



JPL D-40941

JPL Facilities Maintenance and Operations

Technical Description Document

**National Aeronautics and
Space Administration**

**Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California**

May 16, 2025

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1. Definitions

As used throughout this Subcontract, the following terms shall have the meaning set forth below.

1. Adjust. To regulate, settle; bring to a more satisfactory state of normal operating condition.
2. Alteration. Work that changes the configuration of a facility (not Maintenance or repairs) but that does not increase the value of the facility: for example, moving a door or electrical outlet. (NPR 8831.2F Facilities Maintenance Management)
3. Appearance. Outward aspect.
4. As Built Drawings. The schematic documentation of the configuration of facility elements in their current relative position, location, and size as they have been constructed, erected, installed, modified, or assembled.
5. Ashes. The residue from burned wood, coal, coke, and other combustible material.
6. At-Site Employee. Any employee who occupies a JPL provided work space on a permanent basis in order to perform the assigned job function.
7. Automatically Generated Data. Data that the CMMS application generates when certain conditions are met (e.g., time-based Preventive Maintenance actions, cyclical Programmed Maintenance actions, and other repetitive actions).
8. Backlogged Trouble Calls. A routine trouble call issued during the previous Subcontract which was not completed for any reason, or maintenance and repair requirements which may be identified during lapses, if any, in services between this Subcontract and the previous Subcontract.
9. Building. A usually roofed and walled structure built for permanent use (as for a dwelling) including modular workspaces. For purposes of this Subcontract, "Building" also includes the capital improvements and fixed items of equipment that are normally required for the functional use of the building, especially those items which become permanently attached to and made a part of the building and which cannot be removed without cutting into the walls, ceilings, or floors, such as plumbing, heating, and lighting equipment; elevators; central air-conditioning systems; and built-in safes and vaults. See also "Building-Type Equipment."
10. Building-Type Equipment. Equipment that is normally required to make a building or facility useful and operable. It is built in or affixed to the building or facility in such a manner that removal would impair the usefulness, safety, or environment of the building or facility. Such equipment includes elevators; heating, ventilating and air-conditioning systems; transformers; compressors; and other like items generally accepted as being an inherent part of a building or structure and essential to its utility. Such equipment also includes general building systems and subsystems such as electrical, plumbing, pneumatic, and monitoring systems. See also Collateral Equipment and Fixtures.
11. Built-in or Large, Substantially Affixed Equipment. Equipment that is to be built in, affixed to, or installed in real property in such manner that the installation cost including special foundations or unique utilities service, or the facility restoration work required after its removal, is substantial.

12. The need for additional service or repair following the technical response, which did not resolve the original issue.
13. Central Plant Operations. A NASA reporting category, unique to the Central Plant, which includes both operating and maintenance costs. Operators are assigned full time to operate the Central Plant, but they perform Central Plant maintenance between various operations tasks.
14. Central Plant. Central Plant consists of Buildings 230 and 264. These buildings are operational 24 hours per day 7 days per week.
15. Child Work Order. A child or follow-up work order is a work order that contains a description, asset number and/or location, labor, materials or services that is closely associated with the parent work order. This may also include a “call-back” work order, however no cost should be associated with a “call-back” work order.
16. Clean. Free of dirt, dust, spots, streaks, stains, smudges, litter, debris, and other residue.
17. CMMS - Computerized Maintenance Management System. A software solution that populates a database with asset maintenance planning and the historical repair or replacement of assets. The CMMS typically manages equipment, parts, jobs, crafts, costs, step-by-step instructions, and other information involved in the maintenance effort. This information may be stored, viewed, analyzed, reproduced and updated within the CMMS program. The maintenance-related functions typically include –
 - a. Facility/Equipment Inventory
 - b. Facility/Equipment History
 - c. Work Input Control
 - d. Job Estimating
 - e. Work Scheduling and Tracking
 - f. Preventive and Predictive Maintenance
 - g. Facility Inspection and Assessment
 - h. Labor Management
 - i. Service Management
 - j. Utilities Management
18. Material Management. Collateral Equipment and Fixtures. Encompasses building-type equipment, built-in equipment, and large, substantially affixed equipment/property and is normally acquired and installed as part of a facility project.
19. Communication Cables. Building Automation System data cables within the buildings will be maintained by the Subcontractor.
20. Completion of a Work Order. Action taken when all relevant data relating to the completed work order has been gathered and entered into a work order in the CMMS application.

21. Component Part. Any part of any item or system which is detachable or removable from the main body or main assembly of the item or system; a constituent part or an essential part necessary to the performance of the system.
22. Condition-Based Maintenance (CBM). Facility and equipment maintenance scheduled only when the condition of the facility or equipment requires it. CBM replaces maintenance scheduled at arbitrary time or usage intervals. It usually involves the application of advanced technology to detect and assess the actual condition. See PT&I and RCM.
23. Condition Monitoring. The continuous or periodic monitoring and diagnosis of systems and equipment in order to forecast failure. Also see Predictive Testing and Inspection (PT&I), and Predictive Maintenance.
24. Construction. The erection, installation, or assembly of (1) a new or replacement facility, or (2) an addition in area, volume, or both, to an existing facility, or (3) a modification or addition that results in a change of primary function.
25. Contract Technical Manager (CTM). The JPL employee with the authority to administer the technical aspects of the Subcontract.
26. Control. A mechanism used to regulate or guide the operation of a machine, apparatus, or system.
27. Customer. Occupants of the facility, requesters of services, and individuals placing trouble calls. This also includes JPL's FM&O QA team.
28. Data is defined as all maintenance information and statistics collected together in the CMMS for future reference and analysis.
29. Date of Work Completion is the last and final labor, service or material transaction against a work order. If all labor/services and/or materials and/or tool transactions are not complete then the work order will be considered as incomplete.
30. Reported or requested Date of Work. The date and time a work order is created within the CMMS.
31. Debris. Includes but is not limited to, paper, rags, shavings, saw dust, oil, grease, cans, bottles, limbs, branches, pine straw, pine cones, leaves, rocks, abandoned wood, abandoned pipes, abandoned wire or tubing and other similar items including spare or excessive components, parts, or fittings.
32. Deficiencies. Work performed unsatisfactorily or below specified work standards. Includes the use of incorrect parts, materials, or methods. See also Non-Compliance.
33. Derived data is higher data that is computed from the basic values of other table columns of the CMMS database.
34. Effective. Producing a decided, decisive, or desired effect.
35. Electronically Entered Data. Data that is uploaded to the CMMS database via handheld solution, laptop, and other computing devices.
36. Environmental Protection Agency (EPA). That federal agency delegated authority to enforce the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).

37. Facilities Technical Library (FTL) contains building history files, including available drawings, warranties, records, manufacturer's equipment manuals, history files, and other available pertinent data
38. Facility Service Request (FSR) Work. Work that is funded by a customer. This work is submitted on a Facility Service Request Form.
39. Facility. A term used to encompass land, buildings, trailers, modular workspaces, structures, and other real property improvements, including utility systems and collateral equipment. The term does not include operating materials, supplies, special tooling, special test equipment, and non-capitalized equipment.
40. Facility/Building Manager. A JPL-designated employee responsible for reporting on the utilization of a facility(s), and being assigned oversight of all maintenance, construction, and other related activities affecting the facility(s).
41. Fertilization. The process of applying nutrient elements to the soil for proper plant growth and health.
42. Finds. Equipment deficiencies that are discovered during the reliability centered maintenance (RCM) process, such as vibration readings above pre-set limits, infrared temperature outside of acceptable range, impurities discovered during oil analyses, or insulation breakdown noted in motor analyses.
43. Fiscal Year. The fifty-two (52) week accounting year used by JPL running roughly from October 1 of one calendar year through September 30 of the following year.
44. Frequency of Service. Items a. through m. service due dates are based upon the last work order completion date.
 - a. Quadrennial – Services performed once every four years during performance of the Subcontract.
 - b. Tri-ennial – Services performed once every three years during performance of the Subcontract.
 - c. Bi-ennial – Services performed once every two years during performance of the Subcontract.
 - d. Annual (A) - Services performed once during each 12-month period of the Subcontract.
 - e. Semiannual (SA) - Services performed twice during each 12-month period of the Subcontract.
 - f. Quarterly (Q) - Services performed four times during each 12-month period of the Subcontract.
 - g. Tri-annual – Services performed three times during each 12-month period of the Subcontract.
 - h. SEMI-annual – Services performed two times during each 12-month period of the Subcontract.
 - i. Monthly (M) - Services performed 12 times during each 12-month period of the Subcontract.

- j. Semimonthly (SM) - Services performed 24 times during each 12-month period of the Subcontract.
 - k. Weekly (W) - Services performed 52 times during each 12-month period of the Subcontract.
 - l. Twice weekly (2W). Services performed twice a week, such as Monday and Thursday or Tuesday and Friday.
 - m. Three times weekly (3W). Services performed three times a week, such as Monday, Wednesday, and Friday.
 - n. Daily (D5) - Services performed once each day, Monday through Friday, including holidays unless otherwise noted.
 - o. Daily (D7) - Services performed once each day, seven days per week, including weekends and holidays.
- 45. Functional Test. A test designed to establish whether something functions or performs to its intended use.
 - 46. Functionality. The action for which a thing is specially fitted or used or for which a thing exists; performing or able to perform a regular function.
 - 47. Ground Cover. Perennial plants used in place of grass for decoration, for preventing erosion, and for decreasing airborne dust around buildings (e.g., ivy, ice plants).
 - 48. Hazardous Material (HM). Materials in various forms that can cause death, serious injury, long-lasting health effects, and damage to buildings, systems, and/or the environment.
 - 49. Hazardous Materials Collection Station (Building 305). The designated point where hazardous wastes will be delivered by the Subcontractor for appropriate disposal by JPL.
 - 50. Hazardous Operation. A process that produces hazards such as noise, dusts, gases, fumes, or mists that may be flammable, combustible, toxic, and/or reactive.
 - 51. Hazardous Waste. Waste materials that are toxic or poisonous, oxidizers, corrosive, irritating or sensitizing, radioactive, biologically infectious, explosive, flammable, or that presents a significant hazard to animal or human health and the environment as determined by Federal, State, or Local regulatory authorities, or that are listed in Federal or State regulations. Special handling procedures and facilities are required in their disposal.
 - 52. Hazardous. Dangerous; involving or exposing one to risk, loss, or harm.
 - 53. Implement. Carry out, accomplish, especially to give practical effect to and ensure of actual fulfillment by concrete measures.
 - 54. Inspection. Examination of a product design, product, process or installation and determination of its conformity with specific requirements or, on the basis of professional judgment, with general requirements. The results of inspections must be documented and contain objective evidence of conformity and completion.
 - 55. JPL Personnel. Persons employed by JPL/Caltech or NASA which work at JPL.
 - 56. JPL Quality Assurance (QA). A method used by JPL FM&O to provide control over the quality of purchased goods and services received as a part of the FM&O Subcontract.

57. Labor Hour Performance Standards. A labor hour job estimating system for assessing the average time necessary for a qualified craftsman working at a normal pace, following acceptable trade methods, receiving capable supervision, and experiencing normal delays to perform defined amounts of work of a specified quality.
58. Labor Hour Unit Price. The unit price bid by the Subcontractor to provide one performance standard hour of work-in-place. The unit price includes all direct and indirect costs associated with performing a standard hour of work.
59. Licensed Official. Possesses state or federal legal permission to perform inspections or services.
60. Maintenance. The planned or unplanned work required to preserve or restore a facility to such a condition that it may be effectively utilized for its original design purpose.
61. MCR. Maximo Change Request, usually submitted to the CMMS System Administrator for changes to a Maximo application.
62. Management. Personnel, policies, systems, and organizational structure used to plan, budget, acquire, implement, and control resources for the accomplishment of work.
63. Manual entry. A keyboard entry of maintenance data (through the front-end GUI) into the Maximo application by a registered CMMS user.
64. Safety Data Sheets (SDS). A summary of safety, health, and emergency response information provided by the product manufacturer or distributor. The SDS contains information about the material hazards.
65. Objective Evidence. Objective evidence for the purpose of the audits or inspections generally consists of records, statements of fact, or other information which are relevant to the performance criteria and independently verifiable.
66. On-Site Employee. Any Subcontractor employee (or sub-tier Subcontractor employee) who reports to the JPL work site but is not assigned a permanent work space or work station.
67. Operator Maintenance. Maintenance normally associated with Central Plant (or SFOF) operations.
68. Parcel. A given area of land.
69. Pest Management. Pest control or prevention by a comprehensive approach that considers various suppression techniques, the habitat of the pest, and interrelationships between the pest populations and the ecosystem.
70. Pesticide. Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.
71. Planned Repair. Repair performed prior to prevent unplanned failure. Material condition degradation, usually identified through PM, PT&I, or other inspection, is repaired to prevent catastrophic failure. Also see Repair.
72. Power certification is certifying power reliability within the SFOF facilities (Buildings 230 and 264).

73. Predictive Testing & Inspection (PT&I). The use of advanced technology to assess conditions of machinery and building subsystems (such as roofs, air leaks, and electrical distribution). Common PT&I technologies include vibration analysis, infrared thermography, and lubricating oil analysis.
74. Preventive Maintenance (PM). The planned, scheduled, periodic inspection, adjustment, cleaning, lubrication, parts replacement, and minor repair of systems and equipment. Also known as periodic maintenance, time-based maintenance, or interval-based maintenance, or reoccurring maintenance. See also Predictive Test & Inspection (PT&I), which is a subset of PM. Preventive Maintenance activities shall be documented and contain objective evidence of conformity and completion.
75. Proactive Maintenance. The collection of efforts to identify, monitor and control future failure with an emphasis on the understanding and elimination of the cause of failure. Proactive maintenance activities include the development of design specifications to incorporated maintenance lessons learned and to ensure future maintainability and supportability, the development of repair specifications to eliminate underlying causes of failure, and performing Root Cause Failure Analysis to understand why in-service systems failed. (NPR 8831.2F, Reliability Centered Maintenance)
76. Programmed Maintenance (PGM). Recurring work items with maintenance cycles greater than one year.
77. Project Manager. The Subcontractor's representative, having overall responsibility for the conduct of Subcontract operations.
78. Process Equipment or Assets. Equipment or assets that if removed from the building would not affect the operation of the building mechanical or electrical systems. Typically used by the occupant for Research and Development purposes
79. Pruning. Selective removal of unwanted growth to make a plant or tree grow or respond in a desired manner. Pruning differs from "trimming".
80. Quality Assurance. JPL's process of checking to see whether the Subcontractor's conformance to the FM&O subcontract is meeting specified requirements or the Subcontractor's process of reviewing its own work for conformance with specified requirements.
81. Quality Assurance Monitor (QAM). A JPL employee responsible for the inspecting and evaluation of Subcontractor performance.
82. Reactive Maintenance. Unplanned maintenance performed when the deterioration of a facility, equipment, or system causes a functional failure.
83. Recyclables. Waste material that can be transformed into reusable material to prevent waste of potentially useful materials.
84. Refuse/Rubbish. All garbage, ashes, debris, and other similar waste materials. Refuse, for purposes of this Subcontract, does not include explosive and incendiary waste, hazardous wastes, contaminated waste from medical and radiological processes, solids or dissolved materials in domestic sewage, or other significant pollutants in water resources such as silt, dissolved or suspended solids in industrial waste, water effluents, dissolved materials in irrigation return flow, or other common water pollutants.

85. Regular Working Hours. JPL's Regular Working Hours are from 7:00 AM to 5:00 PM, Mondays through Fridays except JPL holidays.
86. Rejected Work. Work elements performed that fail to conform to specified work quality standards in the Subcontract.
87. Reliability Centered Maintenance (RCM). A maintenance strategy that incorporates a mix of preventive, predictive, reactive, and proactive maintenance practices. These maintenance practices, are integrated to take advantage of their respective strengths in order to maximize facility and equipment operability and efficiency while minimizing life cycle costs.
88. Repair. That facility work required to restore a facility or component collateral equipment to a condition substantially equivalent to its originally intended and designed capacity, efficiency, or capability. It includes the substantially equivalent replacements of utility systems and collateral equipment necessitated by incipient or actual breakdown. Also, restoration of function, usually after failure.
89. Replacement of Obsolete Items (ROI). Procedure that provides for the replacement of functional but obsolescent equipment.
90. Resources. Assets such as cash, personnel, material, and supplies.
91. Response Time. The time allowed the Subcontractor after initial notification of a work requirement to be physically on the premises at the work site with appropriate tools, equipment, and materials, ready to perform the work required.
92. Rework. Any task or work not performed correctly or found to be defective, technically or in any other regard. When defective work is discovered, it shall be corrected to satisfy the operational needs and to meet safety requirements. Correction of safety related defects shall be accomplished immediately. All costs associated with rework shall be the responsibility of the Subcontractor and shall not be passed on to JPL as reimbursable costs.
93. Routine calls. Calls for minor problems dealing with existing facilities.
94. Shrub. A low, usually several-stemmed, woody plant or bush.
95. Site Manager. The Subcontractor's representative at site, having overall responsibility for the conduct and performance of Subcontract operations.
96. Solid Waste. Refuse and other discarded solid materials resulting from commercial, industrial, residential, and community activities.
97. Space. An interior/exterior building area that may or may not be considered a room by common definition. Examples of spaces are definable sections of hallways, stairwells, lobbies, offices, porches, entrances, and elevators.
98. Spillage. Any refuse dislodged from containers and/or solid waste collecting equipment.
99. Subcontracts Manager. The JPL employee with the authority to enter into, administer, and/or terminate Subcontracts and make related determinations and findings.
100. Subcontractor Employee. A person employed by the Subcontractor providing services under this Subcontract.
101. Subcontractor Quality Control (QC). A method used by the Subcontractor to control the quality of goods and services produced.

102. Subcontractor. Can refer to both the prime Subcontractor and to any lower-tier subcontractors. The prime Subcontractor shall ensure that subcontractors comply with the provisions of this Subcontract and will maintain copies of any documented information required by this Subcontract. Such information shall be subject to audit by JPL and Subcontractor quality assurance reviews.
103. Supervisor. A person or persons designated to have the charge and direction of work under the Subcontract.
104. Trailer. A movable structure used for housing personnel and/or equipment.
105. Training Records. Training records of Subcontractor employees are kept according to ISO 9001, and contain: Name of the employee who received the training, date of the training, type of training received (e.g., internal training, external training, online training), duration of the training, description of the training content, trainer's name and qualifications, results of any assessments or evaluations conducted as part of the training, signature of the employee and the trainer.
106. Travel Time. Time expended between shop and the job site.
107. Trimming. Clipping all growth on a plant at a uniform distance and shape.
108. Trouble Calls. Reactive or unplanned maintenance work and small jobs that are generally called in by occupants of a facility.
109. Waste Containers. Trash receptacles, wastebaskets, trashcans, wastepaper baskets, ashtrays, bins, or any container holding trash, paper, or refuse of any type.
110. Work Control. Receipt, documentation, and distribution of trouble calls work orders (via the CMMS).
111. Working Day. 24-hour period
112. Xeriscaping. An environmentally friendly form of landscaping that uses a variety of indigenous and drought-tolerant plants, shrubs, and ground cover.

