA heat illness prevention regulations if the temperature at the Site equals or exceeds 95°F. This must include the following:

(1) Ensuring that effective communication by voice, observation, or electronic means is maintained so that employees at the work site can contact a supervisor when necessary. An electronic device, such as a cell phone or text messaging device, may be used for this purpose only if reception in the area is reliable.
(2) Observing employees for alertness and signs or symptoms of heat illness. The employer shall ensure effective employee observation/monitoring by implementing one or more of the following:

    (A) Supervisor or designee observation of 20 or fewer employees, or

    (B) Mandatory buddy system, or

    (C) Regular communication with sole employee such as by radio or cellular phone, or

    (D) Other effective means of observation.

(3) Designating one or more employees on each worksite as authorized to call for emergency medical services, and allowing other employees to call for emergency services when no designated employee is available.
(4) Reminding employees throughout the work shift to drink plenty of water.
(5) Pre-shift meetings before the commencement of work to review the high heat procedures, encourage employees to drink plenty of water, and remind employees of their right to take a cool-down rest when necessary.

3.2.2 Hypothermia

Hypothermia can result from abnormal cooling of the core body temperature. It is caused by exposure to a cold environment and wind-chill. Wetness or water immersion can also play a significant role. Typical warning signs of hypothermia include fatigue, weakness, lack of coordination, apathy, and drowsiness. A confused state is a key symptom of hypothermia. Shivering and pallor are usually absent, and the face may appear puffy and pink. Body temperatures below 90°F require immediate treatment to restore temperature to normal.

Current medical practice recommends slow re-warming as treatment for hypothermia, followed by professional medical care. This can be accomplished by moving the person into a sheltered area and wrapping with blankets in a warm room. In emergency situations, where body temperature falls below 90°F and heated shelter is not available, use a sleeping bag, blankets, and body heat from another individual to help restore normal body temperature.

3.2.3 Ultraviolet (UV) Radiation (Sunlight)

Moderate to high potential for overexposure to UV light exists for field personnel. To prevent erythema (sunburn), workers will be provided Sun Protection Factor (SPF) 30 or greater sunscreen to apply to areas not covered with clothing or PPE. Workers will be encouraged to seek shade whenever possible.

3.2.4 Rain/Thunder/Lightning

Due to the site's location in the Los Angeles Area, foul weather including rain storms can occur especially in the months between November and March. Monitor local weather through available media or a weather radio. Although not as frequent, electrical storms can potentially be very hazardous to field personnel. During lightning and thunderstorms, the following is necessary:

- Equipment shutdown;
- Seek shelter in a building or vehicle; and
- Await further instruction from Project Leader.

A 30-minute STAND DOWN period is required after encountering Lightning or Thunder in order to allow the storm to pass.

3.3 PHYSICAL HAZARDS

Physical hazards discussed under this section include slips, trips, and falls, heavy equipment, traffic, large rotating equipment, underground utilities, noise, motor vehicle operation, and ergonomic hazards.

3.3.1 Slips, Trips, and Falls

The excavation delineation work required at this Site may require soil borings to be advanced on a steep slope located behind the starting point of work. The steep slope may have uneven terrain or loose gravel on the surface, and footing may be difficult on this area.

Slips, trips, and falls are a leading cause of injury on construction and remediation worksites. Water and slime collect on horizontal surfaces and stairs, posing a potential hazard. Proper

housekeeping is the key to preventing injuries of this nature. To minimize potential for injuries, the following measures will be implemented:

- Site around open manholes, excavations, trenches, etc. will be kept clean and orderly
- All potential trip and fall hazards will be clearly marked, modified to reduce the hazard, or engineered in a configuration to eliminate the hazard (if possible)
- All floors and stair treads will be kept clean of water, oil, and polymer.
- All hoses will be coiled and stored out of the way when not in use.
- There will be no running on the site.

As with all field work sites, caution will be exercised to prevent slips on rain slick surfaces, stepping on sharp objects, etc. Work will not be performed on elevated platforms without fall protection.

3.3.2 Equipment Hazards

Large drilling equipment will be used to perform the drilling and boring activities. Other large construction equipment will be present during construction of the housing development. The operators of these vehicles have limited vision of the ground around their equipment and hence they pose a significant hazard to pedestrians. Do not stand in an area where construction vehicles move back and forth.

- Do not approach any construction equipment with an operator at the equipment's controls without making eye contact with the operator, signaling to the operator that you wish to approach the equipment, AND RECEIVING POSITIVE AFFIRMATION FROM THE OPERATOR THAT HE/SHE KNOWS YOU ARE APPROACHING.
- Any construction equipment with a non-operational back-up alarm is to remain stationary with chocks under all four wheels until the alarm is fixed.

3.3.3 Underground and Overhead Utilities

Reasonable efforts will be made to identify the location(s) of underground utilities (e.g., pipes, electrical conductors, fuel lines, and water and sewer lines) before mechanized soil intrusive work is performed. The state underground utility notification authority Underground Services Alert (USA), will be notified at least 48 hours prior to starting field activities (not including the day of the notification). USA in turn will notify representatives of the utility companies who will mark the location of underground services entering the property. USA markings will be noted prior to drilling to prevent damage to utility lines.

The Project Manager is responsible to ensure that underground utility locations are identified prior to the commencement of any subsurface (> 1 foot) activities. Resources include site plans, utility companies, and the use of a private locating firm prior to mechanized drilling or excavating. The proper utility company personnel should certify the deactivation of utilities, and the certification should be retained in the permanent log.

In accordance with CCR, Title 8, Section 1541 (Excavations), an excavation shall not commence until:

- The excavation area has been marked as specified in Government Code Section 4216.2 by the excavator; and
- The excavator has received a positive response from all known owner/operators of subsurface installations within the boundaries of the proposed project; those responses confirm that the owner/operators have located their installations, and those responses either advise the excavator of those locations or advise the excavator that the owner/operator does not operate a subsurface installation that would be affected by the proposed excavation.

Only qualified persons shall perform subsurface installation locating activities, and all such activities shall be performed in accordance with this section and Government Code Sections 4216 through 4216.9

When excavation or boring operations approach the approximate location of subsurface installations, the exact location of the installations shall be determined by safe and acceptable means that will prevent damage to the subsurface installation, as provided by Government Code Section 4216.4.

While the excavation is open, subsurface installations shall be protected, supported, or removed as necessary to safeguard employees.

An excavator discovering or causing damages to a subsurface installation shall immediately notify the facility owner/operator or contact the Regional Notification Center to obtain subsurface installation operator contact information immediately after which the excavator shall notify the facility operator. All breaks, leaks, nicks, dents, gouges, grooves, or other damages to an installation's lines, conduits, coatings or cathodic protection shall be reported to the subsurface installation operator.

If a utility strike presents an immediate danger to the work crew or general public (e.g., electrical, gas, high-pressure water line), then the crew should evacuate to a safe distance, contact 911 immediately, and cordon off the area to prevent public access.

All utility strikes should be reported out to the PM and/or SSHO as soon as it is safe to do so, and then a plan will be made for reporting to the utility company and client. If a utility strike does occur, refer to the accident reporting requirements in Section 6.0.

In areas not evaluated by the underground utility notification authority, and/or a reasonable potential for underground utilities exists, the following techniques will be employed to determine the location of subsurface structures:

- contracting the services of a qualified private utility locator
- subsurface testing (i.e., potholing) to the expected depth of probable utilities (not less than 5 feet bgs)

If utilities cannot be located and/or if unlocated utilities are suspected to be present, subsurface activities (i.e., borings, excavation) should not be conducted prior to confirming the location(s) or absence of underground utilities.

Equipment with articulated upright booms or masts shall not be permitted to pass within 20 feet of an overhead utility line (less than 50 kilovolts [kV]) while the boom is in the upright position. For transmission lines in excess of 50 kV, an additional distance of 4 inches for each 10 kV over 50 kV will be used.

Excavation, drilling, crane, or similar operations adjacent to overhead lines shall not be initiated until operations are coordinated with the utility officials. Operations adjacent to overhead lines are prohibited unless one of the following conditions is satisfied:

- Power has been shut off and positive means (e.g. lockout/tagout) have been taken to prevent lines from being energized. Wherever possible, the SSHO will observe power shut off and place a lock and tag on the switch. In all cases utility company personnel shall certify in writing to the Project Manager or SSHO the deactivation of overhead utilities, and the certification retained in the project files. The Site Manager or SSHO must also attempt to verify power shut off by checking that power is no longer available to the affected building or equipment.

- Equipment, or any part of the equipment, cannot come within the following minimum clearance from energized overhead lines:

Power Lines Nominal System (kv)	Minimum Required Clearance
0-50	10 feet
50- 75	11 feet
75-125	13 feet
125-175	15 feet
175-250	17 feet
250-370	21 feet
370-550	27 feet
550-1000	42 feet

1.1.1 Excavation Hazards

If hazardous atmospheres are suspected, the atmosphere in any trench or excavation more than 4 feet deep must be monitored in accordance with 29 CFR 1926.651. In addition, a means of egress from excavations (such as a stairway, ladder, ramp, or other safe means of egress) shall be located in excavations greater than 4 feet. However, if excavations will extend beyond 5 feet

deep, personnel are prohibited from entering a trench or excavation that is deeper than 5 feet without the excavation being properly shored, sloped, or benched in accordance with 8 CCR 1540-41. If personnel are required to enter a trench or excavation that is deeper than 5 feet, the contractor who created the excavation must make the following provisions prior to entry:

- If hazardous atmospheres are suspected, the atmosphere in any trench or excavation must be monitored;
- Adequate shoring, sloping, or benching techniques must be employed;
- Adequate means of employee access and egress must be utilized and will be located within 25 feet of the work area;
- The contractor's trained competent person must inspect the trench or excavation on a daily basis, before work commences, and on an as-needed basis throughout the day; and
- The contractor controlling the excavation must have a current Cal/OSHA trenching/excavation permit.
- All provisions of this regulation must be complied with when working in a trench or excavation that is deeper than 5 feet at the deepest point

Adequate protection shall be provided by placing and keeping excavated soils, rock, and equipment a minimum of 2 feet back from the edge of each excavation.

Terraphase will place temporary fencing and yellow caution barricade tape around the excavation area any time the work area is left unattended and at the end of each work day until the excavation activities are completed. Additionally, the sidewalls of the excavation will be sloped or benched in accordance with OSHA requirements. The competent person will determine the required slope based on site conditions and soil types, but any excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.

3.3.4 Machinery/Moving Parts

Drilling, vacuum, and heavy equipment may have various motors, booms, and other equipment. These present a general physical hazard from moving parts. Personnel will stand clear of machinery at all times unless specific instructions are given by the trained operator or other person in authority. Always make eye contact with the operator prior to moving around the machinery. Steel-toed shoes or boots will be worn at all times when on the site. All appropriate guards will be in place during equipment use. All machines, parts of machines, or component parts of machines which create hazardous revolving, reciprocating, running, shearing, punching, pressing, squeezing, drawing, cutting, rolling, mixing or similar action, including pinch points and shear points not guarded by the frame of the machine(s) or by location, shall be guarded. Field personnel should be careful to keep loose clothing, hands, and feet away from vacuum hose inlets.

3.3.1 Hand and Power Tools

Use of power tools presents potential physical hazards (e.g., pinch points, electrical hazards, flying debris, and struck-by/caught-between hazards) to personnel operating them. The following safety rules must be implemented:

- Inspect tools frequently for defects. Turn in all tools which are burred, mushroomed, have split or loose handles, have worn or sprung jaws, have exposed wires, or are generally unsafe.
- Use hand tools properly and for their intended use only.
- Do not to operate power tools, machinery, or equipment without proper training or supervision.
- Do not operate equipment unless all guards and other protective devices are properly secured and correctly adjusted.
- Keep cords of electrical equipment coiled when not in use.
- When using electrical equipment, position its power cord to avoid its being run over by vehicles or equipment.
- Turn off, and if possible unplug, machinery before cleaning, oiling, adjusting, or repairing unless the equipment is designed or fitted with safeguards to protect the person performing the work.
- Do not wear loose or frayed clothing, dangling ties, finger rings, etc. when operating or working near moving machinery or other mechanical sources of entanglement.
- Do not lift or lower portable electric tools by means of a power cord; use a handline.
- Never throw tools, equipment, or material up or down from one working level to another; always use a handline. Do not disconnect air hoses at compressors until hose line has been bled.

3.3.2 Electrical Hazards

In order to prevent accidents caused by electrical shock, field personnel will inspect electrical equipment being used (e.g. power tools, electrical cords) on a daily basis for evidence of frayed or loose connections.

If necessary, all provisions of the Occupational Safety and Health Agency (OSHA) standard as stated in 29 Code of Federal Regulations (CFR) 1910.147 will be followed for controlling hazardous energy or locking out or tagging out electrical and utility hazards.

3.3.3 Lock-out/Tag-out

Lock-out/Tag-out procedures should be used on any pieces of equipment being worked on by field personnel. The only exception to this is equipment with a plug, which can be unplugged and remain in control of the worker. Proper lock-out/tag-out includes the identification and isolation of hazardous energy. The energy sources must be locked out so that only the worker(s)

has the key to release the isolation point. Stored energy (e.g. air or water pressure) must also be released prior to conducting work on the equipment. If necessary, all provisions of the Occupational Safety and Health Agency (OSHA) standard as stated in 29 Code of Federal Regulations (CFR) 1910.147 will be followed for controlling hazardous energy or locking out or tagging out electrical and utility hazards.

3.3.4 Confined Spaces

Confined space entry is not anticipated for this project. Terraphase field personnel will not enter any confined space without specific approval of the Project Manager. Subcontractors may need to conduct permit-required confined space entries. In the event that a subcontractor project manager determines a permit-required confined space entry is necessary, the Terraphase Project Leader should be notified.

If confined space entries are conducted they will be in accordance with the subcontractor's confined space entry program. An attendant will be stationed above the confined space while the entrant(s) are in the confined space. A full-body harness with emergency retrieval equipment or another means of egress (e.g. ladder) shall be in use if necessary and if the confined space is greater than 6 feet deep.

Before conducting any work inside a confined space (e.g. tank), the personnel will conduct a visual inspection of the area from the opening to identify any hazards before proceeding. Gas measuring devices will be utilized to detect any presence of harmful or dangerous atmospheres. Any floating or rotating machinery that are in the confined space are turned off and locked out prior to beginning any work.

3.3.5 Noise

Direct push drill rigs and excavation equipment are extremely loud. Appropriate hearing protection (ear muffs or ear plugs with a noise reduction rating of at least 20 decibels [dBA]) will be used if individuals work near high-noise generating equipment (> 85 dBA). Determination of the need for hearing protection will be made by the Project Leader.

3.3.6 Heavy Equipment Operation

Physical hazards can arise from loading and off-loading heavy equipment from tractor-trailers and locating equipment to designated areas of use. Hazards will be mitigated by personnel avoiding close proximity to moving equipment and immovable objects.

Belts and rotating parts have the ability to injure, crush, or amputate body parts and limbs. Personnel will avoid contact with any moving part. Any loose items will be removed before working around moving or rotating equipment. Any moving parts that can be guarded will have an appropriate machine guard installed. Equipment will not be operated without the proper

guards in place. Repairs/adjustments will be done with the equipment stopped and locked out as appropriate.

The following measures will be implemented for heavy equipment operation:

- The minimum required work uniform for all field personnel (e.g. Level D protection) shall be general work clothes, steel-toed construction boots ANSI approved, safety goggles or glasses, work gloves, high visibility vest, hearing protection, and a hard hat (American National Standards Institute (ANSI) approved).
- Adequate workspace shall be maintained during equipment operation.
- Equipment shall be inspected for proper working condition prior to use.
- Field personnel shall only approach operating equipment from the operator's angle of view, and only after making eye contact with the equipment operator.
- A 10-foot perimeter will be maintained around all active equipment as a "Danger Zone".
- Only trained and qualified persons shall operate individual equipment.