2. Acronyms

2W	twice weekly
3W	three times per week
A	annual
A/C	air conditioning
ACM	asbestos-contaminated materials
ADA	Americans with Disabilities Act
ADOS	After Date of Subcontract
AFFF	aqueous film-forming foam
AFR	Accident Frequency Rate
AGPs	Additional General Provisions (California Institute of Technology)
ANSI	American National Standards Institute
AP	Acquisition Plan
APCS	Acquisition Planning and Compliance Section
ASME	American Society of Mechanical Engineers
ASRB	Acquisition Strategy Review Board
ASTM	American Society for Testing Materials
ATS	automatic transfer switch
AWS	American Welding Society
BHMA	Building Hardware Manufacturers Association
BS	Bachelor of Science
BS	basic service
C of F	Construction of Facilities
Caltech	California Institute of Technology
CAPA	corrective and preventive action
CAT A	Category A, subcontractor personnel who perform their jobs on-Lab
CAT X	Category X, subcontractor personnel who perform their jobs off-Lab
CBA	collective bargaining agreement
CDRL	Contract Data Requirements List
CEC	California Electrical Code
CFC	chlorofluorocarbon (class of refrigerant)
CFR	Code of Federal Regulations

CFSA	Customer-Funded Service Authorization
CIH	Certified Industrial Hygienist
CMMS	Computerized Maintenance Management System
CO	Contracting Officer
COI	conflict of interest
CONUS	contiguous United States
COTR	Contracting Officer's Technical Representative
CPO	Central Plant Operations
CRV	current replacement value
CSP	Certified Safety Professional
CT	current transformer
CTM	Contract Technical Manager
CTM	Contract Technical Manager
CTMR	Contract Technical Manager's Representative
CUP	central utility plant
D5	daily, five times per week
D7	daily, seven times per week
DART	Days Away, Restricted, or Transferred
DDC	direct digital control
DRD	Data Requirement Description
EAO	Environmental Affairs Office (JPL)
EAR	Export Administration Regulations
EMCS	Energy Management and Control System (JPL)
EMCS	energy monitoring and control system
EMR	Experience Modification Rate
EMS	energy management system
EMS	energy-management system
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EPM	Evaluated Procurement Manual
ERT	Emergency Response Team
ESD	electrostatic discharge
ESPC	Energy Savings Performance Contractor

FAR	Federal Acquisition Regulations
FBR	fixed burden rate
FCA	Facility Condition Assessment
FDS	Facilities Design Standards
FFP	firm fixed price
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FM	Factory Mutual
FMS	Functional Management System
FOIA	Freedom of Information Act
FPR	Final Proposal Revision
FSR	Facilities Service Request
FTE	full-time equivalent
FTL	Facilities Technical Library
G&A	General and Administrative (costs)
GFCI	ground-fault circuit interrupter
GFE	Government-furnished equipment (in this case JPL)
GFF	Government-furnished facilities (in this case JPL)
GFI	ground-fault (circuit) interrupter
GFM	Government-furnished material (in this case JPL)
GPM	gallons per minute
GP's	General Provisions (California Institute of Technology)
GSA	General Services Administration
HAZMAT	hazardous material
HAZWOPER	Hazardous Waste Operations and Emergency Procedures
HM	hazardous material
HUBZone	Historically Underutilized Business Zone
HVAC	heating, ventilation, and air conditioning
ID	identification
IDIQ	Indefinite Delivery, Indefinite Quantity (contract type)
IPM	integrated pest management
ITAR	International Traffic in Arms Regulations
JPL	Jet Propulsion Laboratory
JV	joint venture

kV	kilovolt
LACSD	Los Angeles County Sanitation District
LEED	Leadership in Energy and Environmental Design
LEL	lowest exposure limit
LLP	limited liability partnership
LOE	level of effort
LPTA	lowest price technically acceptable
LTIR	Lost Time Incident Rate
M	monthly
M&O	maintenance and operations
M&R	maintenance and repair
MCR	Maximo Change Request
MDL	Microdevices Laboratory
MIS	management information system
MOP	method of procedure
MPY	mils per year
MQs	Mandatory Qualifications
MRG	Management Review Group
MSDS	Material Safety Data Sheet
MSO	Maintenance Service Order
MTS	manual transfer switch
MWS	monthly work schedule
NACE	National Association of Corrosion Engineers
NAICS	North American Industry Classification System
NASA	National Aeronautics and Space Administration
NEC	National Electrical Code
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NHB	NASA Handbook
NHPA	National Historic Preservation Act
NID	NASA Interim Directive
NPD	NASA Policy Directive
NPG	NASA Procedures and Guidelines

NPR	NASA Procedural Requirements
NRCA	National Roofing Contractors Association
NSS	NASA Safety Standards
NTP	Notice to Proceed
O&M	operations and maintenance
O/H	overhead
OCONUS	outside the contiguous United States
ODS	ozone-depleting substances
OGC	Office of the General Counsel (JPL)
OPP	Operational Procedures Plan
OPS	operations
OSHA	Occupational Safety and Health Administration (US)
OSPO	Occupational Safety Program Office
OVE	objective, verifiable evidence
PCB	polychlorinated biphenyl
PCC	Power Control Center
PGM	programmed maintenance
PLC	programmable logic computer
PM	preventive maintenance
POL	petroleum/oil/lubricant
PPE	personal protective equipment
PPM	parts per million
PRV	pressure-reducing valve
PT&I	predictive testing and inspection
PWS	Performance Work Statement
Q	quarterly
QA	quality assurance
QAE	Quality Assurance Evaluator
QC	quality control
RCM	Reliability-Centered Maintenance
RFCA	Request for Corrective Action
RFP	Request for Proposal
RFQ	Request for Quote

RIEI	Roofing Industry Educational Institute
ROI	replacement of obsolete items
RTF	run to failure
SA	semiannual
SAM	System for Award Management
SB	small business
SBPO	Small Business Programs Office
SCAQMD	South Coast Air Quality Management District
SCI	Sensitive Compartmented Information
SCM	Subcontract Manager
SCTM	Subcontracts Technical Manager
SDRL	Subcontract Data Requirements List
SDS	Safety Data Sheet
SEB	Source Evaluation Board
SET	Source Evaluation Team
SFOF	Space Flight Operations Facility
SHP	Safety and Health Plan
SM	semimonthly
SME	subject-matter expert
SOW	Statement of Work
SPECSINTACT	automated specification processing, storage, and retrieval system for preparing JPL construction and repair contract documents
SR	Service Request
SSO	Source Selection Official
SSPC	Steel Structures Painting Council
Staefa	product name for Siemens energy management system
SWOT	strengths, weaknesses, opportunities, threats
SWPPP	Storm Water Pollution Prevention Plan
TC	trouble call
TCIR	Total Case Incident Rate
TDD	Technical Description Document
TRIR	Total Recordable Incident Rate
UL	Underwriters Laboratory

ULV	ultralow-volume
UPS	uninterruptable power supply
VAV	variable air volume
VOC	volatile organic compounds
W	weekly

3. Standards

The Subcontractor shall follow all relevant Federal, State, and local codes, regulations, and standards including the following:

6.2 NASA-STD-8719.17 NASA Requirements for Ground-Based Pressure Vessels and Pressurized Systems (PVS).
6.2 NASA-STD-8719.9 Lifting Standard.
American Society for Testing Materials (ASTM) D2688-15 (Coupon Test Method)
ANSI/ASSE Z359.2-2017 Minimum Requirements for a Comprehensive Managed Fall Protection Program.
ANSI/ISEA Z358.1-2014 Emergency Eyewash and Shower Equipment.
ANSI/NETA Standard for Acceptance Testing (ATS)
ANSI/NETA Standard for Electrical Commissioning (ECS)
ANSI/NETA Standard for Maintenance Testing (MTS)
ASHRAE 62.1 -2022, Ventilation and Acceptable Indoor Air Quality
ASME Safety Code for Elevators and Escalators (ASME 17.1-2014 and ASME 17.3-2015)
AWS D1.1. Structural Welding Code—Steel.
California and local building codes
California Electrical Code
CCR Title 8 California Code of Regulations (CCR) Title 8.
CFR Part 112 – Oil Pollution Prevention
Clean Air Act
Endangered Species Act
Energy Act 2005
Energy Act of 2020
Energy Independence and Security Act 2007
Equipment and system manufacturer’s instructions
Executive Memorandum of April 26, 1994 entitled Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds
Executive Order 12845
Executive Order 12893

Executive Order 13148, Section 207
Executive Order 13693 of March 19, 2015 entitled Strengthening Federal Environmental, Energy, and Transportation Management
Executive Order 14057
FAR 52.223-11 Ozone-Depleting Substances and High Global Warming Potential Hydrofluorocarbons.
FAR 52.223-12 Maintenance, Service, Repair, or Disposal of Refrigeration Equipment and Air Conditioners.
FAR 52.223-19 Compliance with Environmental Management Systems.
FAR 52.223-2 Affirmative Procurement of Biobased Products Under Service and Construction Contracts.
FAR 52.223-3 Hazardous Material Identification and Material Safety Data.
FAR 52.223-9 Estimate of Percentage of Recovered Material Content for EPA-Designated Items.
Federal Insecticide, Fungicide, and Rodenticide Act, as amended (7 U.S.C. 136 (et seq.))
Industry standards and national codes (American Water Works Association, AWWA; American National Standards Institute, ANSI; National Fire Protection Association, NFPA; and American Society of Mechanical Engineers, ASME, Western Sunset Gardening Guide and the American Society of Landscape Architects (ASLA), etc.)
ISO 10015, 2019, Quality management systems — Guidelines for competence management and people development
ISO 50001 Standard
ISO 9000, 2015, Quality Management Systems- Fundamentals and Vocabulary
ISO 9001, 2015, Quality Systems Standards
JPL Center Energy Efficiency and Water Conservation Plan
JPL Disaster Preparedness Plan
JPL Facilities Design Standards
JPL Facilities Division 2800 Emergency Response Plan
JPL Pollution Prevention Plan
JPL Rules! DocID 36852 JPL Cybersecurity Requirements.
JPL Rules! DocID 42472 Ground-Based Pressure Vessels and Systems.
JPL Rules! DocID 78000 JPL Information Technology and Cybersecurity.

Local air quality regulations of the Southern California Air Quality Management District (SCAQMD)
NASA Facilities Maintenance and Operations Management (NPR 8831.2F) NASA Reliability Centered Building and Equipment Acceptance Guide
NASA Interim Directive (NID) 8831.124: Use of Condition Based Maintenance and Maintenance Manager Training
NASA-HDBK-8709.24 NASA Safety Culture Handbook.
NASA-STD-8719.11 NASA Standard for Fire Protection and Life Safety.
NASA-STD-8739.12 Metrology and Calibration.
National Board of Boiler and Pressure Vessel Inspectors Code
National Environmental Policy Act
National Fire Protection Association (NFPA) 70
National Fire Protection Association (NFPA) 70B
National Fire Protection Association (NFPA) 70E
National Historic Preservation Act (NHPA)
NFPA 70 National Electrical Code.
NFPA 70B Recommended Practice for Electrical Equipment Maintenance.
NFPA 70E Standard for Electrical Safety in the Workplace.
NFPA 780 Standard for the Installation of Lightning Protection Systems.
NPR 1800.1 NASA Occupational Health Program Procedures, JPL Implementation Plan.
NPR 2810.1 Security of Information and Information Systems.
NPR 8530.1 NASA Sustainable Acquisition.
NPR 8570.1 NASA Energy and Water Management Program.
NPR 8621.1 NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping.
NPR 8715.1 NASA Safety and Health Programs.
NPR 8715.2 NASA Emergency Management Program Procedural Requirements.
Resource Conservation and Recovery Act (RCRA)
Rules and Regulations of the Los Angeles County Sanitation District
SPECSINTACT (the automated specification processing system used by JPL) and its referenced documents, standards, codes, and procedures

• State of California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders
• State of California Title 8, Subchapter 7, Group 13
• Uniform Building Code

4. Government-Furnished Facilities, Equipment, and Material

- a. In accordance with the Government Property Provision in the General Provisions of this Subcontract, JPL will provide the Subcontractor with Government-owned facilities, equipment, and software set forth below for on-site use in connection with this Subcontract. The use of Government-furnished property for any efforts outside of this Subcontract is prohibited. All such facilities, equipment, and software will be provided in an “as-is” condition.
- b. The TDD is not a 100% replacement of all assets in Maximo. It serves as a very close guideline of what to expect, have the ability to develop, manage an operating structure (OPP) and budget. Any identified significant edits/changes/additions will be performed via contract Mod. The full list of assets is available in Maximo which is not practical to add onto this document.

4.1 JPL-Furnished Facilities

- a. JPL will furnish or make available to the Subcontractor the facilities described below. Should the Subcontractor choose to use JPL-furnished facilities, adequate precautions shall be taken to prevent fire hazards, odors, and vermin. Janitorial services for JPL furnished facilities shall be provided by the janitorial Subcontractor. The Subcontractor shall obtain written approval from the JPL CTM prior to making any modifications or alterations to the facilities. Any such modifications or alterations approved by JPL will be made at the expense of the Subcontractor. At the completion of the Subcontract, all facilities shall be returned to JPL in the same condition as received, except for reasonable wear and tear, approved modifications and alterations. The Subcontractor shall be held responsible for the cost of any repairs caused by negligence or abuse on the Subcontractor's or on the Subcontractor's employees' part.
 - (1) Assembly and work spaces shown within the hatched areas in Building 200 – 1st. Floor, B230 SFOF operations area and B309.
 - (2) Parking spaces for personal vehicles to be determined. Parking spaces located east of Building 200 is available for contractor vehicles/carts and 2 personal vehicles. Larger and other contractor vehicle parking spaces to be located and approved by JPL.

4.2 JPL-Furnished Equipment and Software

- a. JPL will furnish or make available to the Subcontractor, the equipment and software described in appendix A.7. The Subcontractor shall not be obligated to use any of this equipment or software. Should the Subcontractor choose to use any or all of this equipment or software, the Subcontractor shall properly maintain and repair same and take prudent measures to safeguard and ensure proper use. At the completion of the Subcontract, all equipment shall be returned to JPL in the same condition as received, except for reasonable wear and tear. Repairs, if any, shall be at Subcontractor's cost. Equipment that becomes worn out due to normal wear and tear shall be returned to JPL and any replacement shall be the responsibility of the Subcontractor and shall not be charged to the Subcontract.
- b. The Subcontractor and the JPL CTM shall jointly conduct an inventory before commencing work on this Subcontract to determine the exact number and serviceability of JPL-provided equipment chosen by the Subcontractor for use on the Subcontract.
 Note: The Subcontractor shall be responsible for the loss or destruction of, or damage, to the

equipment listed in appendix A.6, while in the custody of the Subcontractor in accordance with the Government Property Provision in the General Provisions of this Subcontract.

- c. JPL software will be utilized by the Subcontractor for use on computers used in the efforts of this Subcontract.
- d. The software for the Computerized Maintenance Management System (CMMS) shall be MAXIMO Version 7.6.1.3 and MAS 8, and Maximo Mobile for Mobile Field Devices.

5. Computerized Maintenance Management System Configuration Control

The CMMS and its associated database serve specific purposes. Maximo, JPL's CMMS, is used to issue work orders for maintenance and repair and to keep records of equipment and building maintenance history. The data entered and residing in Maximo shall be valid, current, relevant, complete, and appropriate at all times. The FM&O Subcontractor shall provide a wireless handheld solution to enable real-time updating of Maximo; maintain latest version of EZMaxMobile system as a base minimum. Wireless technology shall be in compliance with JPL's IT security guide lines and FCC regulations.

The Configuration Control of Maximo is outlined. Each of these requirements has conditions that are intended to ensure the integrity of the data that is entered into the CMMS. The JPL Maximo System Administrator (SA) will have sole responsibility for the maintenance and modification of the CMMS operating system and associated software, hardware, and database administration. All data entered into the Maximo database by the FM&O subcontractor or sub-tier subcontractor shall be entered only through Maximo's front-end applications which utilize MBOs.

The following requirements shall be followed when data is entered into Maximo:

- a. The Subcontractor shall enter correct, relevant, and accurate data in all required fields.
- b. Only labor, materials, and services used directly in the performance of maintenance and operations work shall be entered into a work order. Non-productive time such as meetings, lunch, and breaks may be entered separately (defined as 'non-productive') if the FM&O Subcontractor will be using Maximo as their timekeeping system. The non-productive time must have no associated costs and must not have a work type that is used for productive time.
- c. Only one asset shall be serviced or repaired per work order. The asset number (ASSETNUM) field shall contain the correct alphanumeric identification of the facilities asset being maintained or repaired.
- d. Only one location shall be used per work order. If the work to be done includes many locations, each location will have its own work order. If the work being performed is on a system that affects two or more buildings, child work orders shall be created to the original work order request.
- e. The downtime status of equipment that is off-line due to repairs shall be entered into the CMMS when the equipment downtime is estimated to exceed 24 hours. Scheduled downtime will not need to be noted if it is less than one work day or is the result of rotating equipment.
- f. The work order shall have a status of "COMP" at the time of completion. If JPL's WIFI is not available for a real-time Maximo work order transaction, the required work order data shall be entered into the Maximo database by appropriate or approved means, not more than one day (24 hrs.) after the work was completed.
- g. A work order will not be considered complete by JPL until the work description, work-order priority, location, asset number (if maintained equipment is involved), requestor name, requestor phone, lead craft, labor hours and costs, materials used and costs, services

performed by other subcontractors and their costs, equipment rental costs, and actual work performed has been entered accurately in the appropriate required fields along with work type by NASA element, date and time of work request, date and time work was completed, an objective evidence data element (equipment reading or metric, photo, etc.) that validates the task completion, and technician/service provider identification. An incomplete work order is considered to be a non-compliant work order and non-compliant work orders will affect award fee determination.

- h. Work orders that have been completed (issued the “COMP” status) shall be closed (issued the “CLOSE” status) after 3 months of the completion status date.
- i. The difference between the work order reported date and time (REPORT DATE) and the ACTSTART date and time, will be used to measure response time. The difference between the reported date and time (REPORT DATE) and the ACTFINISH date and time, will be used to measure the duration or completion time. Any work order that is not started and completed within the time constraints stated within Section 6 and Section 7 will be considered non-compliant.
- j. If a field addition, configuration, or modification is desired, the Subcontractor shall submit a Maximo Change Request (MCR) type work order, and if necessary, an illustration of the modification in digital format to the CMMS System Administrator for review and approval.
- k. All submitted work orders shall contain the fields required for Subcontractor’s QA/QC program to review. All work orders, whether open, pending, completed, shall be included in Subcontractor’s QA/QC program and reviewed.
- l. Any external program to be used in conjunction with Maximo requires JPL approval.
- m. If available, the equipment installation and maintenance manuals shall be added to Maximo Asset.

6. General Requirements and Procedures for Trouble Calls

Trouble calls (TC) are unplanned, generally one-time occurrences (including support for other subcontractors as directed by JPL) that can originate at any time and from anyone on the facility and that have a scope limit of 20 direct labor work-hours or \$2000 in direct costs per work order. During the course of the trouble call if it is determined that the permanent fix or repair is estimated to exceed 20 direct labor work-hours or \$2000 in direct costs a child Repair work order shall be generated in accordance with the requirements of this TDD, Section 7.

Depending on severity and/or location, TCs shall be prioritized, from highest to lowest, using the following classifications: “emergency,” “urgent,” “priority,” “routine,” “discretionary,” or “deferred.” Timely and quality response to and resolution of TCs is critical to the performance of the Contract. The Subcontractor shall not alter the priority classification in the CMMS unless approved or directed by the JPL CTM.

In performing work, the Subcontractor shall ensure that hazards associated with the TC are controlled immediately, and that hazards associated with the work zone are controlled such that Subcontractor employees, JPL employees and visitors are not exposed to any hazards.

- a. Quality Work: The Subcontractor shall perform all work in accordance with the specified standards. Unsatisfactory work shall be corrected within 5 working days of notification to the Subcontractor to be considered for timely completion.
- b. Procedures: The Subcontractor shall follow the recording and notification procedures specified in Article 1 Work Reception and Processing and Scheduling. TCs shall be documented in the CMMS in accordance with the requirements specified in this TDD, Section 5. The Subcontractor shall respond to emergencies within the construct of the Incident Command System (ICS).

TCs shall be treated as follows:

- c. Emergency Trouble Calls (TC). If the trouble call is classified as an emergency (aka, Priority 5), the Subcontractor shall respond immediately and begin work within the response times stated herein. Emergency TCs require immediate action to avoid loss of life, personal injury, or illness; to prevent loss of or damage to JPL property; to restore essential services that have been disrupted affecting the operation of critical buildings, equipment, or systems as identified in Appendix 20; to eliminate hazards to personnel or equipment; or to prevent environmental harm. The Subcontractor shall have personnel available or on call who are familiar with JPL’s Emergency Operations Center and Incident Command Post operations in the event that these resources are utilized.
 - (1) Response to Emergency TCs: The Subcontractor shall respond immediately. During regular working hours the Subcontractor shall be on the job site and working within 15 minutes after receipt of an emergency TC at Work Control. Outside regular working hours the Subcontractor shall be on the job site and working within 1 hour.
 - (2) Timely Completion: The Subcontractor shall work continuously without interruption and shall arrest the emergency condition and restore the utility and system. If it is a non-critical building then the Subcontractor will perform a temporary repair (e.g., shut off water, close a gas valve, temporarily patch a roof leak). Temporary services may be required in order to bring a building back online. The Subcontractor shall do what

is necessary in order to temporarily restore services or systems in a building (temporary chillers, air handlers, boilers, etc.) If additional labor and material (follow up work) is required to complete the work, the Subcontractor shall order parts, procure services and work to complete the TC within 14 calendar days. If it is determined that the emergency TC will exceed the completion limits, the additional work shall be performed in accordance with the requirements of this TDD.