3.3.7 Drill Rig

The operator of the Drill Rig will comply with the precautions in the above section. In addition, the following precautions should be observed whenever a drill rig is in use:

- Workers must not wear loose clothing, nor leave long hair, boot laces, or jacket ties uncontrolled while operating moving equipment;
- Hard hats, hearing protection, safety footwear, and eye protections must be worn at all times;
- Prior to the start of daily operations, the drill rig operator should inspect the drill rig carefully to be sure that it is suitable for the day's work;
- The drill rig operator will ensure that there is adequate lighting on the rig to enable the job to be performed safely;
- The drill rig must be equipped with an operable kill switch;
- All fittings, connections, and hydraulic hoses must be of a standard to operate in a safe manner;
- At no time will the operator of the drill rig operate the drill controls and add stem while alone, unless the drill rig is designed to operate as a single person operation;
- Repairs and service must not be attempted while rotary machinery is running;

If electrical storms can be seen or heard, drilling operation will be shut down until it is deemed safe by the SSO.

3.3.8 Motor Vehicle Operation

Employees may be exposed to vehicle accident hazards associated with the operation of vehicles during the project. To control these hazards, the following safety requirements will be strictly enforced:

- Only licensed drivers are authorized to operate motor vehicles
- Seat belts shall be worn anytime a vehicle is in motion, regardless of speed or distance to be traveled. Seat belt requirements also apply to the operation of backhoe and other construction equipment;
- The basic speed law shall be followed at all times; and
- Vehicles shall never be operated at a speed that is not safe for the conditions (i.e. road surface, traffic, visibility, weather, etc.).
- Minimize potential distractions while driving (eating, reading, adjusting the radio, etc.)
- Drivers are required to use hands-free equipment while talking on their cellular telephones per California state law

3.3.9 Ergonomic Hazards

The initial site safety briefing given to all workers prior to the start of the project will cover the basics of ergonomics and focus on the following topics:

- Ergonomic injuries – their prevalence, causes, and significance
- Proper lifting procedures and planning all lifts
- Proper posture when standing, operating a motor vehicle or heavy equipment
- Avoiding overexertion
- Awareness of repetitive task and the hazards that they can pose

3.3.9.1 Hand Augering

In addition to the precautions listed in the Back Safety discussion below, additional care should be taken to prevent injuries when using slide hammers.

- Wear cotton or leather gloves when rotating the auger.
- Avoid putting pressure on the palms of your hands; use a good grip to spread the pressure over the entire hand.
- Take frequent stretch breaks to stretch and relax your back, arms, and hands.

3.3.9.2 Back Safety

Using the proper techniques to lift and move heavy pieces of equipment (greater than 50 pounds) is important to reduce the potential for back injury. The following precautions should be implemented when lifting or moving heavy objects:

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

3.3.10 Traffic Hazards

Though the bulk of this work will occur at the back of the business, which is away from traffic, it is still important to note traffic flow and any potential hazards. Traveling to and from site will mean sitting in traffic and navigating safely through it. Employees should always follow:

- The traffic control plan prepared for the work (if required),
- Park work vehicle between on-coming traffic and work zone to the extent feasible
- Demarcate the work zone with high visibility traffic cones
- Wear high visibility vest (minimum of Class II vest per Caltrans specification)
- Follow all laws regarding pedestrian crossing of streets
- Provide as much barrier between work area and traffic lanes as practicable
- When possible, employees should not walk between the traffic cones and the active lane of traffic.
- Equipment and supplies should be unloaded from the back of the vehicle or the sidewalk side of the vehicle to minimize the potential to travel in the active traffic lane

3.4 Biological Hazards

This section provides health and safety precautions against potential biological agents that might be encountered by field personnel during field activities. The biological hazards that may be encountered include: microbiological agents, insects and wild animals.

3.4.1 Arthropods – Insects, Ticks, and Spiders

The work area may have insect and tick populations. Appropriate insect repellants (with N, N-diethyl-metatoluamide [DEET]) will be provided. Educational information will be given on the identification of ticks and lyme disease. Field personnel wearing light colored clothing can easily inspect themselves for insects and ticks.

The work area may have venomous spider populations. Venomous spiders native to Southern California are the female black widow spider, the Desert Recluse and the Chilean Recluse. The female black widow is normally shiny black, with a red hourglass marking on the underside of abdomen. Black widows can be found both outdoors and indoors. In indoor settings, black widows prefer undisturbed, cluttered areas, which may exist in the warehouse at the site.

Recluse spiders are generally timid and seldom seen by humans. Bites usually occur when someone feels around in an area that they can't see, or when someone puts on an old item of clothing that the spider was hiding in. Both the desert recluse and the Chilean recluse are varying shades of solid brown or tan.

Field personnel should wear long sleeves and work gloves if they need to move stored material or debris at the site to avoid spider bites.

3.4.2 Vermin

Feral cats, skunks, rats, mice, squirrels and rabbits may be carriers of disease. Where vermin are identified in work areas, the Project Leader shall be immediately notified. Bites will be immediately reported and medical care obtained. Infections may occur in humans associated with activities that bring humans into contact with rodents, rodent saliva, or rodent excreta. Disturbing rodent-infested areas may bring humans into contact with the etiologic agents causing infections.

Transmission of disease may occur through broken skin, contact with conjunctivae, ingestion of contaminated food or water, or inhalation of aerosols. Personal hygiene practices, such as frequent hand washing, will help prevent rodent-borne diseases as well as using caution in areas likely to be occupied by vermin.

Workers will be advised that if a fever or respiratory illness develops within 45 days of the potential exposure, they should seek medical attention and inform the physician of potential Hantavirus exposure. All precautions will be made to ensure Hantavirus exposure is eliminated in the field. Rodent-borne diseases, including Hantavirus, result in severe respiratory distress and plague.

4.0 SITE CONTROL AND GENERAL SITE SAFETY PROCEDURES AND REQUIREMENTS

The following section describes the roles and responsibilities of the personnel involved with the project. See Figure 1 in Section 5 for a schematic of roles and levels of authority. Appendix A has a list of contact names and phone numbers related to this project.

4.1 Site Control

Site control measures have been developed in accordance with 8 CCR 5192(d). Site control requires the establishment of a regulated area and designated site work zones. Site security will be accomplished with a fence and gate that is locked during non-operational periods. During operations, site control is also required to keep non-project personnel from entering job site areas. Physical barriers such as temporary fencing, cones, barricades, and/or caution tape should be used to block access to unsecured points of entry during working hours. The Project Team Leader will approve all visitors to the site ensuring they have a valid purpose for entering the site. Persons authorized to access the site will be trained on the HASP. Persons will avoid working at the site alone, and will ensure that others onsite are aware of their presence prior to beginning work.

Before site work begins, the site will be prepared to ensure safe and efficient operations. The following preparations will be in place prior to the start of activities:

- Assess roadways to provide ease of access and a sound roadbed for heavy equipment and vehicles. Traffic flow patterns will also be arrange to ensure safe and efficient operations.
- Elimination of physical hazards such as debris, unsecure objects, and low overhead wiring from the work area.
- Establishment of a decontamination area as discussed in Section 4.2 below.

Site workers and visitors will review the HASP before commencing work which will serve as site-specific training. The SSHO will review the HASP before field operations begin (i.e. pre-job health and safety conference) and the SSHO, or designee, will conduct daily tailgate safety meetings (i.e. pre-entry briefings) to bring up appropriate health and safety concerns and discuss any changes in field conditions. The SSHO will conduct additional pre-entry briefings with entrants to the site who are not present for the tailgate safety meeting. Field personnel will certify their review by signing a HASP acknowledgement form (Appendix B).

4.2 Decontamination Procedures

Prior to performing work, a decontamination area will be established in a location such that dust and debris are removed from equipment and personnel leaving the exclusion zone.

This section describes procedures for removal, collection, and containment of dust and other potentially contaminated material from equipment and transportation vehicles; decontamination of personnel and tools; and methods for temporary storage, characterization, treatment, and off-site disposal of decontamination wastes generated during decontamination activities. Decontamination procedures take place in a designated area within the Contamination Reduction Zone (CRZ). Access into and out of the CRZ from the Exclusion Zone (EZ) will be through Access Control Points. Types of decontamination include dry decontamination for lead-impacted dust.

4.2.1 Decontamination equipment

The following decontamination procedures for respirators and sampling and monitoring equipment will be conducted.

4.2.1.1 Respirators

Respirators, if donned to protect against hazardous substances and other non-disposable PPE will be cleaned with alcohol wipes. Each employer will provide the cleaning agents for all equipment decontamination. When dry, respirators will be stored in accordance with the manufacturer's instructions. Cartridges cannot be cleaned. During scheduled breaks, respirators will be removed and cleaned; cartridges are not required to be replaced during breaks. Care will be taken to ensure that cartridges remain clean while not in use during breaks.