- d. **Urgent TCs.** Urgent TCs (aka, Priority 4) require action to prevent interruption of work or restore a healthful and working environment (e.g., hot/cold room temperature, lighting calls).
 - (1) **Response to Urgent TCs:** During regular working hours the Subcontractor shall be on the job site and working within 1 hour after receipt of the call at Work Control. Outside of regular working hours the Subcontractor shall be on the job site and working within 2 hours.
 - (2) **Timely Completion:** The Subcontractor shall work and complete the TC within 14 calendar days. If further labor and material (follow up work) are required to complete the work and it is determined that the urgent TC will exceed the maximum labor hours and cost limits for a TC, the additional work shall be classified as a Repair and shall be performed in accordance with the requirements of this TDD.
- e. **Priority TCs.** Priority TCs (aka, Priority 3) require action on a priority basis or to meet project deadlines.
 - (1) **Response/Completion to Priority TCs:** The Subcontractor shall respond to all priority TC work within 7 calendar days of call receipt.
Timely Completion: The Subcontractor shall work and complete the Priority TC within 14 days. If further labor and material (follow up work) are required to complete the work and it is determined that the Priority TC will exceed the maximum labor hours and cost limits for a TC, the additional work shall be classified as a Repair and shall be performed in accordance with the requirements of this TDD.
- f. **Routine TCs.** Routine TCs (aka, Priority 2) can be scheduled routinely within the Subcontractor's capability and may be consolidated by facility or zone or as directed to obtain efficiency of operation.
 - (1) **Response/Completion to Routine TCs:** The Subcontractor shall complete all routine TC work within 14 working days of call receipt.
- g. **Discretionary TCs.** Discretionary TCs (aka, Priority 1) include work that is desired but not essential to protect, preserve, or restore facilities and equipment. Typically, discretionary TCs include new work that is not tied to a specific mission milestone.
 - (1) **Response to Discretionary TCs:** The Subcontractor shall complete all discretionary TC work within 60 working days of call receipt.
- h. **Deferred TCs.** Deferred TCs (aka, Priority 0) include work that may be safely, operationally, and economically postponed. The work may be reclassified as determined by the JPL CTM.
 - (1) **Response to Deferred TCs:** The Subcontractor shall complete all deferred TC work within 1 year of call receipt.

- i. Documentation of Completed Calls. When all work has been completed against the work order the work order shall then be completed in the CMMS with objective evidence. If JPL's WiFi system has experienced a failure and is not available, the data shall be entered within 1 work day after completion of the trouble call. The Contractor shall also enter detailed information about the resolution of the trouble call in the Work Log of the work order.
- j. Customer Notification. The Subcontractor shall be required to notify the person that placed the trouble call of when the work was completed and what was done to correct the problem. Whenever a normal operating source i.e., power, water, HVAC, etc., is lost to a particular building or buildings, an email notification shall be immediately be sent to all building occupants informing them of the issue and a projected timeline of when the service is expected to be restored. Upon restoration of the service, all occupants shall be informed that the systems are back to a normal status via email.

If the service is not restored within 24 hrs., a daily consequent email correspondence shall be sent to all occupants keeping them informed of the progress.

The M&O subcontractor shall document all scheduled utility shutdowns onto the JPL Facilities "Utility Shutdown/Facility Outages Calendar" (JPL Website) upon knowledge of any scheduled utility interruption.

- k. Materials and Equipment. It is expected that the Subcontractor will have availability to selected reliable vendors which will be able to supply materials and equipment if the Subcontractor does not have the materials or equipment on-hand. If the material or equipment requires a significant lead time the Subcontractor will check at least two other vendors for the materials or equipment to ensure the work can be done without delay. However, if the lead time for finding and shipping the materials or equipment is unavoidable and is expected to extend the duration of the work order past the timely completion of the work order (as defined above), the P-47 problem code will be used to identify the work order as needing additional time to complete. In addition, the Work Log of the work order shall be used to indicate with enough detail what materials and/or equipment is needed, the amount of lead time, and what is causing the lead time (out of production, no longer stocked, etc.). It shall be required that only authorized personnel have access to use this problem code. It is also required that the appropriate personnel shall have training on its use based upon the TDD. All work orders with the P-47 problem code shall be reviewed by the subcontractor's QC, and approved by a Resource Manager or equivalent.

The Subcontractor shall maintain a minimum of 3 vendors for all necessary outside services. The list of vendors shall be provided to JPL upon request.

- l. Area Availability. If the initial corrective action has temporarily solved the problem but the person responsible for the area or location (that the TC work order is for) indicates that the area is not available for a permanent repair until a later date, the TC work order will be completed indicating the temporary repair and approximately when the permanent repair can be performed. A follow-up work order will be generated when the area is available for the permanent repair.
- m. Flash Reports. JPL M&O personnel is to be contacted ASAP upon a flash report incident during both normal and after work hours. A flash report email is to be distributed to all noted

personnel on the Flash Report LOP within 1 hour of the incident.

An updated status of the flash report issue shall be provided to JPL M&O by the following morning.

During a power loss, network conductivity can be compromised and sending out flash reports via email may not be viable. The subcontractor shall have an alternative method such as text messaging to key personnel when email service is off-line.

7. General Requirements and Procedures for Recurring Work and Repairs

Recurring work is planned work consisting of preventive maintenance, programmed maintenance, and predictive testing and inspection as detailed in this TDD. In performing recurring work, the Subcontractor shall continually practice Reliability Centered Maintenance (RCM), which is a NASA-developed maintenance philosophy that incorporates a mix of reactive, preventive, predictive, and proactive maintenance practices.

In performing work, the Subcontractor shall ensure that hazards associated with the work zone are controlled such that Subcontractor employees, JPL employees and visitors are not exposed to any hazards.

Recurring work includes all work requirements for which JPL has included schedules of accomplishment in the Contract or for which the Subcontractor is required to submit Monthly Work Schedules (MWS).

The necessity to generate a Repair work order may arise during the course of PM, PGM, or PT&I work. Repairs may also be the outgrowth of TC work (reference Section I).

The Subcontractor shall perform recurring work as described below.

- a. PM and PGM. The Subcontractor shall perform PM and PGM on the facilities, structures, equipment, and systems listed in Exhibits, Attachments, and Appendixes 19, 20 & 21 in accordance with the job plan tasks specified in the TDD.

PGM is recurring work items with maintenance cycles greater than 1 year, such as painting a building every 5 years. (PGM possibly to be deleted by NASA BY 4/25, we'll modify Maximo accordingly).

PM/PGM consists primarily of inspection, cleaning, lubrication, adjustment, calibration, and minor part and component replacement (e.g., filters, belts, hoses, fluids, oil, and grease) as required to minimize malfunction, breakdown, and deterioration of equipment; and the identification of and/or performance of any work required to bring the equipment up to the manufacturer's operating standards. The Subcontractor shall complete all work (see paragraph a (1) below) requirements identified during the performance of a PM/PGM inspection as part of the PM/PGM.

The Subcontractor will be held liable for the full cost of repairs if JPL determines that the cause of system or equipment failure, malfunction, or damage was due to the Subcontractor's failure to perform required PM/PGM work.

Work orders shall be submitted for all known deficiencies/issues/concerns, regardless of potential costs or responsibility. This will allow the issue to be recorded, discussed and addressed.

The Subcontractor shall repair or replace equipment or system components that are determined to be faulty at the time of PM/PGM performance. The Subcontractor shall correct all deficiencies identified during the performance of PM/PGM work. JPL will allow

appropriate additional time for this work in accordance with the limits described in this section of the TDD.

- (1) Quality: Quality PM/PGM will be measured by the extent to which:
 - (a) Subcontractor performs the job plan tasks listed in Appendix A.1 in accordance with requirements and standards specified in this section of the TDD.
 - (b) Tasks are completed on schedule.
 - (c) Items of equipment perform their intended function.
 - (d) Site is left clean and free of debris.
 - (e) PM/PGM data is entered in the CMMS accurately and completely, in accordance with Section 5.
- (2) Records & Reports: The Subcontractor shall make available for JPL review, both in the CMMS and by electronic/hard copy, the previous week's completed portion of the MWS's PM/PGM work. The PM/PGM data shall indicate the scheduled PM/PGMs completed during the previous week and those not completed with explanations for non-performance. Included work completion data shall be the following:
 - (a) Subcontractor shall provide and attach inspection tags that shall be dated and signed at the time of completion of mechanical and electrical PMs by the technician completing the work. Inspection tags shall be located on equipment or as close as possible. All documentation required as part of Cal OSHA and ANSI Z358.1-2014 inspection documentation shall be noted on tags of all associated equipment (such as eye wash stations, emergency showers, etc.).
 - (b) Deficiencies noted during the PM/PGM's shall be described in detail in the CMMS. Repairs completed shall be identified along with the estimated cost to correct any remaining deficiencies.
 - (c) All documentation required as part of PM/PGMs and Air Quality records shall be retained in accordance with all operational conditions listed on South Coast Air Quality Management District (SCAQMD) permits to operate/construct. A copy of the relevant report shall be placed in close proximity to the permitted equipment. Original permits shall be submitted to the JPL CTM. These permits include but are not limited to: refrigerant usage, paint spray booths; fuel usage and hours of operation, records for boilers and emergency generators, and boiler maintenance records.
 - (d) All work will be considered to be complete within the CMMS at the time it is completed in the handheld/tablet device.
 - (e) Data entered into the CMMS shall include equipment number, location, date of find, description of work and materials and labor used.
 - (f) The Subcontractor must implement a process for reallocating PM/PGM and WO to former employees who are no longer active in the CMMS system.
- b. Predictive Testing & Inspection (PT&I) The Subcontractor shall provide all hardware and software required to perform PT&I. The Subcontractor shall perform PT&I on the

equipment and systems as described in paragraph (2) (a) above in accordance with the procedures specified in this paragraph and Appendix A.1. The PT&I program details are shown Appendixes A.1.11. The Subcontractor shall correct all deficiencies identified during the performance of PT&I work. JPL will allow appropriate additional time for this work in accordance with the limits described in this section of the TDD.

- (1) Specific Requirements for PT&I Operations. The Subcontractor shall perform the following services:
 - (a) Provide surveillance to detect abnormal conditions of JPL collateral equipment. Abnormal conditions will be designated as finds, defined in this TDD.
 - (b) Document all finds in the CMMS within 3 working days of discovery in accordance with the time limits defined in this TDD.
 - (c) Correct all finds in accordance with the timeliness requirement in paragraph c.
 - (d) Conduct PT&I baseline monitoring during the commissioning of JPL new collateral equipment, including the review of criteria, drawings, and specifications related to performing acceptance inspection tests.
 - (e) Maintain the database to provide information such as equipment alarm parameters, historical data, trends, and information on installation and modification of collateral equipment. Document in the CMMS monthly and make available for JPL review locations of new monitoring points, routes, and any other additions to the system.
 - (f) Provide evidence upon request by JPL of annual calibration of all PT&I test equipment and associated documentation.
 - (g) Make available to JPL upon request histories of all alarms.
 - (h) The Subcontractor shall furnish all PT&I workstation hardware and software.
 - (i) The Subcontractor PT&I System Administrator (PT&I-SA) shall make daily computer backups of all data on suitable removable media and ensure data integrity by following best practices in storage of backup data.
- (2) Quality: Quality PT&I will be measured by the extent to which continued safe operation is assured through the use of instruments that are calibrated and effective for the conditions being monitored and the performance of these tasks by qualified personnel. Quality will be assessed by evaluation of the certified analyst's diagnosis of equipment conditions and by inspection of the PT&I equipment.
- (3) Records & Reports: The Subcontractor shall make available in the CMMS for JPL review, both in the CMMS and by electronic/hard copy, the previous week's portion of the MWS PT&I schedule. The PT&I schedule shall indicate the scheduled PT&Is completed during the previous week and those not completed with explanations for non-performance. The CMMS work completion data shall include the following:
 - (a) Deficiencies discovered during the PT&Is shall be described in detail. Repairs completed shall be identified along with the estimated cost to correct any remaining deficiencies.

- (b) Data entered into the CMMS shall include equipment number, location, date of find, estimated cost of repair, estimated cost avoided, description of work, and materials and labor used.
 - (c) The work order shall be completed immediately in the CMMS. If handheld system has experienced a failure and is not available, the data shall be entered within 3 working days after completion of the preventive maintenance. The Contractor shall enter detailed information to the CMMS record.
 - (d) All records and reports shall be available to JPL for review and validation. In addition, all data gathered shall be immediately processed and shall not reside solely in the PT&I instruments. All PT&I data is JPL property and shall be saved and properly backed up to a secure server to be provided to JPL upon request, including necessary software/programming required to analyze data.
- c. Repairs: The Repair work order ('R' work type) shall be identified by estimated or actual repair costs greater than \$2,000 or hours exceeding 20 hours of labor per occurrence (including the value of the TC, if the repair is an outgrowth of TC work). If the Repair work order is an outgrowth of a TC work order or a PM, PGM, PT&I work order it shall be a child work order to the parent TC, PM, PGM, or PT&I work order.

That portion of repair work that exceeds \$50,000.00 per occurrence shall be subject to an equitable adjustment to the contract as stated in the General Provision entitled, "Changes."

For purposes of this contract, disaster response shall be treated as a Repair.

Except for disaster responses, all repair work in excess of \$50,000.00 per occurrence shall be authorized in writing by the Subcontracts Manager prior to performance. "Historical Data of Repairs" received and their classification categories are set forth in the Facilities Technical Library (FTL).

All projects subject to funding >\$50k shall be submitted to JPL M&O immediately upon identifying that a project cost may exceed >\$50k, as JPL M&O must also secure funding approval.

- d. Timeliness. There are two categories of Repair work. These categories and their maximum task completion times are:
 - (1) Category One: Tasks costing greater than \$2,000.00 to less than \$50,000.00. These tasks shall be completed within 30 calendar days from the time of Subcontractor acceptance of the task for accomplishment.
 - (2) Category Two: Tasks costing greater than \$50,000.00. These tasks shall be completed within 90 calendar days from the time of Subcontractor acceptance of the task for accomplishment.
- e. Rental or Temporary Equipment on Lab. All rental equipment and systems including temporary systems that are brought onto the Lab shall require the completion of Exhibit 25 "JPL Equipment Rental Check List 02.05.21". The form shall be completely filled out and submitted to JPL Facilities personnel upon arrival before any system is placed in service. The

form must be validated by JPL facilities and safety representatives. In the event of an after-hours emergency, the form can be emailed and will be validated by JPL personnel at the earliest convenience. In the event of an internal combustion engine requiring fuel to operate, fuel levels must be recorded upon arrival and departure of equipment. Fuel levels must be reported to EAPO upon arrival and departure of any system utilizing fuel for an internal combustion engine.

8. Buildings and Structures Maintenance and Repair

- a. General Requirements. Appendix 19 describes the buildings, structures (including trailers and modular complexes), and appurtenances to be maintained in this Subcontract. Included are walls, partitions, ceilings, and floors; roofing, siding, flashing, footings and foundations; stairs, ladders, railings, and platforms; doors (including hinged, sliding and manual and mechanical roll-up) and windows; cabinets and countertops; interior and exterior accessories; signs; framing and metal structures; lighting, alarm, power, control and other electrical systems; plumbing and plumbing fixtures, water heaters, and drinking fountains; piping and piping systems, including natural gas and compressed air distribution systems; compressors, motors, pumps, motor-generators, air-dryers, gear boxes, couplings, fans and other mechanical systems; gates and fences; and food service equipment. This work includes the performance of TCs and recurring work.
- b. Performance Criteria. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
- c. Operation Procedures. Work shall be accomplished in accordance with the subcontractor's, "Operations and Procedures Plans for Maintenance and Operations Services at JPL (OPP)," incorporated into the subcontract, which shall address the following:
 - (1) Methods for inspecting and repairing various types of roofs (including PVC) and seasonal scheduling of these inspections, procedures for emergency repair of roof leaks, and their permanent corrections. Method of protecting roof surfaces from damage by foot traffic.
 - (2) Methods for ensuring comprehensive repairs (including mechanical and electrical equipment located on roofs, ductwork, flashings, gutters, downspouts, guy wires, scuppers, and screens).
 - (3) Procedures to prevent interior/exterior damage caused by any unforeseen conditions (weather, work stoppages etc.) when roofing repair is undertaken. Method of ensuring that roofing workers do not cause any collateral damage. Method for performing quality control and for obtaining and exercising warranties.
 - (4) Evaluation criteria for replacement of floor coverings, method of demolishing existing flooring materials, including disposal of hazardous materials. Method of laying down new flooring materials and ensuring comprehensive completion of work (e.g., cove base door stops, floor-mounted receptacle covers, and cleanup of construction debris). Method of ensuring that flooring workers do not cause any collateral damage. Method for performing quality control and for obtaining and exercising warranties. Method of recording areas of completed work.
 - (5) Application methods for different painting materials and coatings. Method of preparing interior/exterior surfaces, and disposal of material including disposal of hazardous material, dust, debris, and fume control. Method of compliance with AQMD rules when undertaking painting work.
 - (6) Method of determining how areas will be evaluated and scheduled for painting. Description of how areas that have been painted will be identified and tracked. Method

of ensuring that painters do not cause any collateral damage. Method for performing quality control (e.g., testing coverage of surfaces) and for obtaining and exercising warranties.

- (7) Methods for ensuring comprehensive plumbing maintenance/repair, including restroom fixtures, faucet handles, water distribution system, hot water heaters, heat exchangers. Method of ensuring that plumbers do not cause any collateral damage (e.g., floors, ceilings, and walls). Method for performing quality control and for obtaining and exercising warranties.
- (8) Methods of identifying, prioritizing, and correcting uneven pedestrian surfaces and pedestrian surfaces in need of non-slip coatings. Non-slip coatings or paint shall have an acceptable coefficient of friction >0.5 when used in walkways and curbs.
- (9) The Subcontractor is required to submit an annual plan for repairing Walking Working Surfaces in compliance with the SDRL contractual requirement.

d. Technical Requirements.

- (1) Requirements for Carpentry and Masonry. Carpentry and masonry maintenance and repair shall be provided as described in the following paragraphs and in Appendix A.1.2.
 - (a) Floors and Floor Coverings: Damaged or deteriorated flooring, sub-flooring, and structural members shall be repaired or replaced to provide a structurally sound, uniform, and aesthetic surface that is free of cracks, breaks, chips, tears, wrinkles, gouges, stains, buckling, and tripping and other safety hazards. The Subcontractor shall repair floors with like material and workmanship to ensure a good aesthetic match.
 - 1. Resilient Tiles: Damaged or deteriorated tiles shall be replaced with matching tiles of the same thickness and color as the original. Damaged tiles or tiles to be replaced shall be removed without affecting adjacent tiles. If the tiles adjacent to a wall are replaced, vinyl baseboard shall be replaced. If the tile in an entire room is replaced, all vinyl baseboards in that room shall be replaced. Installation shall be in accordance with the tile manufacturer's instructions. Includes electrostatic flooring.
 - 2. Linoleum and Vinyl Sheet Flooring: Areas of flooring having gashes or other defects shall be replaced with matching sheet flooring of the same thickness and color as the original. Damaged flooring to be replaced shall be removed without affecting adjacent areas. The patch shall be installed using adhesive as recommended by the flooring manufacturer. If flooring is replaced adjacent to a wall, vinyl baseboard shall be replaced.
 - 3. Wood Flooring: Loose or slightly warped flooring shall be re-nailed or re-glued to sub-flooring and/or concrete slabs with appropriate adhesive. Scarred flooring that has holes and gashes less than 1/2 inch wide shall be filled and sealed. All other damaged flooring shall be removed and replaced without damage to adjacent walls or flooring. Replacement flooring or damaged flooring that requires touch-up refinishing shall be finished as part of the job. Prior to refinishing the wood flooring, all flooring repairs or replacements shall

be completed as specified above. All damaged or deteriorated shoe molding shall be replaced. Wood flooring shall be finished in accordance with paragraph d(2) below. Replacement wooden strips shall, unless otherwise directed, run parallel to adjacent strips, be sanded to 100 grit, cleaned, sealed, finished, buffed, and marked, as necessary, to match the adjacent strips and existing configuration and design.