4.2.1.2 Sampling Equipment

Sampling equipment will either be new/disposable, or if reusable it will be pressure-washed or hand-washed with non-phosphate detergent and rinsed with potable water before use.

4.2.1.3 Monitoring Equipment

To the extent practicable, measures will be taken to prevent contamination of monitoring equipment. Once contaminated, instruments are difficult to clean without damaging them. Any delicate instrument that cannot be easily decontaminated should be protected while in use. It should be placed in a clear plastic bag, with the bag taped and secured around the instrument. Openings are made in the bag for sample intake.

4.2.1.4 Heavy Equipment

In the event that equipment (i.e. aerial lifts) comes in contact with potentially contaminated dust or other media, the equipment will be cleaned before being released from the EZ. Decontamination will consist of dry decontamination, or if determined that additional decontamination is needed, through combinations of spray/wipe cleaning and/or detergent (Liquinox® or equivalent) wash, tap water rinse, and distilled water rinse. If generated, water

from the decontamination pad will be collected using tarping and transferred to a drum for disposal according to hazard classification.

4.2.1.5 Decontamination Specifications

Personnel	Sample Equipment	Heavy Equipment
☐ Boot wash or boot cover removal ☐ Glove decon ☐ Tyvek removal and disposal, including booties ☐ Respirator removal ☐ Inner-glove removal ☐ Hand wash/rinse ☐ Face wash/rinse ☐ Dispose of PPE in municipal trash, or contain for disposal ☐ Dispose of personnel rinse water per local requirement.	☐ Decon/Wash/rinse equipment ☐ Contain rinse water for offsite disposal	☐ Dry decon to extent practicable. If additional cleaning is needed: spray or wipe, with water and/or detergent ☐ Dispose of equipment, rinse water based on hazard classification.

Note: Employees before leaving the site must inspect their clothing and footwear to prevent transport of soil and debris off the site, into their vehicles, homes, etc. A visual inspection will be conducted in the CRZ; Gross contaminants will be washed off and/or initially wetted and brushed off. Employees are encouraged to leave any potential contaminated footwear (e.g. safety boots) in plastic bins or pads in their personal vehicles. Employees must be informed of these procedures and reviewed during tailgate/toolbox safety meetings.

4.2.2 Personal Decontamination

- Remove and decon hard hat.
- Remove outer gloves
- Boot wash
- Remove Tyvek and booties
- Place disposable PPE in an appropriate container for disposal.
- Remove the respirator (if applicable). Dispose of cartridges in PPE disposal container. Clean and disinfect the respirators and place into a plastic bag for storage.
- Remove liner gloves.
- Thoroughly wash hands and face.
- All disposable protective clothing shall be removed during decontamination and shall be disposed of in a lidded or otherwise secured container lined with a labeled drum liner. All waste generated at the site shall be disposed of according to the hazard classification of the debris.

- Any wash water resulting from decontamination activities will be collected and managed in accordance with all applicable laws and regulations.
- The SSHO must establish and monitor the decontamination procedures and their effectiveness. Decontamination effectiveness will be visually observed by the SSHO.

4.3 Personal Hygiene and Sanitation Facilities

The following personal hygiene requirements will be observed:

- Water Supply: a water supply meeting the following requirements will be utilized:
  - Potable Water: an adequate supply of potable water will be available for field personnel consumption. Potable water will be provided in the form of water bottles, canteens, or water coolers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.
  - Non-Potable Water: non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating: “Non-Potable Water; Not Intended for Drinking Water Consumption.”
- Toilet Facilities: portable toilet facilities with hand washing stations will be provided to site personnel or access to off-Site restrooms will be provided. If used, portable toilets will be serviced regularly to ensure they are maintained in a clean and sanitary condition.

4.4 Illumination

Proper illumination is important in the prevention of slips, trips, and falls. It is anticipated that the lighting in the future site buildings will conform to the OSHA standards for work place lighting. In the event the lighting is not adequate, or the lighting is no longer operational, an addendum to this HASP will be prepared to specify auxiliary lighting requirements that conforms to OSHA workplace standards.

It is anticipated that any outdoor work will be conducted during daylight hours, therefore, no additional illumination will be required.

4.5 Spill containment

In the event that refueling is conducted onsite for generators or other small gasoline or diesel powered equipment, the fueling will be conducted in accordance with the following procedures:

- Shut off engine.
- Verify the fuel is the proper type for engine.
- Maintain a spill kit in vicinity of fueling operations including absorbent clean-up materials (pads and kitty litter). Any used materials shall be disposed of properly after use.
- Nozzles used in equipment fueling shall be equipped with an automatic shut-off to prevent overfill.
- If a sight glass is present, observe the capacity remaining during filling to prevent overfill. If a sight glass is not present, check the capacity with a dip stick prior to initiating fueling, and fill slowly, checking the remaining capacity regularly.
- Fuel tanks shall not be “topped off.”
- Mobile fueling shall be minimized. Whenever practical, vehicles and equipment shall be transported to an off-site fueling station.
- Drip pans or absorbent pads shall be used under nozzle and other leak-prone areas during fueling.
- Fueling operations must be attended by personnel.

5.0 ROLES AND RESPONSIBILITIES

The following section describes the roles and responsibilities of the personnel involved with the project. See Figure 1 (below) for a schematic of roles and levels of authority. Appendix A has a list of contact names and phone numbers related to this project.

All Terraphase employees have the authority to stop work at any time if personnel or community safety and health is jeopardized.

5.1 Project Manager

The project manager has the responsibilities to:

- staff the project with qualified personnel (including proper training and certifications);
- ensure proper documentation is being collected and maintained;
- provide adequate resources and equipment to field personnel;
- monitor the performance of field activities; and
- ensure company policy is in compliance with all applicable regulations.

5.2 Project Leader

The project leader will serve as the Site Safety and Health Officer (SSHO) and will report to the Project Manager. The project leader is responsible to Terraphase and has the authority and knowledge necessary to implement this HASP and verify compliance with applicable safety and health requirements. The project leader has the responsibilities to:

- Be present at all times during site operations;
- Act as the liaison between field personnel and the subcontractor(s);
- Lead the daily and weekly safety meetings;
- Ensure the HASP is being followed;
- Authority to enforce and stop operations if personnel or community safety and health is jeopardized;
- Provide adequate resources and equipment to field personnel; and
- Monitor the performance of field activities.

5.3 Sub Contractor(s)

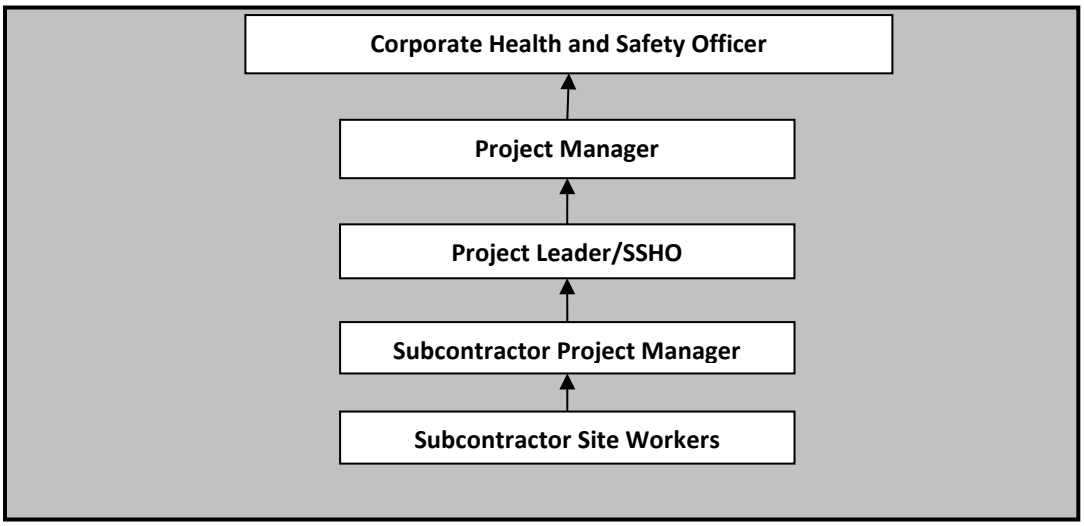
Terraphase is responsible for the oversight and implementation of the project safety program. Each subcontractor will be required to designate one individual to work directly with and under the authority of the SSHO to ensure safety responsibilities are being met. Coordination and control of work flow will be achieved through frequent meetings (formal and informal) and job

site inspection. The designated subcontractor safety designee (subcontractor project manager) must be granted stop work authority over persons from their company.