4. Terrazzo: Areas of terrazzo flooring having gashes or other defects shall be repaired to match the adjacent terrazzo. Treatment shall be appropriate for its respective type of binder. New terrazzo and grout shall be cured and polished to match the existing terrazzo. Portland cement systems shall be sealed with a penetrating-type sealer immediately following final polishing to regulate moisture evaporation and to inhibit the penetration of spilled materials upon initial contact with the terrazzo floor. Surface sealer shall be used on epoxy and polyester-type terrazzo floor systems.
5. Metal: Floor deck units shall be cut and fitted as required for the passage of other work projecting through, or adjacent to, the floor decking. Metal reinforcement and closure pieces shall provide the required strength, continuity of the floor decking, and required support of other work. Floor deck units shall be fastened to the steel supporting members at the ends and at all intermediate supports, both parallel and perpendicular to the deck span, by welds, as applicable. Scarred areas on the metal floor decking and on the surface of supporting steel members shall be wire-brushed, cleaned, and touch-up painted. Scarred areas shall include welds, weld scars, bruises and rust spots. Galvanized surfaces shall be touched up with galvanizing repair paint.
6. Elevated Flooring: Floor covering shall be attached to the floor panel by a non-creep adhesive. The floor system shall be laterally stable in all directions whether the panels are in place or not. The finished assembly shall be rigid and free of vibration and rocking panels. The floor shall be level within 0.10 inch. The floor panels shall be able to be conveniently removed for under floor servicing and for openings for new collateral equipment. No part of grilles or registers shall project more than 1/8 inch above the floor. Edge strips shall be mechanically secured to the floor panel in a manner to preclude detachment under foot and wheel traffic. The top of the strip shall be flush with the top of the floor covering. There shall be no voids between the floor panels and the contiguous vertical surface trim. No cutting, trimming, or other debris-producing operation shall be conducted in the area where any new flooring is being installed. Includes electrostatic flooring.
7. Carpet: Damaged seams shall be repaired and damaged carpet and transition strips shall be repaired or spot-replaced. Carpeting shall be stretched and repaired as required to match existing carpeting. Carpet color (dye lot) and pattern shall be selected to match contiguous carpeting. The Subcontractor shall ensure that the surfaces receiving carpet repair or spot-replacement are thoroughly clean. Carpet moldings, either vinyl or aluminum, shall be installed where the floor covering material changes or the carpet edge does not abut a vertical surface.

8. Concrete Floors: Cracked, broken or spalled areas shall be patched with a non-shrinking cement mortar or epoxy. Shallow spalled areas shall be chipped to provide space for an adequate patch thickness. Defects in concrete slabs, such as rough or scaling areas or high/low spots shall be corrected. The patch shall be finished even with the adjacent surfaces and finished to match existing texture. Exposed reinforcing steel shall be sandblasted to bare metal and coated with a rust inhibitive primer before restoring concrete. Epoxy coated floors shall be color matched.
 9. Vinyl Baseboards: Deteriorated or damaged sections of vinyl baseboard shall be removed and wall and floor surfaces cleaned of all dirt, oil, grease, mildew, moisture, adhesive, and debris. Loose baseboards shall be re-secured to the wall and damaged, deteriorated, or missing baseboard sections shall be replaced with sections of the same color, pattern, and size with an adhesive conforming to the manufacturer's recommendations.
 10. Ceramic Tile: Ceramic tiles surfaces that are broken, missing, cracked, or discolored shall be replaced as required. Ceramic tiles shall be re-grouted, as required, to provide a waterproof seal. In those cases where replacement tiles of an exact match cannot be found, the Subcontractor may be required to remove and replace non-defective tiles to create a pattern and minimize the visual effect of the mismatch.
- (b) Interior Walls, Ceilings, and Trim: Damaged and deteriorated walls, ceilings, and related trim shall be repaired or replaced to provide a surface free of noticeable cracks, spalls, raised areas, holes and dents, and marks and stains.
1. Drywall: Cracks, small dents, and holes shall be repaired. When water intrusion has affected the drywall and after 48 hours the drywall is not dried, the affected portions need to be removed and replaced. Replacement gypsum board shall be of the same thickness and texture as the adjacent sheets.
 2. Vinyl Wall Covering: Wall covering that has been ripped, scarred, stained, or otherwise damaged shall be repaired or replaced. If matching wall covering is not available, the Subcontractor shall find a comparable substitute. Replacement wall covering shall be hung according to the manufacturer's recommendations.
 3. Ceramic Tile. Ceramic tile walls and window stools and marble saddles that are broken, missing, cracked or discolored shall be replaced, as required. Tiles shall be re-grouted as required to provide a waterproof seal. In those cases where replacement tiles of an exact match cannot be found, the Subcontractor may be required to remove and replace non-defective tiles to create a pattern and minimize the visual effect of the mismatch.
 4. Masonry: Damaged masonry units (brick or concrete block) shall be replaced with a unit of the same size, color, and texture.
 5. Suspended Ceilings: Missing, broken, scratched, water damaged, and stained ceiling tiles shall be replaced with undamaged tiles of the same material, style,

size, and color. Damaged and broken suspended grid system shall be repaired/replaced to provide a suspended ceiling system as designed.

- (c) Doors, Windows, Awnings, and Screens: Doors shall be maintained and repaired to operate smoothly without binding or sticking. Damaged, deteriorated, or missing doors and associated hardware shall be repaired or replaced. The replaced doors shall be the same type and have the same finish as the original doors and include door stops, wall protectors, weather stripping, and coat hooks. All replacement doors shall be installed with the hardware from the damaged door unless the hardware is non-repairable. All locking hardware must accept specified and provided locks. Note: only personnel from JPL Locks and Keys will remove and install all locks and related locking hardware. The repair and maintenance of automatic doors will not be the responsibility of the Subcontractor. Doors, windows, awnings (including slats and canvas), and screens shall operate smoothly without binding or sticking in accordance with the manufacturer's design. Caulking, glazing, and weather-stripping shall be fully intact to maintain a fully weather tight seal. Replacement glass shall be of the same size, type, and quality as the existing glass.
1. Doors (including swinging and sliding doors): Exterior doors shall be removed and replaced the same workday. All replaced doors shall be installed with appropriate hardware. JPL - not the Subcontractor - will remove and install all locks and related locking hardware; therefore, the Subcontractor shall coordinate all work with the Subcontracts Manager. Cracked and broken glass in doors shall be replaced with tempered glass of the same quality, type, and size. Damaged or deteriorated thresholds and weather stripping shall be replaced in accordance with its manufacturer's recommendations. Flattened spring-type weather stripping shall be lifted or replaced to provide an effective seal.
 2. Screens: Oxidation deposits shall be removed from metal parts. The affected area shall be cleaned and a protective coating of paste wax shall be applied. Replacement screening shall be of the same material as the existing metallic screening. Warped screens and frames shall be straightened if possible to fit squarely in opening. If beyond repair, warped items shall be replaced.
 3. Hardware: Damaged, inoperable, or missing hardware (such as hinges, locks, striker plates, latches, keepers, panic devices, window operating mechanisms, door closers, and springs) shall be adjusted, repaired, repacked, or replaced as required. Replacement hardware shall match existing hardware in type, size, quality, and finish. Hardware shall be installed in accordance with the manufacturer's recommendations.
 4. Overhead, Automatic, or Rolling Doors: Work shall include, but not be limited to the following: Rails shall be checked for alignment. Rusted or corroded areas shall be repaired or replaced. All bearings, rollers, gears, and pulleys shall be properly lubricated. All hangers, bolts, springs, and pins shall be free of rust and corrosion and shall be tightly mounted and secured. Motors shall

operate properly and be properly lubricated. Cables and fusible links shall be correctly installed and free from corrosion and rust.

5. Fire-Rated Doors: All installed, replaced, or repaired fire-rated doors shall conform to the applicable building and fire codes.
 6. Windows: Broken and cracked window glass shall be replaced with tempered glass to match the original size to avoid personal injury, leaks and to keep solar coverings/tinting's over windows in good repair. Windows designed to open and close shall move freely and be able to be secured as designed.
- (d) Stairs and Stairwells: The Subcontractor shall secure loose treads, risers, stringers, handrails, brackets, and other components. Badly damaged stair and handrail components shall be refinished to match original components. Deteriorated non-slip coverings and other damaged stair finish shall be repaired or replaced. Trim items susceptible to damage during the repair activity shall be removed and reinstalled upon completion of the repair activity. The Subcontractor is to apply anti-slip materials or a slip-resistant coating with contrasting features to the stair nose to mitigate slip hazards.
 - (e) Built-in Cabinets and Countertops: Damaged or deteriorated cabinets, shelving, and countertops shall be repaired. Missing or inoperative hardware shall be replaced. Countertops shall be free of warped, chipped, burned, cut, or otherwise marred areas. Countertops with loose protective covering shall be repaired in place. Loose joints shall be secured and filled. Countertops and backsplash shall be the fully formed type consisting of a single unit with the backsplash no less than 3-1/2 inches high. When painting or varnishing repaired or replaced cabinets is required, all cabinets in the room shall be painted or varnished, if required, to make a satisfactory match.
 - (f) Interior Accessories: The Subcontractor shall repair or replace damaged, inoperative, or missing interior accessories including, but not limited to, paper holders, soap trays, dispensers, towel bars, shower curtain rods, medicine cabinets, mirrors, and door stops. Loose accessories shall be re-secured by tightening or replacing screws or by using a suitable adhesive. Damaged or missing items shall be replaced with items matching the original. Repairable rusted metal components shall be cleaned of all rust, coated with a rust inhibitor and restored to an operational condition.
 - (g) Traverse/Curtain Rods: Sagging and/or non-functioning rods shall be replaced or repaired to an operating condition. Loose brackets shall be secured. Broken cords shall be replaced. Broken or missing drapery slides shall be replaced. Rods shall be level and parallel with the ceiling. Additional support brackets shall be installed to support sagging rods.
 - (h) Venetian Blinds and Shades: Venetian blinds and window shades shall be restored to a smooth operating condition. Cracked or damaged slats shall be replaced. Broken or worn cords shall be replaced. Soiled or worn tapes shall be replaced. Loose or missing brackets and supports shall be secured or replaced. Damaged or

deteriorated hardware shall be replaced or reworked to operating condition. Damaged rails and torn fabric shall be repaired.

- (i) Exterior Walls: The Subcontractor shall repair damaged walls to maintain the aesthetics of the facility and quality of the original construction or latest remodel. Damaged or deteriorated wall areas shall be repaired to restore them to a serviceable, structurally sound, and watertight condition. This includes, but is not limited to, replacing damaged masonry units, tuckpointing loose or eroded mortar joints, sealing penetrations in wall openings, replacing damaged or deteriorated structural members, siding, underlayment, and exterior trim, replacing miscellaneous hardware items, and removal of vegetation, discoloration, graffiti, or other defects that would render an unsightly appearance to exterior walls.
 - 1. Masonry: Damaged masonry units (brick or concrete block) shall be replaced with a unit of the same size, color and texture, and with the same type mortar.
 - 2. Hardboard Siding: Damaged hardboard siding shall be removed without damaging adjacent siding or underlayment. Replacement siding shall match the existing siding in color, texture, and material. All joints shall be caulked.
 - 3. Metal Siding: Damaged metal siding shall be removed without damaging adjacent siding, underlayment, or insulation. Replacement siding shall match the existing siding in color, type of finish, gage thickness, tensile and yield strength, panel width and length, appearance, texture, and material. The siding shall be installed in accordance with the manufacturer's recommendations.
 - 4. Seams: Seams between window or door frames, wall panels, and exterior walls shall be caulked. The caulking and sealant products shall be approved by the CTM and applied according to the manufacturer's directions.
 - 5. Metal Flashing and Trim: Damaged or deteriorated metal flashing and trim shall be repaired or replaced to match the existing trim. Caulking and sealant products shall be applied according to the manufacturer's directions.
- (j) Exterior Trim: Damaged or deteriorated exterior trim, including all millwork, shutters, and cornices, shall be repaired or replaced. Damaged or deteriorated insulation board or underlayment shall be replaced with material of the same type, thickness, and quality. Bird screens and soffit vents shall be intact and free of corrosion.
- (k) Roofing: The Subcontractor shall immediately remedy roof leaks. Leaking is defined as any moisture penetration beyond the outermost moisture barrier. The Subcontractor shall accomplish temporary repairs under wet conditions to protect JPL property and personnel. Durable permanent repairs shall be completed as soon as conditions allow. Damaged, deteriorated, or missing roofing, sheathing, flashing, gravel stops, roof structures and components, and structural supports shall be repaired or replaced to provide a watertight seal and to retain the original whole condition of the roof system. Note: Various roofs have OSHA-compliant tie-off points, roofs without compliant tie-off points may require the use of a portable tie-off point as necessary. Subcontractor must have more than one (1) Sarnafil certified technician on staff.

1. Structural Members: All trusses, joists, sheathing, and other structural roof members shall be repaired or replaced to ensure the structure is safe for occupancy and is structurally sound. While making repairs, inspection of other supporting members shall be made and deficiencies corrected.
 - a. Metal Roofing: Damaged metal roofing shall be removed without damaging adjacent roofing, underlayment, or insulation. Replacement roofing shall match the existing roofing in color, type of finish, gage thickness, tensile and yield strength, panel length and width, appearance, texture, and material. Sections shall be in full and firm contact with structural supports. Flashings, fillers, and other sheet metal accessories shall be factory formed material of the same type. The roofing shall be installed in accordance with the manufacturer's recommendations.
 - b. Built-up and Elastomeric Roofing: Damaged and deteriorated roofing shall be removed without damaging unaffected areas. The replaced roofing shall be the same type and size and be compatible with the existing roofing. The roofing shall be installed in accordance with the manufacturers' recommendations.
 - c. Roof Flashing: Damaged or deteriorated flashing shall be rehabilitated to form an effective water seal. Damaged flashing around vent pipes, attic turbines, and other mechanical openings shall be replaced with appropriately formed flashing.
 - d. Gutters and Downspouts: Clogged gutters and downspouts shall be cleaned out. Broken, damaged, misaligned, or leaking gutters and downspouts shall be repaired or replaced with new material to match the original in gage, type of material, and finish. Loose hangers and fasteners shall be tightened. Missing wire guards, hangers, and fasteners for gutters, downspouts, and splash blocks shall be replaced. Splash blocks shall be properly positioned to receive the impact of drainage water.
 - e. Miscellaneous Roof Structures and Components. Vent stacks, roof ventilators, other items piercing the roof, gravel stops, pitch pockets, ridge caps, and scuppers shall be repaired or replaced so as to function as originally intended and designed.
- (l) Exterior Concrete and Masonry Structures: Exterior concrete or otherwise surfaced areas, such as foundations, patios, sidewalks, and steps, shall be repaired so that they are structurally sound, at original alignment and grade, and are free of damage and major cracks. The subcontractor is responsible for repairing and/or replacing concrete and asphalt pedestrian surfaces and roads with a breaking elevation or crack of 0.5 inches or more. Masonry fences, planters, and steps shall be repaired to replace missing or broken masonry units and repair deteriorated mortar parts, gaps, breaks, and loose components. Subcontractor shall repair and/or replace concrete and asphalt pedestrian surfaces and roads to eliminate trip hazards or damage to vehicles. Subcontractor shall remove roots that are causing heaving in asphalt or concrete, paved walkways, roads, and pedestrian hazards.

Hard Surface and Trip Hazard Repair. Subcontractor shall perform documented inspections that cover all exterior walking/working surfaces at JPL at least once each year and repair and/or replace concrete and asphalt pedestrian surfaces and roads to eliminate trip hazards or damage to vehicles. Subcontractor shall remove roots that are causing heaving in asphalt or concrete, paved walkways, roads, and pedestrian hazards.

- (m) Exterior Accessories: Damaged, defaced, deteriorated, or missing building numbers, signage (street, traffic, and advisory signs), bike racks, exhaust fan vent caps, chimney caps, and other miscellaneous components, and hardware shall be repaired, or replaced.
- (n) Miscellaneous Buildings and Structures: The Subcontractor shall perform maintenance and repair on miscellaneous buildings and structures, such as employee recreation facilities, storage platforms, guard shacks, bus stops, bike racks, flagpoles, fountains, mall areas, target range, monuments, fueling stations, and other miscellaneous structures.
- (2) Requirements for Painting. The Subcontractor shall comply with the requirements of the *JPL Pollution Prevention Plan* for low volatile organic compounds (VOC) paint, lead paint abatement, and all other environmental directives, instructions, policies, and regulations. Painting shall include both the interior and exterior of all types of surfaces on buildings and miscellaneous structures such as trailers and modular units, as well as the painting of other miscellaneous items such as signs, electrical banks, clean rooms, guard posts and rails, generators, HVAC equipment, pipes, bollards, and non-slip coatings on pedestrian surfaces. Interior and exterior painting shall be performed in conjunction with TCs and recurring work. All painting, whether interior or exterior, shall include all work necessary for a finished job including required lifts and scaffolding. The Subcontractor shall be responsible for lead abatement in the course of painting. Painting shall be performed in accordance with the PM requirements in Appendix A.1.9

The JPL Safety Office and/or the JPL Environmental Affairs Program Office will review and approve all paint and related materials and their corresponding Safety Data Sheets (SDS).

- (a) Protection of Areas: All furnishings, equipment, floor coverings, and other surfaces not to be painted shall be carefully moved, covered, or otherwise protected prior to painting. All removed items shall be repositioned and furnishings and other property returned to their original position. Painted items such as windows, doors, and cabinets shall operate smoothly without binding.
- (b) Surface Preparation: Surfaces to be painted shall be cleaned to remove all dirt, dust, rust, scale, splinters, mildew, chalked paint, loose particles, disintegrated coatings, grease, oil, and other deleterious substances. Sanding, wire brushing, washing including high pressure, and chemical treatments shall be used as necessary to properly prepare the surface for painting, except that water shall not be used on unpainted wood. Toxic chemical use may be undertaken only with the

specific approval of the OSPO/EAPO. SDS shall be provided to the OSPO/EAPO for review and approval. All scratches, nicks, cracks, gouges, spalls, alligating, and irregularities due to partial peeling of previous paint shall be repaired, sanded, spackled, caulked, or otherwise treated to render such defects practically imperceptible. Caulking and other compounds shall be allowed to cure for the times stated in the manufacturer's literature prior to painting. Exterior caulking on masonry, steel, aluminum, and pre-fab wall panels/surfaces shall be replaced. Existing enamel and other glossy surfaces shall be sanded. All new work, surfaces bared by surface preparation, and exposed nails and other ferrous metals shall be primed.

- (c) Paint Spraying: Application of paint by spraying may be undertaken *only* with the specific approval of the CTM.
- (d) Workmanship: Paint shall be applied to surfaces, free from runs, drips, ridges, waves, laps, brush marks, variations in color, or other defects. Two coats shall be applied to all new surfaces, or surfaces exposed during surface preparation to completely cover stains and marks. First coats, including primers, shall be thoroughly dry prior to the application of second coats, and there shall be an easily perceptible difference in the shades of each coat. Paint used in touch-up painting shall blend with the color and texture of the surrounding areas.
 - 1. Miscellaneous Surfaces: Miscellaneous surfaces requiring recoating, not otherwise covered herein, shall be painted or otherwise treated in accordance with the best current practice and manufacturer recommendations.
 - 2. Paint manufacturer's recommendations shall be followed including the weather and other environmental conditions under which the paint should be applied. Paint used in food preparation and food service areas shall be NSF-approved for use in such areas.
- (3) Requirements for Plumbing. Piping. Plumbing work shall include maintenance and repair of all plumbing systems and fixtures at the JPL facilities. Included, but not limited to, are: conventional plumbing, compressed air systems, control air systems, filtration systems, bottled gas manifold systems, propane systems, water distribution, natural gas distribution, sewage/sanitation systems, metering stations, pressure-reducing stations, expansion devices, vibration eliminators (pertinent to piping systems), filters, strainers, and valves. Flow adjustments will be made in accordance with established flow requirements. When repaired, plumbing systems and fixtures shall be free flowing, in good, safe operating condition, free of leaks and drips. Excavation and backfilling services shall be provided by the Subcontractor. The Subcontractor shall obtain a digging permit from JPL OSPO for all excavations, as appropriate. Where excavations are required for the work, the Subcontractor shall restore the area to its original condition. Domestic water lines shall be maintained throughout JPL and including any tap or plumbing fixture. All waste and sewage lines shall be maintained throughout JPL including any drain or plumbing fixture. Natural and propane gas lines as well as hydraulic and pneumatic systems shall be maintained for leak-free and proper operation. All work shall conform to the original design

specifications. Plumbing PMs shall be performed in accordance with the requirements in Appendix A.1.10.

- (a) Clean-up and Restoration: The Subcontractor shall mop up, vacuum, or otherwise remove water resulting from overflowing fixtures, leaks, clogged drains, etc. as part of the repair. Walls, ceilings, and other structures, paved areas (such as sidewalks, roads, etc.) which are damaged by and/or removed to gain access to leaks, clogs, or other defects shall be restored by the Subcontractor to original condition. The janitorial subcontractor shall assist in cleaning of interior areas as necessary.
- (b) Plumbing Fixtures: All sinks, tubs, toilets, urinals, basins, and faucets, lavatories, showers, drain lines, etc. shall be free of leaks and drips, operate properly, drain freely, and be free of cracks. All fixtures and components thereof that cannot be repaired shall be replaced with fixtures of equal type.
- (c) Valves: The Subcontractor shall maintain (but not be limited to) butterfly valves, backflow valves, plug valves, ball valves, and gate valves. The Subcontractor shall provide inspection, repair and certification of back flow prevention devices. The Subcontractor shall send completed backflow testing forms to Los Angeles County field office for proper recording of test results.
- (d) Water Heaters: The Subcontractor shall repair or replace water heaters with commercial-grade units as necessary to provide hot water at the originally designed flow rate and a temperature of 120° F at point of use. Controls, control devices, and safety devices shall operate safely per manufacturer's recommendations. Water heater earthquake straps shall be installed on all replacement water heaters and/or existing units when excessively worn, damaged, or missing. Any proposed changes on replacing water heaters with tank-less or installing non-commercial water heaters is to be approved by JPL in advance.
- (e) Drinking Fountains: The Subcontractor shall maintain and repair or replace, as necessary, bottle fillers, drinking fountains, and when replaced, shall be of the same type or likeness, including their component parts and filters. All fountains shall have carbon filters. The carbon filters shall be replaced at least once a year. Replacement fountains or component parts shall be equal to or better in quality to that being replaced. Fountains shall be firmly secured to support structures, and free of movement and vibration. No lead-containing materials (e.g., solder containing lead) which may come in contact with the supplied drinking water may be used in the repair of drinking water services or equipment.
- (f) Eyewashes and Safety Showers: The Subcontractor shall maintain and repair/replace all Eyewashes and Safety Showers (Shown in Appendix 20). Replacement Eyewashes and Safety Showers or component parts shall be equal to or better in quality, size, and capacity to that being replaced. Eyewashes and Safety Showers shall be firmly secured to support structures, and free of movement and vibration. Contractor shall maintain and inspect all eyewashes and safety showers in accordance with ANSI Z358.1-2014.
- (g) Pipe Covering and Insulation: The Subcontractor shall maintain all insulated piping to conserve energy and to eliminate failure due to extreme temperatures.

This work shall include the application of various materials to piping, maintaining jackets on insulated piping, and maintaining identification medium on piping surfaces.

- (h) Water Shut-off Valves: The subcontractor shall exercise and maintain GPS co-ordinances on all main water shut-off valves and main gas valves once per year, data shall be maintained in Maximo and the GPS co-ordinances in Arbor Pro.
- (4) Requirements for Electrical. The Subcontractor shall maintain and repair all JPL electrical systems on the demand side of Edison's Arroyo substation, feeding power to JPL's Main Substation H. All electrical equipment, service connections, distribution panels, conduits, conductors, outlets, switches, receptacles, wiring, circuit breakers, branch circuits, ground fault circuits, lighting fixtures, photo cells, dimmers, contactors, motors, built-in collateral equipment, emergency lighting systems, exit signs, obstruction lighting, ATSs and door bells or buzzers shall operate in a safe manner as originally intended and designed. PMs shall be performed in accordance with requirements in Appendix A.1.4.
 - (a) Re-lamping. This work shall include replacing all blinking and burned-out CFL's, LED lamps and drivers, fluorescent tubes, HID lamps and incandescent bulbs; and other defective parts such as, ballasts, starters, etc. Energy-saving lamps and ballasts shall be used for re-lamping. If new ballasts are required during lamp replacement, the old ballasts will be replaced with energy-saving electronic ballasts. The Subcontractor is not required to replace otherwise functional ballasts. Replacement lamps and components shall be the same type, wattage, and voltage as those removed, unless they are of an energy-saving upgrade and otherwise directed by the Subcontracts Manager. In areas where the fixtures are not easily accessible, such as high bay areas, the Subcontractor may elect to perform group scheduled re-lamping, including emergency, exit, and exterior lights attached to buildings. A list of such areas is included in Appendix A.3, Special Locations for Re-lamping.
 - (b) Emergency Light Requirements. Existing emergency lighting throughout JPL shall be maintained under this Subcontract. NFPA 101 defines installation and maintenance requirements for existing emergency lights and their replacement. Maintenance of these devices is included in the PM program.
- (5) Requirements for Perimeter/Security/Deer Fences. The Contractor shall provide maintenance and repair of perimeter/security fences to ensure that all exterior and interior fences are kept in good repair. All gates/turnstiles shall be maintained security tight, and all hinges and hardware shall be kept in good working order. Repairs required include, but are not limited to, the following: repairing holes in the chain link fence and wire cages; stringing barbed wire on top of the fence; tightening fence fabric that has become slack or loose over time; replacing or resetting fence support stanchions/footings; replacing or repairing hinges, eliminating gaps between ground and bottom of fence due to erosion. PMs for the deer fences shall be performed in accordance with the requirements in Appendix A.1.2
- (6) Requirements for Machining, Welding, and Metalworking. The Subcontractor shall provide maintenance, repair, or replacement of metal components of buildings and structures, installed building equipment such as exhaust fans, and shall construct and

install metal components in support of maintenance activities as required by this Section.

- (a) Metalworking: Metalworking shall include, but not be limited to, heating and bending to form metal shapes, drilling, torch-cutting, grinding, sawing, and fitting of metal parts. The Subcontractor shall perform metal-working requirements to maintain and repair or fabricate and replace metal components of buildings and structures, installed building equipment, and kitchen collateral equipment, including the construction and installation of metal components in support of other maintenance activities. The Subcontractor shall work with materials from a variety of sheet metal stocks including aluminum, copper, galvanized and stainless steel.
- (b) Welding: The Subcontractor shall provide all types of welding and brazing procedures in the accomplishment of maintenance and repair of buildings, structures (including trailers), and appurtenances in support of other maintenance activities. The Subcontractor shall notify JPL OSPO and obtain a welding permit from the JPL Fire Department before proceeding.
- (7) Requirements for Food Service Equipment and Food Preparation and Serving Areas. The Subcontractor shall provide maintenance and repair services for a variety of food service type collateral equipment including, but not limited to, electric and/or gas baking ovens, pizza ovens, grills, ranges, deep fat fryers, ice machines, ice dispensers, refrigerators, freezers, display boxes, conveyers, pumps, grease hoods, grease traps, exhaust fans, juice machines, steam tables, toasters, coffee pots, and dishwashers. Facilities and equipment shall be maintained in a manner sufficient to pass all Los Angeles County Health Department inspections without citations. See Appendix A.1.1 for cafeteria equipment PMs.
- (8) Requirements for Gym Equipment and Furniture. The Subcontractor shall provide maintenance, adjustment, and repair to ensure that all gym equipment and furniture performs safely and correctly. Original equipment manufacturer specifications and parts shall be used for all maintenance, adjustment, and repair. See Appendix A.4 for list of equipment and furniture. PMs for gym equipment shall be performed in accordance with the requirements in Appendix A.4. The gym equipment is located in B180 and B321.
- (9) Miscellaneous Building Services. The Subcontractor shall mount and relocate fire extinguishers as requested.
- (10) Requirements for Teak Furniture Program. The Subcontractor shall provide maintenance, adjustment, repair, and inventory/placement of all teak furniture/umbrellas at the Laboratory. Maintenance shall include annual refinishing of all teak tables, chairs and benches. Refinishing shall consist of industry standard restoration techniques using teak oil. Note: refinishing must take place off-Lab and will require furniture to be removed from Laboratory. Inventory/placement shall consist of monthly inventory and placement of all Teak furniture at high profile areas including the mall area, JPL store (B114), B167 Cafeteria, B190 Cafeteria, and B303 Cafeteria. All umbrellas shall be cleaned and stored at the start of the rainy seasons and returned to original locations at the end of the rainy season. PMs for teak furniture shall be performed in accordance with the requirements of Appendix A.1.2.

- (11) Requirement for Bulk Paper Waste. The subcontractor shall provide bulk Waste Containers for paper waste generated by the JPL general Laboratory population during office move out/relocation. Historically, these bins have been approximately 3'×4' in size and on wheels (for easy movement in and out of office areas). Historically, the subcontractor has had 25 to 35 of these containers. Work shall be accomplished per Section 6, General Requirements and Procedures for Trouble Calls. The M&O subcontractor does not manage the containers, they only manage the service requests for containers. All containers are managed by the janitorial services subcontractor.
- (12) Accellograph. The subcontractor shall maintain and provide annual service to 3 Accellographs located at B321. The service requirements are per state mandated policies/regulations.
- (13) Roof Davits/Anchors. The subcontractor shall maintain and provide annual service to various roof davits and roof anchors identified in Appendix A.18. Davits to be inspected annually. Horizontal lifeline and anchor points are inspected every six months.
- (14) Temporary Internal Combustion Engines. Any temporary system that is brought onto the Lab and has an internal combustion engine (ICE) must be immediately reported to JPL M&O and EAPO via form "JPL On-Lab Rental Equipment Check List" which shall be used to capture the system parameters. Upon removal from the Lab, the same entities shall be notified.
- (15) Emergency Generators. The back-up emergency generators for B340 and B345 are portable type and are stored and maintained at B309. They are to be moved and put into place for use whenever a loss of power occurs at these locations. The generators are to be installed quickly as possible following a power loss, the subcontractor has a portable canopy for inclement weather as necessary.
- (16) Backflow Device Management. JPL 2823 receives backflow test forms identified by M# from LA County and forwards them to the M&O Subcontractor for testing. The M&O Subcontractor completes the backflow testing forms and then forwards the completed forms back to LA County and copies all documents into Maximo and notifies JPL 2823. Backflow PMs shall be reconciled to ensure that all backflows have recertification documents on-file.

County backflow test forms are not always received from the county on a timely manner, backflow PM's shall continue to be performed on an annual basis regardless if the county has sent JPL a recertification notice. JPL M&O approves, pays and processes payment to LA County for annual backflow test permits.

- (17) Collateral and Non-Collateral Systems. The subcontractor maintains many systems which can or are considered of non-collateral type. All non-collateral mechanical systems that are or not maintained by the subcontractor are documented in Maximo. Grandfathered non-collateral systems noted in the TDD shall continue to be maintained by the subcontractor.
 - Several non-collateral systems are recorded in Maximo for inventory control purposes, however are labeled as non-JPL M&O responsibility and shall not be scheduled with any maintenance or repair services unless otherwise approved.

- Grandfathered non-collateral systems are limited to maintenance and standard repairs. Costs >\$2000 related to repairs, capital expenditures or replacement of non-collateral systems shall be managed in conjunction with JPL M&O.

9. Heating, Ventilation, Air Conditioning, Refrigeration, Air Compressors, and Pressure Vessels Systems Maintenance and Repair

- a. General Requirements. The equipment items to be operated, serviced and maintained are described in Appendix 20. The work includes the performance of TCs and recurring work. Millwright and Air Compressor PMs shall be performed in accordance with the requirements in Appendix A.1.8
- b. Performance Criteria. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
- c. Operation Procedures. Work shall be accomplished in accordance with the subcontractor's OPP. The plan shall identify all requirements for work on the heating, ventilation, air conditioning and refrigeration, and control air systems at JPL. The plan shall address:
 - (1) Method of carrying out air balancing when air handlers and distribution systems are altered or modified by maintenance and operations actions.
Method of ensuring good air quality and proper sealing of filter banks so as to prevent ingress of dust and particles into the intake plenum. Procedures for evaluating customer complaints regarding (IAQ) dust particulate discharge and method of resolving same.
 - (2) Procedures for treatment of cooling tower, closed loop, and boiler water. Methods for controlling water quality within required parameters. Method for maintaining gas-fired boilers/heaters, including cleaning of boiler tubes. Method of source testing boilers operating under permits from the AQMD. Method of determining seasonal shut-down and start-up.
 - (3) Method of ensuring environmental compliance and certification, including refrigerant inventory management, and hazardous waste protection, packaging and disposal procedures. Method for calibrating and maintaining refrigerant monitoring systems in equipment rooms and other areas. Procedures for addressing refrigerant leaks. A documented process on refrigerant management shall be provided.
 - (4) Description of how emergency support systems (water chillers, A/C systems, air compressors, hot water systems, humidification systems) will be provided to ensure facilities are operating as designed at all times. Description of how critical facilities will be operated during an emergency.
 - (5) Procedure for effecting maintenance and repairs on kitchen and cafeteria equipment without impact to normal operations.
 - (6) Methods for ensuring comprehensive HVAC maintenance/repair. Method of ensuring that HVAC workers do not cause any collateral damage (e.g., floors, ceilings, and walls). Discuss method for performing quality control and for obtaining and exercising warranties.
 - (7) Methods / Schedules? for ensuring EPA 608 Universal certification and continuous training of HVAC technicians.

- (8) Method for ensuring all operating HVAC and mechanical assets in Maximo will have current and up-to-date images, populating the image feature in the Assets application may be required in Maximo.
- d. Equipment and System Types. Maintenance and repair shall be provided on the following types of equipment and systems:
- (1) Air conditioning equipment and systems, including heat pumps, window and through-the-wall type units, package units, multi-zones, humidifiers, dehumidifiers, portable units, gas-fired heaters, infrared heaters, split system units, and roof-mounted units on trailers.
 - (2) Centrifugal, scroll, rotary, screw machine, and reciprocating water chiller systems.
 - (3) Cooling towers, structures, components, controls, make-up water and chemical feed systems.
 - (4) Evaporative cooling systems.
 - (5) Ventilation equipment and systems.
 - (6) Steam and hot water boilers, heaters, water heaters, radiators, and related equipment and systems.
 - (7) Refrigeration and freezer equipment and systems.
 - (8) Ice machines and related equipment.
 - (9) Exhaust Systems and fume hoods.
 - (10) Air duct systems, registers, grills, hardware, and fittings.
 - (11) Air dryer systems.
 - (12) Air compressors and distribution systems.
 - (13) Vacuum pumps and systems.
 - (14) Pneumatic, electrical, electronic, and DDC controls and systems.
 - (15) Hot water systems and chemical treatment and related equipment/hardware.
 - (16) Condenser water systems and related equipment/hardware.
 - (17) Chilled water systems, chemical treatment, related equipment, and hardware.
 - (18) The subcontractor shall exercise all main gas and water shut-off valves located at each building once a year, records are to be maintained in Maximo.
 - (19) Ionic air filters.
- A complete list of the equipment is located in Appendix 20.
- e. Technical Requirements.
- (1) Temperature and Humidity Control. The Subcontractor shall maintain and operate HVAC systems to provide temperature and humidity within design requirements. The Subcontractor shall maintain, repair, and replace as needed, temperature sensing,

mixing and regulating valves, and equipment related to heating and chilled water systems.

- Building temperature operating parameters range between 68-76° F. Lab temperatures are generally maintained between 70-76° F, most systems do not have humidity control. Critical and other non-typical areas may have other stipulated design conditions. Customers requesting a lower space condition setting that's beyond the system design standards for that system, shall be forwarded to JPL M&O for further analysis as our obligation is to maintain the systems within their stipulated design parameters (sequence of operation) which are located on the buildings design drawings. Sequences of Operation (SOO) shall not be modified without written approval from JPL M&O. All SOO are located and maintained within Meridian.
 - Data Centers/Cleanrooms operating temperatures/humidity/pressures may vary depending on their design criteria, each location may have a different operating parameter, refer to the systems design drawings and SOO.
 - HVAC systems operating beyond typical hours of comfort (6:00AM-6PM Monday-Thursday and until 5 PM Friday) shall have an exemption form on file. The form shall stipulate why the building must operate for extended hours, which are managed by JPL M&O. Startup times may vary based on the amount of time necessary to bring the area up to a buildings comfort temperature. Requests for additional hours of operation beyond their documented stop time shall be submitted to JPL M&O for approval.
- (2) System Balancing, Adjustment, and Calibration. The Subcontractor shall balance air and hydronic systems up to and including an entire building as needed, adjust and calibrate pneumatic systems, adjust electric and electronic controls (including direct digital control [DDC]) as specified by blueprints, drawings, and manufacturer's design specifications. The Subcontractor shall repair, troubleshoot, and perform calibration adjustments and replacement of pneumatic, electric, and electronic and digital data control systems to ensure correct HVAC temperatures, humidity, or pressure for proper operation and maximum efficiency.
 - (3) Refrigerant Handling. The Subcontractor shall handle and recycle all refrigerants using EPA-approved methods and equipment. Under no circumstances shall intentional venting of refrigerants be permitted. In addition, the Subcontractor shall maintain an accurate, up-to-date inventory of all refrigerants purchased, used, where used, in what equipment, etc., and how disposed, including an automated software system for managing.
 - (4) Requirements for HVAC Work. In addition to the TDD, the following general performance and workmanship standards for HVAC work are included. These standards do not change or expand the specific PM, PGM and PT&I Requirements set forth in Appendix A.1, but are intended to serve as a basis for the Operation Procedures Plan and for clarification, amplification and guidance in the performance of all HVAC-related work at JPL.

- (a) Equipment Adjustments. Equipment adjustments required for efficient, economical, and safe performance of equipment systems shall be made at the time of each scheduled preventive maintenance or PT&I, or more frequently as required to maintain efficient operation.
- (b) Periodic Cleaning and Sanitation. Routine and scheduled cleaning of work areas and mechanical equipment rooms, systems, drains, drain piping, traps and pans, condenser coils, oil filters, air filters, after coolers, cooling and/or heating coils, blower shields/belt guards and fans, grills, supply and return air registers, screens, diffusers, electrical contacts, switch boxes, motors, gauges, strainers, dampers, actuators, louvers, safety controls, and any other JPL equipment, shall be accomplished as a part of the regular scheduled PM, PT&I, and service, or more frequently as may be necessary to maintain a clean and sanitary operating condition free from dirt, dust, mold, and other debris.
- (c) Lubrication. During preventive maintenance, operator maintenance, and trouble call work, the Subcontractor shall routinely check equipment for excessive bearing temperatures, noise, and the proper lubrication of bearings and moving parts.
- (d) Replacement and Cleaning of Air Filters. Filters shall be fitted so that all air passes through the filters. Replace throwaway type filters and those missing or having improper fit with the proper fiberglass, synthetic media, or high efficiency filters. Filters having a filtration efficiency of 40% or less shall not be used at JPL. Washable filters shall be cleaned in accordance with manufacturer's instructions.
- (e) Rust and Corrosion. The Subcontractor shall clean, prime and paint rusted and corroded areas on equipment. Equipment identification data and coils shall not be obscured or covered up with paint.
- (f) Motors, Drives, Sheaves, Shafts, Couplings, Blowers, Fans, Hubs, Belts, Bearings, Gearboxes, and Guards. The Subcontractor shall check for leaks or accumulations of dust, dirt, grease, and oil; clean, adjust, service, repair, or replace items to correct existing deficiencies such as: worn, loose, missing, or damaged parts, guards, connections, and connectors; bent blades or worn, loose, broken or missing belts; unbalanced moving parts; shaft misalignment; worn or damaged couplings; excessive noises and vibrations; end play of shafts; bad bearings; ineffective isolators; and vibration absorbers; check full load and run load amperages, rotation, and starting components of each electric motor, and compare them with manufacturer's data plate ratings during PMs, trouble calls, or installations; check the condition of motor windings and brushes.
- (g) Wiring, Electrical Control Circuits, Systems. The Subcontractor shall check for loose, charred, broken, or damaged wires and insulation; short circuits, loose or weak contact springs; worn or pitted contacts; proper sizing of fuses; defective operation of parts and components; and other deficiencies. All wire splice connections shall be properly insulated. The Subcontractor shall clean, adjust, service, repair, or replace items found to be deficient.
- (h) Fire and Safety Hazards. The Subcontractor shall, on job sites and in machine rooms, check for dust, dirt, soot, oil and grease deposits and accumulations,

drippings, presence of flammable materials, rags, debris, and any other conditions that may be construed to be a potential fire or safety hazard. The Subcontractor shall correct or remove from the site all fire and safety hazards.