Subcontractor control and coordination will be through the chain of command identified in Figure 1. Although each subcontractor is ultimately responsible for the performance and actions of their employees, the SSHO has the authority to take action when a violation of safety guidelines is in question.

5.4 Chain of Command

Figure 1. Project Personnel Structure



Terraphase key personnel contact information is as follows:

- Corporate Health and Safety Officer, Daren Roth, Daren.Roth@Terraphase.com, Office-(510) 645-1850 ext. 38 Cell-(925)719-5496
- Project Manager, Melissa Schuetz, Melissa.schuetz@terraphase .com, Office 949.377.2227 ext.96, Cell 714.318.6560
- Project Leader/SSHO, Wes Skillings, wes.skillings@terraphase.com, Cell-(5206682968)

5.5 Training

Field personnel engaged in project operations that potentially expose them to hazardous wastes, hazardous substances, or any combination of hazardous wastes or hazardous substances shall have satisfied the requirements of 8 CCR 5192(e) through completion of:

- Initial 40-hour HAZWOPER training, and

- Annual 8-hour HAZWOPER refresher training current within one year.

The onsite supervisors directly responsible for hazardous waste operations shall have received initial 40-hour HAZWOPER training (annual 8-hour refresher), three days of supervised field experience, and at least eight additional hours of specialized hazardous waste operations management training on topics such as the employer's health and safety program, PPE program, spill containment program, and health hazard monitoring procedure and techniques.

5.5.1 General Site-Specific Training

All potential field personnel will review this HASP before commencing work which will serve as site-specific training. The SSHO will review the HASP before field operations begin and the SSHO, or designee, will conduct daily tailgate safety meetings (i.e. pre-entry briefings) to bring up appropriate health and safety concerns and discuss any changes in field conditions. The SSHO will conduct additional pre-entry briefings with entrants to the site who are not present for the tailgate safety meeting. Field personnel will certify their review by signing a HASP acknowledgement form (Appendix B).

Any additional site-specific safety concerns such as, noise, heat illness prevention, or lock-out/tag-out will be addressed by the Project Manager and the SSHO will be provided with proper Site specific training with accordance with any Cal/ OSHA regulations prior to the start of the project, as applicable.

5.5.2 First Aid/CPR

Medical assistance is in near proximity to the Site, and therefore, per 29 CFR 1910.151, a designated first aid provider is not required. Personnel trained in first aid/CPR and bloodborne pathogens (29 CFR 1910.151 and 1910.1030) may administer first aid and CPR if needed.

5.5.3 Respiratory Protection

The project personnel will have the potential to use respiratory protective equipment. The field personnel will be properly equipped by Terraphase with the appropriate mask style and filter type for the specific tasks as well as fit tested prior commencing work. Onsite workers will have successfully completed respiratory protection training in accordance with the requirements of 8 CCR 5144(k).

6.0 SAFETY MEETINGS

All workers permitted access to the site will receive a site orientation briefing and a review of pertinent aspects of the project and HASP before the start of work. Personnel will sign a form (Appendix B) documenting they have had an opportunity to review the HASP, understand the requirements, and agree willfully to adhere to the safety aspects of the plan.

The site orientation briefing will include the following aspects:

- Key personnel and responsibilities
- Site hazards (known and potential)
- PPE requirements
- Emergency procedures (including signals, evacuation locations, and what constitutes an emergency)
- Location and route to the nearest medical facility
- Incident reporting procedures

Weekly formal safety meetings will be conducted once every six working days to detail a specific safety topic of concern. Meetings typically last no less than 10 minutes in time and attendance will be documented. Daily informal safety meeting will be conducted each morning before work commences. Daily meeting attendance will be documented. Sign in sheets for the safety meetings are included in Appendix C.

Personnel are encouraged to immediately report any unsafe work conditions or work practices observed to the Project Leader.

7.0 ACCIDENT REPORTING

Workers are required to immediately report all accidents, incidents, near-miss incidents, injuries, illnesses and injuries requiring first-aid (no matter how trivial) to their supervisor and/or the SSHO.

In the event of a worker injury or illness, the SSHO, or designee, must be notified, who will in turn immediately report the incident to the Project Manager to assist with the coordination of required medical assistance and related workers compensation case management follow-up.

Should an incident such as a serious injury (requiring hospitalization), explosion, fire, or a spill or release of toxic materials occur during the project, the SSHO, or designee, will immediately report the incident to the Project Manager and appropriate government agencies. The written report must include the following information:

- Name, organization, telephone number, and location of the contractor
- Name and title of the person(s) reporting the incident
- Date and time of the incident
- Location of the incident
- Approximate chronological summary of details occurring before and at the time of the incident
- Cause of incident (if immediately known)
- Casualty information (fatalities or disabling injuries)
- Details of any existing chemical hazard or contamination
- Estimated property damage (if applicable)
- Nature of the damage and effect on the contract
- Actions taken to preserve safety and security
- Other damages or injuries sustained
- Witness statements

If a utility strike does occur, report this to the PM and utility operator as soon as it is safe to do so. The contact information for potential utility operators near the Site is available in the USA ticket, which is included in Appendix E.

8.0 PERSONAL PROTECTIVE EQUIPMENT

PPE in the form of protective footwear and appropriate work clothing are required for all field activities. PPE for specific field activities is listed below.

All Field Activities

- Boots – chemical resistant, steel toe and shank (ANSI Z41 - 1983, Safety Toe Footwear Classification 75 and/or ASTM F2413 Active Standard, Standard Specifications for Performance Requirements for Protective (Safety) Toe Cap Footwear). Boots shall be equipped with deep traction sole. Boots purchased after January 26, 2007 will meet the requirements of ATSM F 2412-05 and ATSM F 2413-05. Footwear purchased on or before this date will meet the above ASTM requirements and ANSI Z41- 1999.
- Work clothing (e.g. long pants)
- Safety Vests (Yellow or orange with reflective strips)

Drilling/Excavation and Loading Operations:

- Safety Glasses (ANSI Z87.1)
- Hard Hat (ANSI Z89.1-1986M Class A, B, and C)
- Hearing Protection (foam inserts) will be provided by the employer for elective use
- Gloves - Chemical (Nitrile) and leather

Soil, Soil-Gas and/or Groundwater Sampling:

- Gloves – Chemical (nitrile)
- Work Gloves (Leather or equivalent) – if splitting cores or other activities that require more resilient gloves
- Electrical safety gloves (ASTM D120-14a) – when drilling through asphalt or concrete slabs for vapor pin installation

If necessary:

- Safety Face Shield (splash hazard)
- Tyvek® suit or similar coverall (splash hazard)
- Rubber overboots (wet conditions)

PPE offers a high degree of protection, yet the equipment must be maintained and inspected on a regular basis. Hard hats should be discarded if cracked. Boots should be maintained (use waterproofing if necessary) to prevent injuries, disease (from wet conditions) and insect/snake bites.

Employees required to wear PPE will be trained to know at least the following:

- When PPE is necessary.

- What PPE is necessary.
- How to properly put on, take off, adjust and wear the PPE.
- The limitations of the PPE.
- Proper care, maintenance, useful life and disposal of PPE.

Changes in the workplace or in the type of required PPE that make prior training obsolete may require additional training or retraining of employees.

If air monitoring exceeds action levels identified in Section 9.0, then work will be modified to reduce organic vapors. Action levels are protective of both worker and community health and safety. If air monitoring indicates that an upgrade to level C PPE is necessary, Level C includes the PPE specified above plus the NIOSH-approved half- or full-face air-purifying respirator (APR) equipped with the appropriate filter cartridges for particulates and organic vapors. Personnel will be fit-tested for the specific make and model respirator that will be used. Note: safety glasses are not required when wearing a full-face APR.

8.1 Respirator Cartridge Change Out Schedule

If respirators are used, the respirator cartridge change-out schedule will be based on breakthrough calculations for specific VOCs or based on manufacturer's recommendations. Change-outs will be performed conservatively to ensure adequate protection.