- (i) Controllers (including, but not limited to, thermostats, sub-bases, guards, time clocks, covers, ambient air temperature sensors, sub- and master controllers, sensors, transmitters, temperature and pressure controls). The Subcontractor shall check for improper settings, defective operation, calibration or validation and cleanliness, proper control voltages, and pneumatic air operating pressures; check for deficiencies in wiring, tubing, piping, switches, relays, coils, solenoids, transformers, controls, sensors, thermostats and protective covers and guards, ambient-stats, aquastats, pressure switches, reversing relays, timing devices, master and sub-master controllers, outdoor temperature override controllers, air quality sensors, etc.; balance systems and adjust and calibrate pneumatic, electric, and electronic controls; clean, adjust, service, repair, or replace items found to be deficient.
- (j) Air Handling Systems (including, but not limited to, air handler units, ducts, fan coils, plenums, grills, registers, diffusers, screens, dampers, bellows, vanes, mixing boxes, variable air volume (VAV) boxes, and balancing of air systems). The Subcontractor shall check plenum chambers, supply and return air ducts, fan coils, branch ducts, mixing boxes, VAV boxes, dampers, bellows, registers, grills, diffusers, louvers, and insect and bird screens; check for mold and/or mildew, check for dirt, dust and trash; air leaks, broken, ripped or torn insulation and disconnected ducts; loose or broken connections, brackets, hangers, supports, and other parts; excessive vibrations or other movements; defects in metal, fiber glass, and other materials; proper operation of movable parts such as linkages, dampers, louvers, and vanes relative to the controlling device; and inadequate air flow and/or distribution in main and branch duct circuits; check air handler unit systems for proper operation and correct CFM air flow; balance air distribution systems to their original design specifications for all areas being serviced by the systems; check air temperatures and static pressures; and check turning vanes, fire dampers, access openings, doors, panels, outside air make-up systems, fuseable links, ducts, and screens. The Subcontractor shall clean, adjust, calibrate, service, repair, and replace all items found to be deficient in order to operate the facility in an optimum manner.
- (k) Temperature Exchange Units (including, but not limited to, heat exchangers, heating and cooling coils, condensers [water and refrigerant], evaporators [water and refrigerant]). The Subcontractor shall check for obstructions to the airflow/water flow through all heat exchangers/coils. Check for leaks, scale, dirt, and foreign materials accumulation, unusual noises and vibrations, and loose, missing, or damaged parts. On direct expansion systems the Subcontractor shall check for frosting or icing of coils; proper operation of expansion valves, capillary tubes, and spider distributors; proper operation of automatic temperature controls and defrost timers; check superheat across evaporator coils; and check all coils for leaks. On water cooling/heating coils the Subcontractor shall check for proper water flow, temperature, and pressures and pressure drop across the coil. The

Subcontractor shall clean and flush the water side of water cooling/heating coils as necessary to correct any deficiencies not allowing for proper operation. The Subcontractor shall check for damaged, bent or corroded coil fins on all coils; clean, adjust, service, repair, or replace items found to be deficient. The heat exchangers are to be maintained per manufacturer's specifications.

- (l) Condensate Drains, Pans, Piping, Traps. The Subcontractor shall check all condensate drain pans for mold, mildew, and algae growth and sedimentation, damaged coatings and insulation, rust corrosion, and leaks; check condensate drains, condensate pumps, interconnecting piping, and traps to assure they are open and water flow is not restricted; clean, adjust, service, repair, or replace items found to be deficient.
- (m) Piping. (Water, Refrigerant, Gas, Oil, and Air). The Subcontractor shall check for leaks, rust, corrosion, deformation, and material defects of all applicable piping and tubing; check for piping and tubing vibrations, looseness, and rubbing against objects that can cause damage to the equipment; proper support for piping and tubing; and vibra-absorbers, expansion joints, and rupture discs. Piping, tubing, and fittings being replaced shall be compatible with existing materials. The Subcontractor shall clean, adjust, service, repair, or replace all items found to be deficient.
- (n) Compressors. The Subcontractor shall check for dust, dirt, oil, and grease deposits and accumulations, leakage of refrigerant and oil, cracked/clear sight glasses and gauges, damaged fittings, piping, valves, etc.; check for loose connections, excessive or unusual noise and vibrations; proper suction and discharge temperature and pressures, and indications of excessive heat; check oil levels, unloaders for proper operation, and change out dirty or contaminated oil and filters; check compressor full load and run load amps, compare against manufacturer's data plate rating, and record the findings; check all electrical wiring, connections, and related components; record type and amount of refrigerant and/or refrigerant/oil added to the system, on the log sheet (as applicable) for air conditioning and compressed air plant compressors; clean, adjust, service, repair, or replace all items found to be deficient including phased out refrigerants.
- (o) Air Cooled Condensers. The Subcontractor shall check for dust, dirt, foreign materials, oil and grease accumulations, leaks, excessive or unusual noise and vibrations; and loose, missing, or damaged parts; check motors, sheaves, belts, bearings, shafts, supports, brackets, hardware, etc.; check the operation and calibration of fan cycling controls, fan rotation and fan shroud, low ambient switch controls and dampers, head pressure control louvers, actuators, and regulators; check for proper air flow through the condenser coil; and bent, damaged, or corroded coil fins and fan blades; balance systems and adjust and calibrate pneumatic, electric, and electronic controls; remove weeds, bushes, and other obstructions within three feet of air cooled condensers; clean, adjust, service, repair, or replace all items found to be deficient.
- (p) Refrigerant and Oil Systems. (Including, but not limited to, Separators, Dryers, Strainers, Filters, and Oil Traps.) The Subcontractor shall check for proper

operation, refrigerant and oil leaks, and other material defects; check sight glass for clarity, cracks, or moisture; and check the charges and levels for refrigerant and oil. The Subcontractor shall clean, adjust, service, repair, or replace all items found to be deficient including phased out refrigerants.

- (q) Tanks. (Including, but not limited to, Water Tanks, Receivers, and Accumulators.) The Subcontractor shall check pressure tanks and other equipment parts for damage and deterioration; blow down or drain air tanks; check all equipment items for leaks and missing or defective parts; check pressure relief valves, check valves and regulators for proper operation to manufacturer's specifications; check liquid levels, sight glasses, heat transfer, temperature differentials, and pressures.
- (r) Balancing Chilled Water, Condenser Water, and Hot Water Systems. The Subcontractor shall test chilled, condenser, and hot water systems to assure these systems are providing the most efficient and economical operations attainable for that equipment and the facilities which it services; check flow and rebalance to meet design specifications; bleed air from chilled, condenser, and hot water loops to maintain efficient operating conditions; repair or replace automatic and manual bleed-off valves in systems for proper operation.
- (s) Insulation. The Subcontractor shall clean, adjust, service, repair, or replace all items found to be deficient. Identification and directional markings shall be maintained on insulation surfaces.
- (t) Exhaust Air and Ventilating Systems. The Subcontractor shall check for accumulations of dust, dirt, grease, and oil; check operation of dampers, baffles, solenoids, protective guards, insect and bird screens; and check caulking around flashing, ducts, collectors, smoke pipes, cowlings, hoods, caps, and covers. The Subcontractor shall clean or replace filters with proper fiberglass, synthetic media, or high efficiency filters as applicable; check for clogging, broken, or separated joints and seams in ducts, stacks, couplings, sheaves, belts, fan blades, blowers, etc.; check thermal insulation, protective coverings, vapor barriers, and loose or missing fasteners and hardware; check for material defects and improper operation of moveable parts and components relative to the controlling device; balance systems, and adjust and calibrate pneumatic, electric, and electronic controls; check for loose, missing, or poor fitting flashing, fire and safety hazards, warning alarms, etc.; clean, adjust, service, repair, or replace all items found to be deficient.
- (u) Valves. (Including, but not limited to, Hand, Check, Relief, three-Way, Reversing, Float, Makeup, and Bleed off.) The Subcontractor shall check valves for operation, fluid or gas bypass, leakage, linkages, travel, range limitations, rust, dust, dirt, corrosion, scale, seizing, binding, mounting, clogging, broken, damaged or missing parts, and material defects; check the source of valve operation, i.e., pneumatic, electrical, pneumatic/electric, etc., for required pressures, electrical power voltages, etc.; clean, adjust, service, repair, or replace any parts, materials, components, or combinations thereof found to be deficient as a result of these inspections, to restore valves to a standard operating condition.
- (v) Evaporative Coolers. The Subcontractor shall check and treat for scale and calcification, leaks and for excessive noise and vibration; check the thermostat for

proper calibration and cycling; check the filter and filter pads for proper size, condition and cleanliness; check the condition of the electrical connections, conduit, disconnect block, block contacts, and fuses; check bearing play on the cooler motor; the blower wheel, blower belt and tension; check water pan; float and water level; check fan temperature control; pumps, motors, distributors and bleed-off; check cleanliness of the pump filter; and clean, adjust, service, repair or replace all items found to be deficient. The Subcontractor shall develop a plan that prevents the disposal of cleaning runoff water and scales into the storm drain

- (w) Cooling Towers. The Subcontractor shall check for external scale, leaks, defective valves, and float assemblies; deterioration and improper positioning of slats, baffles, and eliminators used to control water spray and/or distribution. The Subcontractor shall check for structural damage, rust, and corrosion. The Subcontractor shall check the condition and operation of gearboxes (gear reducers), fans, blades and hubs, motors, drives, shafts, couplings, guards, bearings, etc.; check cooling tower water level, water make-up, drains, valves, overflow, and bleed-off; and clean, adjust, service, repair or replace all items found to be deficient. A plan on how and when to replace the cooling tower media and associated components exposed to the harsh elements shall be prepared.
- (x) Equipment Cabinets and Hardware. (Including, but not limited to, Cabinets, Cases, Doors, Lids, Panels, Gaskets, Latches, Handles, Hinges, Hardware.) The Subcontractor shall check for cracks, scrapes, gouges; check for separation, missing, broken or damaged parts and components; check for bad insulation, bad gaskets, leaks, fitting of doors, etc.; and clean, adjust, service, repair, or replace all items found to be deficient.
- (y) Equipment shall always be operated and maintained in accordance to the manufacture's requirements and SOO. Any observed deviations must be reported to JPL M&O for further evaluation.

Equipment/systems must be operated in the "auto" mode and not be left in "manual" or "hand" modes unless warranted for testing or repairs and is tagged as "testing or repair in progress".

All air filters on Lab shall be on a regular maintenance program and captured in Maximo. All systems on Lab without GPS/ION filtration systems shall utilize MERV13 air filters. Exemptions are wall/window units that don't have the ability to be retrofitted with MERV13 type air filters. Systems with GPS/ION filtration shall be provided with MERV8 air filters unless otherwise noted. Air filters shall be marked with date of replacement whenever they're replaced. Also, air filters should not be stored outdoors, in dirty areas or outside of their original packaging until being used or left for long periods of time (days) in hallways/vestibules, etc. before use. Code compliance requirements for new HVAC systems may differ.

- f. Equipment Operations. The Subcontractor shall perform the operation of those HVAC, refrigeration, and compressed air systems listed in Appendix 20. Operations shall be conducted in accordance with applicable manufacturer's specifications, manuals, brochures, literature, JPL directives, pamphlets, etc., which shall serve as a basis for the OPP, except as may be directed by the CTM for reasons of emergencies, inclement weather, energy

conservation, safety, etc. Operational checks shall be made each workday, as a minimum, during all periods of liquid chiller, steam boiler, and Laboratory main air compressor operations. Operation log sheets shall be filled out as part of each operational check, retained and filed by the Subcontractor, and sorted by building. When systems are secured for extended periods for repair, seasonal shutdown, etc., a remark shall be included on the log sheet to that effect. Log sheets shall be subject to periodic inspection by JPL.

- (1) Specific Requirements for Air Conditioning Systems. Air conditioning systems to be operated, maintained, and repaired are listed in Appendix 20. Maintenance, repair, and operation of these systems shall be performed in accordance with the recommendations of the manufacturer and the provisions of this Subcontract.
 - (a) Compressor Replacement. When compressors are replaced, the internal refrigeration system shall be thoroughly cleaned in accordance with the approved manufacturer's procedures. Additional precautions shall be taken following approved and acceptable industry standards and practice to further control refrigerant system contamination and prevent damage to replacement compressors and components. A compressor final start-up sheet shall be provided to JPL M&O on completion.
 - (b) Portable Chiller System. The Subcontractor shall be required to provide temporary or emergency cooling during times when the Subcontractor is unable to operate primary equipment as designed. The Subcontractor shall maintain a log that lists the location of portable units, name of the requestor, and dates requested, installed and returned.
 - (c) Portable Air Conditioning Systems. The Subcontractor shall be required to provide temporary or emergency cooling during times when the Subcontractor is unable to operate primary equipment as designed. The Subcontractor shall maintain a log that lists the location of portable units, name of the requestor, and dates requested, installed and returned.
 1. Setup Procedures. The Subcontractor shall provide equipment and labor to acquire and maintain portable air conditioning system equipment. System setup shall include the electrical hook-up and all mechanical hook-up, which shall include all hoses, connections, duct work, couplings, hardware, other components needed, and all labor as required for setting up.
 2. If a temporary cooling system is needed during periods when repairs/PMs are being performed, the portable air conditioning system and its installation, operation, and maintenance shall be provided as part of that work. JPL has provided portable air conditioning systems and portable evaporative systems for use by the M&O subcontractor.
 - (d) Portable Air Compressor Systems. The Subcontractor shall be required to provide temporary or emergency cooling during times when the Subcontractor is unable to operate primary equipment as designed. The Subcontractor shall maintain a log that lists the location of portable units, name of the requestor, and dates requested, installed and returned.

- (e) Window and Through-the-Wall Type Air Conditioning Units. Maintenance and repair of these units include work on cabinets, casings, openings, carpentry trim work, caulking, insulation, brackets, supports, painting, and other work normally associated with these types of equipment. When window or through-the-wall type units are removed for servicing, the opening shall be covered with a weather- and element-resistant material in such a way as to prevent the entrance of water, dust, and insects into the facility from which the unit was removed. If a unit cannot be repaired within one working day, a temporary working unit shall be installed.
 - (f) Filter Maintenance. The filters shall be maintained at the frequencies specified as part of the PM program. The Subcontractor shall include filter changes in the Subcontractor's submitted Monthly Work Schedule. Filters shall be installed so as to prevent ingress of dust and particles into the intake plenum. Most buildings are also equipped with ION/GPS air filtration systems; list available from JPL M&O.

Non-designed air filters on the discharge of air diffusers are not allowed and shall be reported to management upon discovery for removal.
- (2) Specific Requirements for Cooling Tower Systems. The Subcontractor shall furnish services for the maintenance and repair of cooling tower systems, and for the treatment of cooling tower circulating water. Services shall consist of, but not be limited to, the development of a treatment program for each cooling tower and be included in the Operation Procedures Plan; installation of monitoring and treatment equipment; flushing and cleaning of cooling towers; and testing and treatment of circulating water to prevent accumulation by precipitation of scale, corrosion, biological growths, and other foreign materials and organisms. Appendix 20 provides a list of the cooling towers requiring service.
- (a) Treatment Program. The Subcontractor shall provide a circulating water treatment program for each cooling tower listed in Appendix 20 in accordance with the following requirements. The treatment program shall be included in the Operation Procedures Plan and, after approval, the program will be monitored continuously and modified by the Subcontractor as required to meet the treatment standards specified. All proposed changes to the approved program shall be submitted in advance for the CTM's approval.
 - 1. Proposed Treatment Program Plan. A draft outline of proposed chemical treatment procedures shall be provided for the CTM's approval at least 30 calendar days prior to the start date of service delivery on the Subcontract. The proposed procedures shall be incorporated in the Operation Procedures Plan and shall include:
 - a. The manufacturer, amount, type, and methods of feeding and controlling chemicals to be used. Where applicable, include chemical active ingredient levels in parts per million (ppm).
 - b. Shop drawings showing the proposed installation of chemical feed equipment and coupons required for corrosion testing.
 - c. Proposed limits for pH, total dissolved solids, corrosion inhibitor, scale inhibitor, and biocide. The concentration ratio to be used as the operating

base, as discussed in paragraph 9.f (2) (a)2.e, Cycles of Concentration, shall also be provided.

- d. Proposed chemical shipping, handling, documentation, and storage procedures. Include specimen label, product registration number, and application instructions for all proposed algacides and biocides.
 - e. Proposed record keeping forms and procedures.
 - f. Proposed circulating water, makeup water, and scale and corrosion testing procedures.
 - g. Name, address, background, and other pertinent information on the proposed independent testing laboratory.
2. Treatment and Control Requirements. The Subcontractor's cooling tower water treatment program shall be designed to minimize corrosion, scale, deposition, and microbiological activity and shall be effective over the entire expected temperature range. All chemicals shall be commercially available for use in the treatment of cooling tower water. All chemical additions and treatment methods shall comply with the current Environmental Protection Agency requirements and recommendations, and bleed off water and other discharges shall be maintained in compliance with all applicable Federal, state, and local laws and regulations. Chromates and other chemicals that are considered potential pollutants shall not be used. All industrial wastewater discharges to the sanitary sewer shall be identified in writing for approval by the CTM at least 24 hours (1 working day) prior to discharge.
- a. Corrosion Control:
 - i. Mild steel corrosion rates shall be maintained below 3.0 mils per year (MPY) at all times.
 - ii. Copper and cupro nickel corrosion rates shall be below 0.3 MPY at all times.
 - iii. Chromium is banned by EPA for use in cooling tower water treatment and shall not be used.
 - b. Scale Control:
 - i. Sufficient scale inhibitor/polymer shall be applied to prevent any calcium carbonate or calcium sulfate scale.
 - ii. Control limits for pH shall be designed to prevent such scaling.

Acid shall be used only with specific approval of the CTM.
Subcontractor shall provide non-acid scale control methods in the event any adverse conditions in the water system or safety concerns are identified.

Subcontractor shall request JPL EAPO review and approval at commencement of subcontract and or prior to introducing any new chemicals onto JPL property.

Subcontractor shall provide Annual usage/Shipment History reporting for Sulfuric Acid at JPL, Report information shall include but not be limited to:

1. Subcontractor Handling Sulfuric Acid
2. Formula / or Name
3. Last Shipment
4. Manufacturer
5. Description
6. Total Lbs.

Annual Report of Chemical Usage for each calendar year shall be submitted to: JPL EAPO, by no later than February 1 of the following year.

- c. Deposit Control: Specific deposit control agents shall be applied to prevent and minimize suspended solids deposition within exchangers.
- d. Microbiological Control:
 - i. Bacterial testing shall be performed to determine bacterial levels in the cooling tower.
 - ii. Test results shall be used to indicate when the biocide treatment should be changed or altered.
 - iii. Historical data on results shall be maintained to determine the most effective treatment.
 - iv. Algae growth shall be minimized.
 - v. The total lethal dosage rate of biocide used shall never drop below a 25% level.
 - vi. No deterioration of cooling towers/components shall occur as a result of the treatment program.
 - vii. Algaecides and biocides used shall be registered with the Environmental Protection Agency under the *Federal Insecticide, Fungicide, and Rodenticide Act*, as amended (7 U.S.C. 136 (et seq.)) specifically for use in cooling towers. The algaecide shall be used in strict conformance with label instructions.
- e. Cycles of Concentration. The dissolved solids concentration in the circulating water shall be controlled such that the treatment program provided will positively prevent scale and corrosion.
- f. Cleaning and Flushing All cooling towers shall be cleaned and flushed of scale, trash, mud, dirt, algae, slime, and other foreign material and organisms while performing PM. Additional flushing's and cleanings shall be performed as necessary to remove excess accumulations of such foreign material. Basins are to be inspected monthly.

(b) Test Requirements.

1. Circulating Water Testing: Circulating water from each cooling tower shall be tested bi-weekly for pH; conductivity; scale and corrosion inhibitor levels; biocide; and bacterial levels. All deficiencies shall be corrected by the Subcontractor. Test results shall be reported not later than the second work day of each month for the previous month.
2. Scale and Corrosion Tests: The Subcontractor shall provide for the accurate measurement of corrosion consistent with American Society for Testing Materials (ASTM) D2688-15 (Coupon Test Method) or the corrosion test method described by the National Association of Corrosion Engineers (NACE). Test results shall be recorded within seven calendar days of the test results being read and provided to the CTM upon request. Reports shall include a scale analysis or corrosion rate in mils per year, and a written description based on ASTM D2688-15.
3. Legionella Pneumophila Bacteria Testing. Monitoring and testing of the cooling tower/condenser water for Legionella Pneumophila bacteria shall be performed twice each year. The samples will be transported to a state and EPA certified and approved medical testing laboratory for analysis. A written laboratory report detailing the Legionella Pneumophila test results will be forwarded to JPL. Test records shall also be maintained in Maximo.