In the event that a user experiences breakthrough, the cartridge or filter becomes soiled or breathing becomes difficult prior to the scheduled change out interval, they should change the cartridge/filter immediately and notify their employer so that use conditions can be re-evaluated, and adjustments made to the change schedule. At a minimum, organic vapor cartridges will be changed out at the end of each shift.

9.0 AIR MONITORING

Air monitoring will be conducted during intrusive activities as the potential exists to contact soil impacted with VOCs. The work environment will be monitored using a photoionization detector. Total organic vapor readings will be taken in the breathing zone approximately once per half hour or more frequently as site conditions warrant.

9.1 Direct Reading Instruments

9.1.1 Photoionization Detector

A PID will be used to determine the presence and concentration of organic vapor. Contaminants such as chlorinated VOCs are detectable with a PID. Air monitoring and actions will be implemented identified in 9.2 below.

9.2 Monitoring Strategy

Inhalation is one of the primary routes of exposure for VOCs and SVOCs. The following approach to air monitoring was selected based on site conditions and background information presented in section 2.

9.2.1 Total Organic Vapor Monitoring

During intrusive and remediation activities, VOCs and SVOCs could potentially become airborne and result in exposure to employees. When intrusive activities are being conducted or when known or suspected contaminated soils or groundwater are encountered, total organic vapors will be monitored with a PID or a similar device.

If the PID detects total organic vapors at concentrations greater than 10 ppm, then sustained for at least 1 minute, air-purifying respirators will be worn. If the PID readings exceed 100 ppm sustained (for greater than 1 minute), all work will be stopped. Work may not resume until airborne total organic vapors readings are recorded below 100 ppm. On-site personnel wearing C Level PPE should try to identify the source of the contaminants once readings fall to below 100 ppm.

9.2.2 Action Levels

Chemicals of Potential Concern (COPCs)		
Direct Reading Instrument Action Levels for Area Monitoring and Breathing Zone Monitoring		
Monitored Parameter	**Action Level**	**Response to Action Level**
VOCs in the work area will be monitored using a PID.	≥ 10 ppm continuous reading in the breathing zone for 1 minute	The SSHO should: • Stop work • Don Level C (HEPA/OV cartridges) to identify source of airborne contamination. • Implement necessary engineering controls where feasible (e.g. work upwind, blower fan) to maintain levels to less than 10 ppm
	≥ 100 ppm continuous reading in the breathing zone for 1 minute	The SSHO should: • Stop work • Contact PM if VOC levels cannot be controlled to less than 100 ppm total

9.3 Quality Assurance/Quality Control

Adherence to a proper quality assurance and quality control (QA/QC) plan is essential for a meaningful air sampling effort. The major concerns of a QA/QC plan are calibration of equipment and document control.

9.3.1 Calibration and Maintenance Procedures

All direct reading instruments will be calibrated daily before work and checked against calibration gas at the end of the day. Calibration records will be kept that detail date, time span, gas or other standard, and the name of the person performing the calibration. The calibration gas for the PID is isobutylene. The SSHO will ensure that the instrument is kept clean and will follow manufacturer's directions for keeping the lamp clean. The SSHO will perform no other maintenance procedures unless approved by the Project Manager.

9.3.2 Documentation

Strict adherence to document and data control procedures is essential for good QA/QC. Data and calibration records must be accounted for and retrievable at all times. Types of documents that are essential include notes, logbooks, maps, data sheets, and reports. These must be placed in the project files. Copies of all field data reports and personal sampling records will be sent to the Project Manager for review.

Documentation of employee exposure monitoring results must be made available and maintained in compliance with Title 8, California Code of Regulations Section 3204 (for California projects) and 29 CFR 1910.1020.

10.0 MEDICAL SURVEILLANCE

Any field personnel engaged in project operations that expose them to hazardous wastes, hazardous substances, or any combination of hazardous wastes or hazardous substances shall be participants in a Medical Surveillance program that meet the requirements of 8 CCR 5192(f). These persons must be medically evaluated and cleared for use of respiratory protection devices and protective clothing for working with hazardous materials by the examining physicians. The medical clearance shall be current within one year through at least the last day of field operations. The applicable requirements under the Cal-OSHA standards for HAZWOPER and Respiratory Protection Program will be observed. Current copies of training certificates and statements of medical program participation for all Terraphase personnel are maintained by the Terraphase headquarters office.

11.0 FIRST AID AND MEDICAL TREATMENT

All persons on site must report any near-miss incident, accident, injury, or illness to the SSHO. Terraphase does not record the names of employees involved in near-miss accidents and there are no repercussions for reporting a near-miss. Reporting near-miss incidents helps fellow employees and may result in saving one of your colleagues from a serious accident. Injuries and illnesses requiring medical treatment must be documented. The SSHO must conduct an accident investigation as soon as emergency conditions no longer exist and first aid and/or medical treatment have been completed. All necessary reports must be completed and submitted to the Project Manager within 24 hours after the incident.

If treatment beyond first aid is required, the injured should be transported to the nearest medical facility off-site. If the injured is not ambulatory, or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance/paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

Nearby Hospital: (805) 988-2500

Saint John's Regional Medical Center
1600 N Rose Ave, Oxnard, CA 93030

Directions to Hospital (approximately 6.9 miles away):

1. Head north on Harbor Blvd for .5 miles
2. Turn right on W Gonzales Rd.
3. Continue for 6.3 miles to N Rose Ave
4. Turn right onto N Rose Ave for .1 miles

Saint John's Medical center **will be on the Left.**

APPENDIX A
CONTACT NAMES AND PHONE NUMBERS

Local Emergency Numbers		
Institution/Department	**Name/Address**	**Phone Number**
Hospital	St. John's Regional Medical Center 1600 North Rose Avenue Oxnard, California 93036	(805) 988-2500
Ambulance		911
Police/Sheriff	Oxnard Police Department 251 S. C St. Oxnard, California 93036	911 or (805) 385-7600
Fire	Oxnard Fire Department 360 W. Second St. Oxnard, CA 93036	911 or (805) 487-6311
Other: Fatality or Multiple Injury Reporting (within 8 hours)		1-800-4BE-SAFE or 800-423-7233

Project Emergency Numbers		
Title	**Name**	**Phone Number**
Project Manager (s)	Melissa Schuetz	O: (949) 227-2227 x96 C: (714) 318-6560
Site Manager/Health and Safety Officer	Wes Skillings	O: (949) 227-2227
Principal-in-Charge	Charles Robinson	O: (949) 227-2227 x94 C: (949) 230-9044
Corporate Health and Safety Representative	Daren Roth	O: (925) 444-0555 x38 C: (510) 455-0522
Certified Industrial Hygienist working for Terraphase	James Bucha	O:
Subcontractor Site Representatives	Mike Carpenter of Waste Management Robert Sunjara of BlaineTech Stan Jackson of Jacob and Hefner	O: (310) 544-5737 C: (310) 200-5271 O: (310) 885-4466 x 115 O: (562) 673-1754

APPENDIX B
HASP REVIEW AND ACCEPTANCE FORM

HASP Review and Acceptance Form

All field personnel working on the site must be familiar with the HASP. By signing below, you confirm you have read, understand, and agree to abide by the HASP. Any questions regarding health and safety on this site may be directed to either the Project Leader/SSHO or Project Manager.

Name	Company	Date

APPENDIX C
SAFETY MEETING SIGN-IN SHEETS

Safety Meeting Sign-In Sheet

Conducted By:

Date:

Topics Discussed:

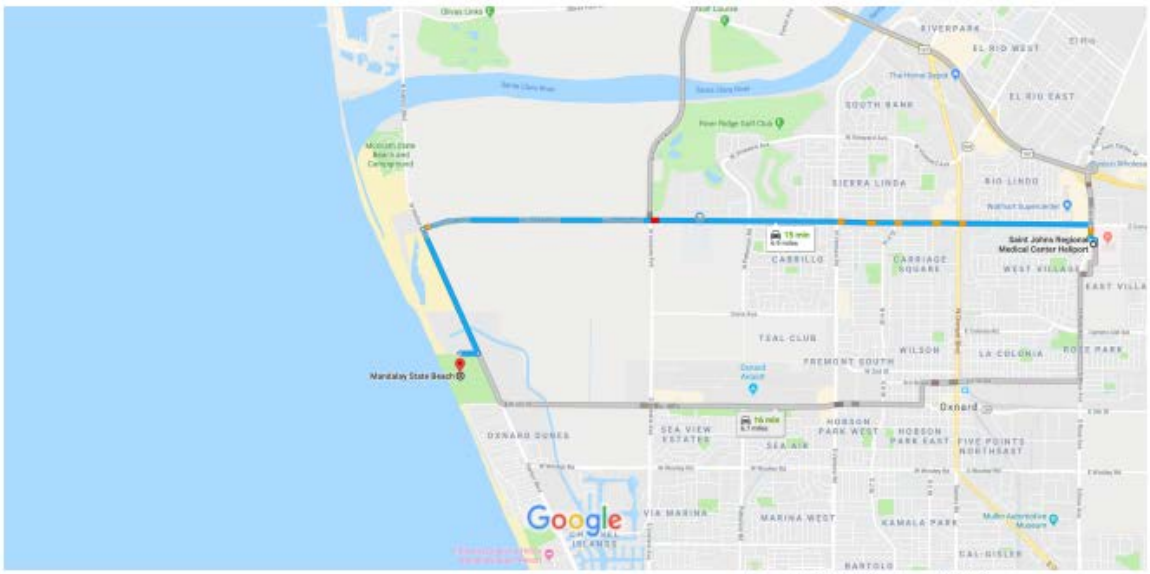
Concerns/Problems/Hazards:

Meeting Attendees

Name	Company

APPENDIX D
DRIVING DIRECTIONS TO NEAREST HOSPITAL

Google Maps **Saint Johns Regional Medical Center Heliport to Mandalay State Beach** Drive 6.9 miles, 15 min



via E Gonzales Rd Fastest route, the usual traffic	15 min 6.9 miles
via W 5th St	16 min 6.7 miles
via US-101 N	16 min 10.1 miles

APPENDIX F
SAFETY DATA SHEETS

SAFETY DATA SHEET
EHC® Liquid Reagent Mix

SDS # : EHCLM-C
Revision date: 2015-10-13
Format: NA
Version 1

1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

Product Name EHC® Liquid Reagent Mix

Other means of identification

Alternate Commercial Name EHC®-L Mix; EHC® Liquid - Solid Component

Recommended use of the chemical and restrictions on use

Recommended Use: Bioremediation product for the remediation of contaminated soil and groundwater

Restrictions on Use: Not for drinking water purification treatment.

Manufacturer/Supplier

PeroxyChem LLC
2005 Market Street
Suite 3200
Philadelphia, PA 19103
Phone: +1 267/ 422-2400 (General Information)
E-Mail: sdsinfo@peroxychem.com

Emergency telephone number

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)
1 303/ 389-1409 (Medical - U.S. - Call Collect)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Combustible dust

GHS Label elements, including precautionary statements

EMERGENCY OVERVIEW

Warning

Hazard Statements
May form combustible dust concentrations in air

Precautionary Statements - Prevention
Keep away from all ignition sources including heat,sparks and flame.
Keep container closed and grounded.
Prevent dust accumulations to minimize explosion hazard.

Hazards not otherwise classified (HNOC)
No hazards not otherwise classified were identified.

Other Information

Any vessel that contains wet EHC must be vented due to potential pressure build up from fermentation gases

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS-No	Weight %
Iron salt	Proprietary	92-97
amino acid	Proprietary	3-7

Occupational exposure limits, if available, are listed in section 8

4. FIRST AID MEASURES

Eye Contact — Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids intermittently. Consult a physician.

Skin Contact — Wash off with warm water and soap.

Inhalation — Remove from exposure, lie down. If symptoms persist, call a physician.

Ingestion — If swallowed, do not induce vomiting - seek medical advice.

Most important symptoms and effects, both acute and delayed — Gastrointestinal effects. Inhalation of dust in high concentration may cause irritation of respiratory system.

Indication of immediate medical attention and special treatment needed, if necessary — Treat symptomatically

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media — Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Specific Hazards Arising from the Chemical — Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

Hazardous Combustion Products — Carbon oxides (COx).

Explosion data
Sensitivity to Mechanical Impact — Not sensitive.
Sensitivity to Static Discharge — Not sensitive.

Protective equipment and precautions for firefighters — As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions For personal protection see Section 8. Avoid dispersal of dust in the air (i.e., cleaning dust surfaces with compressed air.).

Other Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Use only non-sparking tools.

Environmental Precautions No special environmental precautions required.

Methods for Containment Sweep or vacuum up spillage and return to container. Avoid dispersal of dust in the air (i.e., cleaning dust surfaces with compressed air.). Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Material may be recycled when contamination is not a problem.

Methods for cleaning up Following product recovery, flush area with water.

7. HANDLING AND STORAGE

Handling Avoid contact with skin, eyes and clothing. Do not ingest. Ensure adequate ventilation. Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Dry powdered material can build static electricity when subjected to the friction of transfer and mixing operations. Provide adequate precautions, such as electrical grounding and bonding, or inert atmosphere.

Storage Keep tightly closed in a dry and cool place. Keep away from open flames, hot surfaces and sources of ignition.

Incompatible products . Strong oxidizing agents

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines Ingredients with workplace control parameters.

Chemical name	ACGIH TLV	OSHA PEL	NIOSH	Mexico
Iron salt	TWA: 1 mg/m^3	-	-	-

Chemical name	British Columbia	Quebec	Ontario TWAEV	Alberta
Iron salt	TWA: 1 mg/m^3	TWA: 1.0 mg/m^3	TWA: 1 mg/m^3	TWA: 1 mg/m^3

Appropriate engineering controls

Engineering measures Ensure adequate ventilation, especially in confined areas. It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in the handling of this product contain explosion relief vents or an explosion suppression or an oxygen-deficient environment. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Use only appropriately classified electrical equipment and powered industrial trucks.

Individual protection measures, such as personal protective equipment

Eye/Face Protection Safety glasses with side-shields.

Skin and Body Protection Wear suitable protective clothing.

Hand Protection Protective gloves

Respiratory Protection When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Hygiene measures Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Dry powder
Physical State	Solid
Color	light gray
Odor	Slight
Odor threshold	No information available
pH	4.5 (1% solution)
Melting point/freezing point	100 °C
Boiling Point/Range	No information available
Flash point	Not applicable
Evaporation Rate	No information available
Flammability (solid, gas)	May be combustible at high temperatures
Flammability Limit in Air	
Upper flammability limit:	No information available
Lower flammability limit:	No information available
Vapor pressure	No information available
Vapor density	No information available
Density	No information available
Specific gravity	No information available
Water solubility	Fairly soluble
Solubility in other solvents	No information available
Partition coefficient	No information available
Autoignition temperature	No information available
Decomposition temperature	No information available
Viscosity, kinematic	No information available
Viscosity, dynamic	No information available
Explosive properties	No information available
Oxidizing properties	No information available
Molecular weight	No information available
Bulk density	Not applicable

10. STABILITY AND REACTIVITY

Reactivity

Chemical Stability Stable under recommended storage conditions. Decomposes on heating.

Possibility of Hazardous Reactions None under normal processing.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid To avoid thermal decomposition, do not overheat

Incompatible materials Strong oxidizing agents.

Hazardous Decomposition Products Carbon oxides (COx).

11. TOXICOLOGICAL INFORMATION

Product Information

LD50 Oral Iron Salt: 2100 mg/kg (guinea pig)
Cysteine: 1890 mg/kg (rat)

LD50 Dermal No information available

LC50 Inhalation No information available

Sensitization Not expected to be sensitizing based on the components.

Information on toxicological effects

Symptoms Dust is irritating eyes, nose, throat, and lungs.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Carcinogenicity Contains no ingredient listed as a carcinogen.

Mutagenicity This product is not recognized as mutagenic by Research Agencies

Reproductive toxicity This product does not contain any known or suspected reproductive hazards.

STOT - single exposure No information available.
STOT - repeated exposure No information available.

Aspiration hazard Not applicable.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity effects Not expected to have significant environmental effects

Persistence and degradability No information available.

Bioaccumulation No information available.

Mobility No information available.

Other Adverse Effects None known.

13. DISPOSAL CONSIDERATIONS

Waste disposal methods It must undergo special treatment, e.g. at suitable disposal site, to comply with local regulations.