(c) Maintenance and Repair. Cooling tower structures shall be inspected yearly, including all components both internal and external, or as otherwise required by the PM schedule. Cooling tower structures and all of their components shall be maintained and repaired, including, but not limited to, all motors, fans, gearboxes (gear reducers), and hubs; drives, shafts, couplings, sheaves, belts, and guards; float assemblies and valves; drain lines, piping, and valves from the cooling tower pan (basin) to the point at which water is discharged into the sewer or storm drain system, including all supports, columns, piers, braces, beams, brackets, flanges, and hardware to maintain the piping; bleed-off and chemical feed control systems; and make up water piping and valves (from the valve itself into the cooling towers and systems). See Appendix A.1 for cooling tower PM tasks and PM frequency.

(d) Cooling Tower Water Consumption. The Subcontractor shall read cooling tower make-up & blowdown water meters monthly in accordance with requirements specified in Exhibit 2, SDRL, and record the results. The Subcontractor shall observe cooling tower water usage both on cooling towers with meters and those without meters and should the observations reveal a substantial change or high water consumption the Subcontractor shall determine the cause and take appropriate corrective action.

- (3) Specific Requirements for the Chemical Treatment of Chilled and Hot Water Distribution Systems. The Subcontractor shall maintain detailed records of the results of all inspection checks and chemical treatments to include the maintenance of pH limits; building number and system; date chemicals were applied; description of chemicals used; quantity of chemicals used per system to maintain standards; chemical level readings in system before and after adjustments; date of inspection check and

adjustment; and the name of the person(s) performing the inspections and/or adjustments. This information shall be recorded with the inspection data within 5 calendar days of each inspection. The water within the chilled water system shall be tinted bright blue and the water within the heating hot water system shall be tinted bright red; lack of color will immediately denote loss of treated water.

- (4) Specific Requirements for Heating Systems and Boilers. The Subcontractor shall test, repair, and maintain central and stand-alone auxiliary heating systems and boilers listed in Appendix 20. These systems vary in size and capacity and may operate 24 hours per day, seven (7) days per week. Maintenance and repair of these systems shall be performed in accordance with the recommendations of the manufacturer and the provisions on this Subcontract, including the following:
 - (a) The Subcontractor shall maintain automatic firing steam and hot water boilers, humidity steam boilers, electric boilers, forced air gas furnaces, hot water heaters (gas, steam, and electric), gas burners, electric heating elements, unit heaters, hot water circulating pumps, steam condensate pumps, heat exchangers, steam injectors, steam traps, and other related equipment and devices. The Subcontractor shall maintain related heating equipment and systems, feed water systems, chemical feed systems, treated water systems, forced and induced draft fans, and their associated components. The Subcontractor shall perform mechanical and chemical annual tube cleaning and inspection on boilers. Steam boilers shall have mandatory replacement of relief valves once a year and hot water boilers shall have mandatory replacement of relief valves every 5 years.
 - (b) The work shall include, but not be limited to operating boilers and heating systems; water testing, analysis and chemical treatment (where allowed); boiler start-up and shutdown; predictive testing and inspection; trouble calls and minor repair of the boilers, the entire steam and heating distribution system at JPL including the condensate return system.
 - (c) Boilers or steam generators providing steam to clean room environments shall have no chemical treatment. However, the make-up water shall be soft water only (< 1.0 grain per gallon), boiler water tests shall pull water from inside the boiler and cooled before testing (sight glass valves are not acceptable), and blow downs (top and bottom) shall be based upon the recommended TDS (total dissolved solids) reading provided by the manufacturer of the boiler or steam generator. Typically, the TDS of boiler water shall be between 2600 to 3000 PPM. Less than 2600 indicates too many blow downs and greater than 3000 indicates not enough blow downs.
- (5) Specific Requirements for the Certification of Unfired Pressure Vessels. The Subcontractor shall not operate any unfired pressure vessel that does not have a valid inspection certificate attached to it. The Subcontractor shall provide all material and labor necessary to prepare unfired pressure vessels for inspection in accordance with the *National Board of Boiler and Pressure Vessel Inspectors Code* and per the requirements and guidelines of NASA STD 8719.17B "NASA Requirements for Ground-Based Pressure Vessels and Pressurized Systems" and NASA Policy Document NPD 8710.5D "Policy for PV/S". All JPL Facility Air Tanks, Air and Water

Lines, Boilers and Expansion Tanks shall be assessed for compliance with NASA as well as industry standards to assure that they are being operated in a safe manner and inspected periodically. Including all associated systems requiring testing/re-certifications every 5 years. Hot water boiler pressure relief valves shall be replaced once every 5 years and steam boiler/generator pressure relief valves shall be replaced once a year.

- (6) Specific Requirements for Control Air Systems and Components. The Subcontractor shall maintain and repair control air systems throughout the various shops, laboratories, office buildings, and other facilities listed in Appendix 19. These systems vary in size and pressure ranges up to 225 PSIG. The quality of the compressed air produced shall follow ISO Quality Recommended Standards for the application class of General Workshop Air. Maintenance, including repair or replacement of components in these systems shall be performed in accordance with the recommendations of the manufacturer and the provisions of this Subcontract, including the following:
 - (a) Air Compressors. All components, including but not limited to, electrical or internal combustion drive engines, pistons, cylinder walls, and heads.
 - (b) Auxiliary Equipment. Auxiliary equipment, including air intake filters, silencers, electrical motors, generators, air controls, intercoolers and aftercoolers, separators, traps, air receivers (unfired pressure vessels), air dryers, and other associated components.
 - (c) Pressure Regulating Valves. Worn, damaged and leaky stems, disks, seals, and gaskets. The Subcontractor shall test the system pressure after reassembly to ensure that all joints are sealed. Air tank pressure relief valves shall be replaced once every 5 years.
 - (d) Other Miscellaneous Components. Damaged, bent, deteriorated, and leaky drains and compressed air piping. Damaged, worn, or corroded pressure indicators and gauges.
- (7) Specific Requirements for Refrigeration Units and Systems. The refrigeration units and systems to be maintained and repaired are listed in Appendix 20 and include freezers, walk-in freezers, and refrigerated boxes, reach-in freezer and refrigerated boxes, refrigerated display cases, salad bars, sandwich bars, and ice machines. Maintenance and repair of these systems shall be performed in accordance with the recommendations of, and as to meet the rated temperature ranges specified by the manufacturer, the Los Angeles County Health Department, and the provisions of this Subcontract.
- (8) Specific Requirements for Miscellaneous Equipment and Systems. Miscellaneous equipment and systems shall be maintained and repaired in accordance with the recommendations of the manufacturer, including the following:
 - (a) Ventilating Equipment and Systems. The Subcontractor shall maintain and repair or replace as necessary to maintain operation as designed, ventilating equipment consisting of ventilating, exhaust, and utility fans, grease hoods, and those systems associated with the operation of these items of equipment.

- (b) Dehumidification/Humidification Units and Systems. The Subcontractor shall maintain, repair or replace as necessary to maintain operation as designed, dehumidification/humidification units in accordance with the recommended standards of the manufacturer and in accordance with the provisions of this Subcontract.
- (c) Water Softeners. The Subcontractor shall maintain, repair or replace as necessary to maintain operation as designed, water softeners shall be tested, maintained, and repaired in accordance with design standards, the manufacturers' recommendations and the provisions of this Subcontract.
- (d) Vacuum Pump Units and Systems. The Subcontractor shall maintain, repair or replace as necessary to maintain operation as designed, vacuum pump units and systems shall be maintained and repaired in accordance with the manufacturer's manuals and procedures and the provisions of this Subcontract.

10. High and Low Voltage Electrical Power Generation and Distribution Systems Maintenance and Repair

- a. General Requirements. Attachment 9, 9A and 9B describes the High Voltage Distribution System at JPL. Electrical distribution includes all facility electrical distribution systems such as (1) overhead and underground transmission and distribution lines from delivery points to all main service entrance switches in buildings and structures including substations and accessories; (2) electrical manholes and hand holes; (3) exterior lighting systems, including street, parking, flood, perimeter, and security lighting; (4) secondary drops to building or structure weather heads or first connections to a building system; and (5) emergency power generation and backup power systems. Also included is the testing and inspection of electrical safety equipment. The specific facilities and equipment are described in Appendix 19-21. The work includes the performance of trouble call work and recurring work.
- b. Performance Criteria. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
- c. Operations Procedures. Work shall be accomplished in accordance with the subcontractor's OPP. The plan shall identify all requirements for safe, reliable, efficient operation of the high and low voltage electrical distribution and emergency generation systems at JPL and shall describe the Subcontractor's approach to furnish stable electrical power within its rated capacities, continuously and fault-free, to all connected loads. The plan shall address:
 - (1) Methods of predictive testing and inspection (PT&I) and other maintenance procedures to be used including motor analysis and infrared inspection on banks, switch gears, and breakers.
 - (2) Procedures, detailed scope, and schedule for continuous training and certification for all Electricians to operate electrical switchgear/generators, medium-voltage systems, PDU/UPS's, etc., and to test and repair transformer banks' switchgear low voltage circuit breakers (200 Amp rating and higher) per the ANSI/NETA MTS.
 - (3) Description of the conditions warranting emergency power generation and the provision of backup power (including the correct sequential steps to be taken). Description and updated drawings of emergency support systems (generators/UPS's/ATS's) operation to ensure facilities operate as designed at all times.
 - (4) Procedures for scheduling and requesting power outages, internally and externally, including interested third-party points of contact (e.g., local power provider). Compliance with JPL Rules DocID 78752, Directive "Space Flight Operations Facility Freeze, Rev 1".
 - (5) Load shedding and mission support/severe weather contingency procedures using documentation developed in conjunction with the local power company and as directed by JPL.
 - (6) Safety and accident/mishaps reporting procedures.

- (7) Switching procedures (development and updating), and Methods of Procedure (MOP) (development and updating) for medium Voltage systems and low Voltage systems. Lockout /tagout procedures.
- (8) Methods for ensuring certification and continuous training of electricians, EE's, and electrical staff.
- (9) Method for assuring all operating electrical assets in Maximo will have current and up-to-date images populating the image feature in the Assets application.in Maximo.
- d. Safety. All Subcontractor employees shall be responsible for observing safe practices and procedures in their work environment in accordance with this Subcontract. Complying with applicable safety requirements of entities such as JPL, NASA, State of CA, OSHA.
 - (1) Two-Person Safety Rule. In the following situations the Subcontractor shall provide at least two persons to work together – one person, trained to recognize electrical hazards, shall be delegated to watch the movements of the other(s) doing the work so that the other(s) can be warned if they become dangerously close to live conductors or perform other unsafe acts and so that they can be assisted by that person in the case of an accident:
 - (a) Work on energized overhead lines, buss, and switchgear (upon O&M and required AHJ acknowledgment signature. See JPL Form 7029).
 - (b) Work in energized substations (upon O&M & AHJ approval).
 - (c) Work at remote or isolated locations.
 - (d) Work at night or during inclement weather conditions.
 - (e) Work involving handling energized conductors or apparatus (upon O&M & AHJ approval).
 - (f) Confined space entry.
 - (2) Lockout/Tagout. Safety clearance procedures and responsibilities are set forth in the JPL Contractor Safety and Health Notification Form 2885, incorporated into this subcontract.
- e. PM/PGM and PT&I Program. Except as otherwise specified, the minimum scope and frequency of preventive maintenance shall be in accordance with the requirements specified in Appendix A.1.
- f. Electrical Work.
 - (1) Work Performance. The Subcontractor shall operate, maintain, repair, or replace electrical systems and their associated components covered in this Section in accordance with the OPP.
 - (a) Services shall include, but not be limited to, the installation, modification, repair, maintenance, and troubleshooting of electrical feeders, branch circuits, lighting fixtures, lighting, low voltage circuit breakers, switchgear, panelboards, panels, ATS's, MTS's, transformers, VFD's, UPS's, PDU's, and power systems, and associated support. These systems include solid state industrial controls. Large contactors, transformers and switchgear operate at voltages up to 66,000 volts. The

Subcontractor shall operate and maintain the electrical systems and their associated components as defined herein and as recommended by the manufacturer.

- (b) Subcontractor personnel working with and around high voltage distribution systems shall be trained, experienced and certified for this work, as required by Cal-OSHA, NFPA, and JPL OSPO. Proof of this training and certification will be required, and submitted to the O&M CTM upon request, before electrical employees are allowed to work on this Subcontract. Specifically, the Subcontractor shall supply at least one person trained and certified for making 16.5 kV splices and the installation and management of 16.5 kV Vault Stretchers (aka Tee-bodies).
 - (c) The Subcontractor shall provide at least two Electricians trained and certified to remove, test, and provide minor repair of the Banks' low voltage switchgear low voltage circuit breakers larger than 200 Amps. Testing shall comply with ANSI-NETA MTS and/or ANSI-NETA ATS.
 - (d) The Subcontractor shall obtain approval in writing from the OSPO/AHJ Office prior to any deviation from California Electric Code requirements, NFPA Codes, NASA NPR Codes, NASA NPD Codes, ANSI Standards, JPL Facilities Design Standard (FDS), JPL OSPO regulatory requirements, the TDD, and the OPP. Work shall be comparable to the original construction quality for the system or unit and shall be made in such a manner as to ensure a safe and reliable electrical system. When the replacement of equipment may cause the loss of "Grandfathering" with respect to the applicable recent codes, the OSPO/AHJ Office shall approve prior to impacting the equipment and its Grandfather status.
 - (e) Any planned switching of 16.5 kV switching requires a Method of Procedure (MOP) for all switching activities reviewed and accepted by the OSPO/AHJ Office. In addition, a written request to and approval from JPL Facilities Operations and Maintenance is required prior to the switching. A seven (7) day minimum request lead time shall be given. This is separate from the approval for the scheduling of the electrical power outages.
- (2) **Electrical Equipment.** The Subcontractor shall maintain electrical equipment so as to prevent electrical distribution failures and power fluctuations. The following general performance and workmanship standards for medium and low-voltage electrical distribution work are included. The subcontractor is responsible for maintaining electrical equipment at specified intervals and in accordance with the manufacturer's recommendations, NFPA 70B, and NETA standards. The maintenance job plan in Maximo should outline these requirements. These standards may change or expand the specific PM/PGM and/or PT&I requirements as set forth in Appendix A.1, but are intended to serve as a basis of the OPP and as clarification and guidance in the performance of all power system related work at JPL.
- (a) Primary Substations. The Subcontractor shall maintain primary substations in accordance with the procedures listed in Appendix A.1. This work shall include:
 - 1. Substations involving voltage levels of 66-kV, 16.5-kV, and 2.4-kV circuits to their points of attachment to incoming underground lines.

2. All primary substation equipment such as cutouts; disconnect switches; circuit switches; air switches; air, vacuum, and oil circuit breakers; current transformers and potential instrument transformers; and associated metering and control devices.
 3. Oil-filled and dry type transformers, grounding and lightning protection systems, and associated buss work and cables.
 4. Underground and overhead primary servicing lines to the point of service connection feeding the substations.
 5. Battery banks are located in substations; see Appendix A.9.3. There are additional battery banks that support the uninterruptable power supply (UPS) for the SFOF and other critical mission and flight operations. Monthly maintenance on all battery banks shall consist of random testing on three cells to include specific gravity measurement, voltage measurement, temperature measurement, checking and maintaining proper water levels, cleaning the batteries and the battery room and recording the test results and problems found.
 6. Substation visual inspection per PM schedule shall consist of examining the substation grounds for trash, excessive vegetation, broken grounds, insulating oil leaks, transformer nitrogen pressure, transformer temperature, fencing, gates, locks, functional substation lighting and any other unsafe condition and taking suitable corrective action.
- (b) Transformers Banks and/or Substations. The Subcontractor shall perform a monthly visual inspection of each transformer in use or stored for reuse. All primary transformers in substations and transformer banks are listed in Appendix 9.4. Substations and Transformer banks' transformers shall be tested in compliance with the current ANSI/NETA MTS Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems (ANSI/NETA MTS).
1. Weekly Checks.
 - a. Emergency Generators. Emergency generator operational checks shall include starting the equipment, load bank validation, per appendences. The generator tanks shall be maintained with an amount of fuel no less than 7/8 full to allow extended emergency operation when required. Generator's ATS's shall be tested by the generator Service Contractor during their annual PM without impacting the load. Generator's ATS's shall be fully tested during the associated Transformer Bank's PGM complying with by the current ANSI/NETA MTS.
 2. Monthly Inspection on Substations and Transformer Banks. These inspections may be conducted at any time during the month and shall be conducted a minimum of 25 days apart. Visual inspection shall include the investigation for any leak of dielectric fluid on or around the transformer and any other oil-filled devices in the substations. The inspection shall depend on the physical constraints of each transformer installation and should not require an electrical shutdown of the transformer being inspected. The Subcontractor shall inspect

all transformers that are in service including polychlorinated biphenyls (PCB)-containing and PCB-contaminated transformers. Transformer inspections shall also note the following elements:

- a. Presence of combustible materials within 15 feet of the transformer.
 - b. Presence of secondary containment around the transformer.
 - c. Transformer fan operational.
 - d. Operation and function of the temperature switch (every 3 years).
 - f. Fences, gates, and doors for proper grounding of conductors, connections, and operation.
 - g. Transformer temperature
 - h. Transformer nitrogen pressure if applicable
- (c) Secondary Equipment. The Subcontractor shall maintain secondary equipment involving voltages of 600 volts and below at nominal voltage levels of 480, 277, 208, and 120 single- and three-phase, at 60 Hertz. This shall include, but not be limited to, equipment consisting of substation secondary gear involving air circuit breakers, current and potential instrument transformers, fuses, meters, recorders, relays, contactors, magnetic starters, buss ducts, cables, grounding systems, lightning systems, ground fault systems, and feeders. Transformer banks' switchgear low voltage circuit breakers (200 Amp rating and higher) shall be tested (including primary injection testing) in compliance with the current ANSI/NETA MTS Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems (ANSI/NETA MTS).

When a transformer bank PGM (bank PM) is performed, the following shall apply:

- 1) A bank PM shall be done over three (3) days (Thursday, RDO Friday, and RDO Saturday), unless Flight and Missions Operations require a different schedule.
 - a. On Thursday, Sub-H or SS-N switching shall be done to isolate the bank being PM'd on one of the two (2) parallel circuits (e.g. circuits 302 & 312).
On Friday, the bank PM will begin by opening and LOTO the switch to the bank's energized XFMR. Friday's PM time shall be limited to a 12-hour day.
 - b. On Saturday, the bank PM shall be completed.
Saturday's PM time shall be limited to a 12-hour day.
- 2) The MV switches shall be PM'd during the Bank-PM. For older switches, an OEM technician or field engineer shall be present to fine tune and/or repair the switch. Switch repairs shall be done by the OEM technician or field engineer. Switch parts shall be procured thru the technician or field engineer performing the repair. If the OEM technician or field engineer is not available, O&M shall approve the service company being proposed for the switch repairs.
- 3) The following equipment in the buildings fed from the bank being PM's shall have a PM done complying with the current ANSI/NETA MTS:

- a. All low voltage circuit breakers with a trip rating of 200 Amps and higher,
 - b. All SWGR, SWBDS, PNLBDS, MCC's,
 - c. All XFMR's rated 45 kVA and higher,
 - d. All ATS'S and MTS's,
 - e. All Ground fault systems.
 - f. Verify and document the metering CT ratios. Verify and document that the CT polarity is correct.
- (d) Power and Exterior Lighting. The Subcontractor shall maintain power and exterior lighting distribution systems including, but not limited to, circuit breakers, switches, panels, receptacles, lighting fixtures, dimmers, sensors, programmable logic computers, variable speed drives, HVAC electrical systems, contactors, motors, built-in appliances, emergency lighting systems, static grounding systems, obstruction lighting, re-lamping, fusing, conduits, and conductors. The Subcontractor shall re-lamp all burned-out street and perimeter light fixtures and repair or replace all broken fixtures in accordance with Section 1.
- (e) Operational and Emergency Power Generation. The Subcontractor shall maintain power generating plants including transformers; circuit breakers; ATS, MTS, natural gas, propane, gasoline, or diesel engine-driven generators; associated control systems; batteries; chargers; gas supply line regulators; valves; controls; distribution systems with associated switchgear; oil-fused cutouts; and unit load centers. The Subcontractor shall operate these systems on request and maintain fuel supply and operational readiness at all times. The equipment shall be tested (including primary injection testing) in compliance with the current ANSI/NETA MTS Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems (ANSI/NETA MTS). Load bank testing of generators shall comply with the OEM recommendation or requirement. If this is not available, the current ANSI/NETA MTS shall be used.
- (f) UPS/PDU/Inverters. The Subcontractor shall maintain all UPS/PDU/Inverters systems listed in Appendix A.21. The Subcontractor shall inspect the UPS systems every month. The inspection shall include measuring voltage and current output, current and voltage harmonic content, harmonic content of the ground and neutral currents, noise levels, static switch operation, switch closing time, battery bank current, and voltage output. The Subcontractor shall visually inspect each UPS system battery for proper battery fluid level, leaks, cracks, deterioration, and test for specific gravity and voltage output. All defective batteries shall be replaced. The Subcontractor shall test UPS semiconductor impedances and junction voltages once per year. Within 5 working days after each inspection and test, the Subcontractor shall provide the test results in writing to the O&M EE Subject Matter Experts (SME's), shall maintain a file of all UPS inspection and test results, and shall attach the inspection and/or test reports to the associated work order. The Electricians shall be trained and certified to perform basic UPS maintenance and operational tasks (such as placing the system in by-pass mode). Training and

certification records shall be maintained current and proof of certification shall be provided (within 24 hours) to JPL upon request.