Contaminated Packaging Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT NOT REGULATED

15. REGULATORY INFORMATION

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic health hazard	NO
Fire hazard	NO
Sudden release of pressure hazard	NO
Reactive Hazard	NO

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

International Inventories

Component	TSCA (United States)	DSL (Canada)	EINECS/ELINCS (Europe)	ENCS (Japan)	China (IECSC)	KECL (Korea)	PICCS (Philippines)	AICS (Australia)	NZIoC (New Zealand)
Iron salt (92-97)	X	X	X			X	X	X	X
amino acid (3-7)	X	X	X	X	X	X	X	X	X

CANADA

WHMIS Hazard Class Non-controlled

16. OTHER INFORMATION

NFPA	**Health Hazards** 1	**Flammability** 1	**Stability** 0	**Special Hazards** -
HMIS	**Health Hazards** 1	**Flammability** 1	**Physical hazard** 0	**Special precautions** -

NFPA/HMIS Ratings Legend Severe = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0

Uniform Fire Code COMBUSTIBLE DUST/POWDER
References Refer to NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids* , for safe handling.

Revision date: 2015-10-13
Revision note Initial Release

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Prepared By:

PeroxyChem

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End of Safety Data Sheet

SAFETY DATA SHEET
EHC® Liquid Reagent

SDS # : EHCL-C
Revision date: 2015-07-29
Format: NA
Version 1

1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

Product Name EHC® Liquid Reagent

Other means of identification

Synonyms Sorbitan monooleate, ethoxylated: Polyoxyethylenesorbitan monooleate; Lecithin: L-α-Phosphatidylcholine, Azolectin; Sodium Benzoate: Benzoic acid sodium salt.

Recommended use of the chemical and restrictions on use

Recommended Use: Bioremediation product for the remediation of contaminated soil and groundwater

Restrictions on Use: Not for drinking water purification treatment.

Manufacturer/Supplier

PeroxyChem LLC
2005 Market Street
Suite 3200
Philadelphia, PA 19103
Phone: +1 267/ 422-2400 (General Information)
E-Mail: sdsinfo@peroxychem.com

Emergency telephone number

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)
1 303/ 389-1409 (Medical - U.S. - Call Collect)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

This chemical is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

GHS Label elements, including precautionary statements

EMERGENCY OVERVIEW

Hazards not otherwise classified (HNOC)
No hazards not otherwise classified were identified.

Other Information

CONTAINMENT HAZARD: Any vessel that contains wet EHC must be vented due to potential pressure build up from fermentation gases

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS-No	Weight %
Sorbitan monooleate, ethoxylated	9005-65-6	2-4
Lecithin	8002-43-5	20-30
Water	7732-18-5	60-80
Sodium Benzoate	532-32-1	2-4

Synonyms are provided in Section 1.

4. FIRST AID MEASURES

Eye Contact In case of contact, immediately flush eyes with plenty of water. Get medical attention if irritation develops and persists.

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

Inhalation Move to fresh air in case of accidental inhalation of vapors. Consult a physician if necessary.

Ingestion Drink 1 or 2 glasses of water. Get medical attention if symptoms occur. If swallowed, do not induce vomiting - seek medical advice. Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed None known

Indication of immediate medical attention and special treatment needed, if necessary Treat symptomatically

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media Carbon dioxide (CO_2). Dry chemical. Dry powder.

Specific Hazards Arising from the Chemical . Combustible material: may burn but does not ignite readily

Explosion data
Sensitivity to Mechanical Impact Not sensitive.
Sensitivity to Static Discharge Not sensitive.

Protective equipment and precautions for firefighters As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions For personal protection see Section 8.

Other	For further clean-up instructions, call PeroxyChem Emergency Hotline number listed in Section 1 "Product and Company Identification" above.
Environmental Precautions	No special environmental precautions required.
Methods for Containment	Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal.
Methods for cleaning up	After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Handling	Handle in accordance with good industrial hygiene and safety practice.
Storage	Any vessel that contains wet EHC-L must be vented due to potential pressure build up from fermentation gases. Keep away from open flames, hot surfaces and sources of ignition.
Incompatible products	Water, Alkalis

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering measures	None under normal use conditions.

Individual protection measures, such as personal protective equipment

Eye/Face Protection	Safety glasses with side-shields.
Skin and Body Protection	Wear suitable protective clothing.
Hand Protection	Protective gloves Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion and the contact time. If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves
Respiratory Protection	Use only with adequate ventilation.
Hygiene measures	Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Light amber emulsion
Physical State	Liquid
Color	Light Amber
Odor	odorless
Odor threshold	No information available
pH	6.5 - 6.9
Melting point/freezing point	Not applicable
Boiling Point/Range	No information available
Flash point	> 200 °F
Evaporation Rate	No information available
Flammability (solid, gas)	Combustible material

Flammability Limit in Air	
Upper flammability limit:	No information available
Lower flammability limit:	No information available
Vapor pressure	No information available
Vapor density	No information available
Density	No information available
Specific gravity	1.0 - 1.1
Water solubility	Dispersible in water
Solubility in other solvents	No information available
Partition coefficient	No information available
Autoignition temperature	No information available
Decomposition temperature	No information available
Viscosity, kinematic	No information available
Viscosity, dynamic	No information available
Explosive properties	No information available
Oxidizing properties	No information available
Molecular weight	No information available
Bulk density	Not applicable

10. STABILITY AND REACTIVITY

Reactivity None under normal use conditions

Chemical Stability Stable under recommended storage conditions.

Possibility of Hazardous Reactions None under normal processing.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid Temperatures above 71°C

Incompatible materials Water, Alkalis.

Hazardous Decomposition Products None under normal use.

11. TOXICOLOGICAL INFORMATION

Product Information

Product does not present an acute toxicity hazard based on known information.

LD50 Oral	There are no data available for this product
LD50 Dermal	There are no data available for this product
LC50 Inhalation	There are no data available for this product
Serious eye damage/eye irritation	May cause slight irritation.
Skin corrosion/irritation	Not expected to be irritating based on the components.
Sensitization	Not expected to be sensitizing based on the components.

Information on toxicological effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	Not expected to be irritating based on the components.
corrosivity	Not applicable.

Carcinogenicity Contains no ingredient listed as a carcinogen.

Mutagenicity This product is not recognized as mutagenic by Research Agencies

Neurological effects Not neurotoxic

Reproductive toxicity This product does not contain any known or suspected reproductive hazards.
Developmental toxicity None known.

STOT - single exposure Not classified.
STOT - repeated exposure Not classified.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity effects Contains no substances known to be hazardous to the environment or that are not degradable in waste water treatment plants

Chemical name	Toxicity to algae	Toxicity to fish	Toxicity to Microorganisms	Toxicity to daphnia and other aquatic invertebrates
Sodium Benzoate		96 h LC50: 420 - 558 mg/L (Pimephales promelas) flow-through 96 h LC50: > 100 mg/L (Pimephales promelas) static		48 h EC50: < 650 mg/L (Daphnia magna)

Persistence and degradability Expected to biodegrade, based on component information.

Bioaccumulation Bioaccumulation is unlikely.

Mobility No information available.

Other Adverse Effects None known.

13. DISPOSAL CONSIDERATIONS

Waste disposal methods Recovery/recycling recommended. Dispose of in accordance with local regulations.

Contaminated Packaging Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT NOT REGULATED

15. REGULATORY INFORMATION

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any

chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic health hazard	NO
Fire hazard	NO
Sudden release of pressure hazard	NO
Reactive Hazard	NO

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

International Inventories

Component	TSCA (United States)	DSL (Canada)	EINECS/ELINCS (Europe)	ENCS (Japan)	China (IECSC)	KECL (Korea)	PICCS (Philippines)	AICS (Australia)	NZIoC (New Zealand)
Sodium Benzoate 532-32-1 (2-4)	X	X	X	X	X	X	X	X	X

Mexico - Grade Minimum risk, Grade 0

CANADA

WHMIS Hazard Class Non-controlled

16. OTHER INFORMATION

NFPA	**Health Hazards** 1	**Flammability** 1	**Stability** 0	**Special Hazards** -
HMIS	**Health Hazards** 1	**Flammability** 1	**Physical hazard** 0	**Special precautions** -

NFPA/HMIS Ratings Legend Severe = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0

Revision date: 2015-07-29
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Prepared By:

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End of Safety Data Sheet