- (g) Motor Generators. The Subcontractor shall maintain 400-Hertz generating equipment and associated control systems including transformers, circuit breakers, receptacles, distribution panels, transfer and control equipment, feeder and branch circuit conductors, conduits, and supply cords.
- (h) Substation Relays and Metering. The Subcontractor shall calibrate all relays and metering in accordance with the PM schedule. The PM schedule shall comply with the current ANSI/NETA MTS. Calibration shall be accomplished by a certified calibration technician. Substation and SWGR Relaying shall be tested and calibrated (including primary injection testing) in compliance with the current ANSI/NETA MTS Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems (ANSI/NETA MTS).
- (i) Buss Bars and Copper Works. The Subcontractor shall inspect by thermographic and mechanical means every 2 years all buss bars at the mechanical connecting joints, high voltage splices and terminations in manholes, and equipment for audible corona discharge and visible damage. The Subcontractor shall take corrective measures (i.e., cleaning surfaces and installing new bolts) immediately if the joint is loose or producing abnormal heat. An electronic report shall be submitted to JPL Facilities O&M EE Subject Matter Experts (SME's), The Subcontractor shall also maintain a file of all electronic reports, and shall attach the reports to the associated work order within 5 working days from the date of testing.
- (j) Miscellaneous. In accordance with this Section, the Subcontractor shall maintain the electrical system of miscellaneous equipment including parts such as motors, generators, coils, pumps, thermostats, solenoid valves, controllers, regulators, back-up and power generation equipment as well as equipment such as diesel and gasoline dispensing equipment, cathodic protection systems, duct banks, underground conduits, conduits, vaults, and pull boxes. The maintenance shall comply with the OEM recommendations or the most current applicable consensus document (such as ANSI/NETA MTS Facilities FDS, etc.). JPL Facilities O&M EE Subject Matter Experts (SME's), shall approve the consensus document if that is chosen as the source. The Subcontractor shall maintain labeling of electrical equipment to ensure operational safety.
- (k) Underground MV Electric Vaults (manholes)
 Manholes shall be checked for water in the Spring after the rain season, and in the Fall, prior to the rain season. An electronic report shall be submitted to JPL Facilities O&M EE Subject Matter Experts (SME's), The Subcontractor shall also shall maintain a file of all electronic reports, and shall attach the reports to the associated work order within 5 working days from the date of testing.
- g. Meter Reading. (See also paragraph 19(d) (1), Monthly Meter Reading.) The Subcontractor shall record readings of all electric, water, and gas meters on a regular monthly schedule, not later than the last working day of each month, and shall coordinate readings with any utility company readings where possible.

- (1) Meter Locations. Appendix A.9.2 provides an inventory of all meters at JPL.
 - (2) Documentation. The meter readings shall be recorded on a form(s) developed and maintained by the Subcontractor and approved by the CTM. The form shall contain such items as kilowatt hours, peak demand, meter serial number, meter type, last calibration, date, time, general condition, turns ratio of current transformers (CT), multiplying factor, and meter reader's name. Where voltage and current meters are connected to the same line, the Subcontractor shall read and record both voltage and current. The Subcontractor shall maintain and collect trending and power quality data from digital power meters.
- h. PCB-Contaminated Transformers and Equipment. The Subcontractor shall note that at JPL there are transformers, transformer bushings and other equipment containing PCBs. Working with, handling, maintenance of, packaging, and disposal of PCB-associated parts and equipment shall be performed in accordance with contractual requirements. The Subcontractor shall package in an approved manner any waste generated on-site and deliver it to the Hazardous Waste Collection Facility located on-site.
 - i. Aboveground Storage Tanks. The Subcontractor shall test all aboveground storage tanks in accordance with CFR Part 112 – Oil Pollution Prevention, annually in April each year and when material repairs have been performed. Integrity testing shall be visual combined with ultrasonic leak detection performed and certified by an appropriately licensed individual.

11. Operations and Maintenance in Building 230 (Space Flight Operations Facility [SFOF]) and Building 264

- a. General Requirements. The Subcontractor shall operate, maintain, and repair Buildings 230 and 264, hereinafter referred to as the Central Plant, and associated SFOF distribution systems, facilities, and equipment. Central Plant equipment is described in Appendix 20. The work shall include the performance of TC work and recurring work. TC work and recurring work performed by Central Plant operations personnel within the Central Plant shall be classified as Central Plant Operation (CPO). The main responsibility of SFOF Maintenance is to provide core services to various Flight Projects housed within SFOF buildings. The Subcontractor's SFOF team shall maintain a continuous presence (i.e., a minimum of two individuals per shift), which enhances familiarity with SFOF systems and equipment.

Building 230 is a national historical landmark. Changes to Building 230 shall not be undertaken without prior approval from JPL (e.g., structural changes, fixtures, and fittings).

Building 230 is protected under the National Resource Protection Act and together with Building 264, is subject to special access control procedures that require National Agency Checks for persons working within or requiring access to these facilities.

The Power Control Center (PCC) is the hub of SFOF maintenance activities. This center not only monitors the state of SFOF systems and equipment but also provides an auto control board and a manual control board to allow synchronization between Edison and generator power and to provide a means of transparently shifting between utility and generator power. The PCC also houses equipment for power distribution unit (PDU) monitoring as well as Lab-wide monitoring via the Staefa/Talon control system. Support shall include:

- (1) Operational competence of utility mechanics.
- (2) Quality assurance "electrical inspection" for all Flight Projects in Buildings 230 and 264.
- (3) Documenting and certifying power and equipment.
- (4) After-hours monitoring and support of the entire JPL facility.

Due to the criticality of Buildings 230 and 264, the Subcontractor shall provide a qualified and experienced individual on a full time/on-call basis to manage the work crew in the 24×7 PCC in the Central Plant. The individual shall have relevant experience in central plant operations and be conversant with automated power control systems, un-interruptible power systems, and power systems logic. This position shall be a key personnel requirement and shall require frequent interface with project and mission staff regarding facility availability and support requirements for ongoing flight projects.

- b. Performance Criteria. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
- c. Operation Procedures. Work shall be accomplished in accordance with the subcontractor's OPP. The plan shall identify all requirements for operating a 24×7 critical facility and central plant, conducting operator maintenance, and ensuring that all critical requirements are satisfied. The Plan shall address:

- (1) Procedures for operating the 24×7 PCC, including response to electrical power emergencies and contingency measures, such as shut-down procedures, replenishing diesel fuel tanks, and ensuring very-high-power reliability.
 - (2) Plan for 24×7 operator qualifications, staffing, training, and duties, including trade's coverage (HVAC, electrical) on each shift. All SFOF utility mechanics shall be required to operationally understand both electrical and air conditioning systems, regardless of trade specialty. Roving staff must be especially knowledgeable in the HVAC trade. Description of operator training for an environment subject to configuration control.
 - (3) Methods for PT&I and other maintenance procedures, including electrical generator maintenance, UPS maintenance, utility shutdowns, electrical switching procedures, etc., for an environment subject to configuration control.
 - (4) Methods for ensuring comprehensive electrical maintenance and repair. Method of ensuring that operating personnel do not cause any collateral damage (e.g., equipment, floors, ceilings, and walls). Methods for performing quality control and for obtaining and exercising warranties.
 - (5) Procedures to furnish a steady, fault-free power supply during commercial power-load shed and brownout periods, including, but not be limited to, emergency procedures in instances of energy shortages, priorities and special circumstances, and exemptions.
 - (6) Procedures for reporting safety, accidents, and mishaps.
 - (7) TC procedures; e.g., too hot, too cold, loss of power, need power turned on/off, change burnt out lights, document and verify power.
 - (8) Procedures for documenting and certifying power and equipment. Certifying power shall be treated as a priority TC.
 - (9) Plan to support other subcontractors performing work within the SFOF, electrical, HVAC, etc.
 - (10) Procedures for engraving name plates for all Projects in Central Plant.
- d. Configuration Control Requirements. Buildings 230 and 264 are subject to configuration control when critical operations are performed on spacecraft in flight or during launches and planetary encounters. The Subcontractor shall support flight projects during critical Configuration Control Levels, ensuring that all systems, HVAC, electrical, etc., are at optimum performance. There are three levels of configuration control.
- (1) Configuration Control Level 1 - The most critical level, with a maximum duration of 3 days. The PCC in B230-47 shall be staffed with a minimum of two operator personnel at all times. No configuration changes to systems shall be allowed without obtaining a waiver from JPL (Historical Average: 20 days per year).
 - (2) Configuration Control Level 2 - Critical activities exceeding 3 days, with a maximum of 8 days. The PCC in B230-47 shall be staffed with a minimum of one operator at all times. Limited configuration changes shall be allowed with approval from JPL's SFOF Building Manager (Historical Average: 103 days per year).

- (3) Configuration Control Level 3 - Mission activities of unlimited duration where a stable environment is desired (normal operations). The PCC in B230-47 shall be staffed with a minimum of one operator at all times. Configuration changes shall be allowed in accordance with approved operating procedures.
- e. Systems Requirements. The Central Plant shall be staffed on a 24×7 basis. The utilities provided are used for redundant backup building power for flight operations and support. There are three 1.5-MW generators and a UPS with three battery banks of 200 batteries per bank. These systems shall be maintained and operated in a manner to ensure very high reliability. The fuel storage capacity for diesel fuel is 24,980 gallons in two storage tanks; these tanks shall be refilled at 19,900 gallons. There are two primary circuits rated at 16.5 kV, which is transformed to 480 V for building distribution. The Subcontractor shall provide a certified underground storage operator as required by State of California and a certified alternate shall be provided, also. The Subcontractor shall recertify the underground storage operator and the alternate every 2 years. Power certification, when requested, shall be treated as priority work. One of the certified underground storage operators shall be an on-site SFOF personnel team member.
- (1) Plant Operation. The operation of the Central Plant shall include the start-up and shutdown of equipment, operator inspection and monitoring to ensure the availability of critical power and other utilities to the SFOF and Building 264 on a 24×7 days per week basis.
- (2) UPS. The Subcontractor shall maintain the fixed-mounted UPS system in the Central Plant. Subcontractor maintenance shall be performed in accordance with manufacturer's recommendations. The Subcontractor shall inspect the UPS quarterly. The inspection shall include each UPS system battery for proper battery fluid level, leaks, cracks, and deterioration, and testing for specific gravity and voltage output as well as system current and voltage harmonic content, harmonic content of the ground and neutral currents, noise levels, static switch operation, switch closing time, battery bank current, and voltage output. All defective batteries shall be replaced. The Subcontractor shall retain all inspection and test results and enter the data, in a format approved by the CTM, within 5 working days after the test.
- (3) Operator Maintenance. The Subcontractor shall perform operator maintenance, as configuration control requirements permit, on the Central Plant equipment. Operator maintenance, as opposed to Preventive Maintenance, including inspection, tests, and work up to the TC scope limit shall be performed by the Subcontractor equipment operator. The Subcontractor shall follow approved maintenance procedures and associated checklists in the performance of maintenance work. In addition to performing operator maintenance on on-line equipment, the Subcontractor shall periodically operate and inspect idle equipment and clean, preserve, lubricate, and adjust CPO equipment listed in Appendix 20.
- (4) Plant Operations Logs. The Subcontractor shall maintain daily Central Plant operating logs that include record data such as operator checks and adjustment; normal or abnormal operating conditions, deficiencies or malfunctions, and corrective action taken; equipment instrument readings and operating parameters; laboratory tests and results; plant and system maintenance performed; special operator tasks assigned;

emergency conditions; and fuel-tank-level readings. The Subcontractor shall keep all operation, maintenance, and repair records orderly, up-to-date, and readily accessible to the CTM or designee. The Subcontractor personnel shall be intimately familiar with the normal operating range of the equipment such that when taking readings of condition (power, temperature, speed, pressure, etc.) the Subcontractor can recognize anomalies and take corrective action.

- (5) Power Certification. Power certification shall be performed in accordance with procedures shown in Appendix A.15.
- (6) Operational Emergencies. Operational emergencies such as utility failures which result in a change in the plant's reliability or capacity, shall be reported immediately following the occurrence to the CTM or Supervisor. The Subcontractor shall identify the probable cause for the failure and the estimated time to restore full capacity.
- (7) Plant Maintenance and Repair. When equipment or systems are to be secured or de-energized for work to be performed, safety clearance shall be provided by the Subcontractor. Central Plant equipment and its associated systems shall have an availability of 98 percent in a fiscal year. The Subcontractor shall ensure that necessary steps are taken to ensure backup utility services to the SFOF in the remaining 2 percent of each fiscal year, such that there is 100% coverage.
- (8) Lab-wide After-Hours Response. The Subcontractor's SFOF team shall provide first response to after-hours problems. Accordingly, the Subcontractor's SFOF team shall have operational competence with all necessary utility mechanics, especially in the HVAC trade. After-Hours roving technicians must be able to troubleshoot HVAC and electrical related calls.
- (9) Transfer Switches (Power). Automatic and Manual Transfer Switches (ATS) shall be tested in accordance with local code requirements. Testing of the ATS shall be performed no less than once a year.

12. Elevator Maintenance and Repair

- a. General Requirements. Systems covered under this Subcontract are listed in Appendix A.16. By definition, all TCs associated with elevators are considered emergency TCs. Accordingly, the Subcontractor shall ensure that one full-time journeyman elevator mechanic is present and working at JPL during normal M-F working hours.
- b. Performance Criteria. Workmanship and material quality shall be in accordance with the applicable codes and standards contained in the current State of California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders, the ASME Safety Code for Elevators and Escalators (ASME 17.1-2014 and ASME 17.3-2015), and with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
- c. Operation Procedures. Work shall be accomplished in accordance with the subcontractor's OPP, which shall address the following: all elevator systems maintenance and repair procedures, including emergency repairs, emergency responses (entrapments, etc.), shutdowns, notifications of shutdowns, systems testing, inspection and certification plan and procedures, safety and accident response, and reporting procedures. The OPP shall be developed using the following guidelines: (1) manufacturer's instructions (2) State of California Elevator Safety Orders, and (3) ASME Safety Codes and other applicable national codes. The plan shall describe:
 - (1) Levels of certified staffing (min. of one full-time on-site certified elevator technician)
 - (2) PM procedures for maintaining current code compliance for elevators in accordance with State of California, local, and national codes.
 - (3) Interaction with State of California and fire protection officials. Procedures for responding to and correcting citations.
 - (4) Methods for maintaining safe and neat elevator cab interiors and exteriors.
 - (5) Methods for ensuring that elevator workers do not cause any collateral damage (e.g., floors, ceilings, and walls).
 - (6) Methods for performing quality control and for obtaining and exercising warranties.
- d. Licensing and Personnel Qualifications. The Subcontractor or its subcontractors shall be licensed by the State of California to provide the maintenance and repair services required under e. (1). All work shall be performed by journeyman elevator mechanics specifically qualified and trained to work on elevator systems and equipment. Evidence of all required licenses, as well as documentation of the qualifications of personnel, shall be required before elevator mechanics are allowed to work under this Subcontract.
- e. Elevator PM. All work shall comply with State of California Elevator Safety Orders and ASME 17.1-2014 and ASME 17.3-2015 and the manufacturers' maintenance manuals, except as modified herein.
- f. Scope. The intent of elevator PM is to provide routine maintenance services that permit the early detection and correction of items that, if deficient or defective, would: (a) interfere with the normal effective operation of the elevator systems; (b) endanger life and/or property; or

(c) prevent the issuance of a license to operate or cause the issuance of a citation by the appropriate Authorized State Agency.

- g. Maintenance/Repairs. Contractor shall maintain all parts of the Elevators in good condition and repair, including, but not limited to, machines, motors, generators, brushes, controllers, selectors, worms, gears, thrust bearings, brake magnet coils or brake motors, brake shoes, windings, rotating elements, contacts, coils, resistance for operating and motor circuits, magnet frames, leveling devices, cams, pumps, pump motors, operating valves, valve motors, motor winding, leveling valves, plunger packings, exposed piping, hydraulic fluid tanks, car hoistway door hangers, tracks and guides, door operating devices and door motors, pushbuttons, indicators, hall lanterns and all other elevator signal, scheduling, accessory equipment, solid state components and intercom systems.

All work, including regular examinations and repairs in accordance with these specifications, is to be conducted during the regular business hours of the Contractor, with the exception that all Elevators will require 24-hour emergency call back service.

1.1 Lubrication.

Contractor shall lubricate (in accordance with a schedule acceptable to Manager) all of those mechanical parts recommended to be lubricated by the original manufacturer of the elevator equipment. All such lubrication shall occur weekly unless the manufacturer recommends some other routine. MSDA sheets will be provided by Contractor to Manager at the JPL CTM's Office prior to commencing such work.

1.2 Lubricants and Cleaning.

The lubricants used by Contractor shall consist of oils, greases, and compounds furnished by the Contractor, and shall be of the highest quality, with proper consistencies for the purpose and for the parts to which such lubricants are applied. Abrasive bearing lubricants shall not be employed except for new parts installed and then only to the extent recommended by the original manufacturer of the equipment. Where abrasive bearing lubricants have been employed, they shall be thoroughly removed by cleaning after the working-in period has elapsed.

Contractor shall keep the Elevator pits and Elevator car tops clean and properly lubricated to maintain a quiet operation. Contractor shall keep the guide rails clean and properly lubricated, provided that when roller type guides are involved, no rail lubrication shall be used.

When necessary, the Contractor shall renew guide shoe gibs or rollers as required to insure smooth and quiet operation. All oil reservoirs shall be kept properly sealed to prevent leakage. Approved metal containers shall be provided by the Contractor for the storage of wiping cloths.

1.3 Cleaning Materials.

Cleaning compounds, waste cloths, and other materials are to be supplied by Contractor, it being understood and agreed that cleaning agents employed shall not be flammable or

noxious and must always be stored in approved, restricted access metal containers provided by Contractor. All chemicals require Manager's approval prior to being taken on site.

1.4 Spare Parts.

Contractor shall provide and maintain a supply of contacts, coils, leads and generator brushes, lubricants, wiping cloths, and other minor parts in each Project elevator machine room for the performance of routine preventive maintenance. All spare parts shall be kept in storage cabinets provided by Contractor. Contractor shall provide one parts cabinet on this Project.

1.5 Hoist Ropes.

Contractor shall be fully responsible for examining and equalizing the tension of all hoisting ropes. Contractor shall renew all hoisting ropes, compensating ropes, and governor ropes whenever necessary to insure the maintenance of an adequate safety factor. Contractor shall equalize the tension on hoisting ropes, resocket ropes for drum machines as required to maintain legal counterweight bottom clearances, and repair or replace conductor cables and hoistway and machine-room elevator wiring.

1.6 Wiring.

Contractor shall be fully responsible for repairing and/or replacing all electrical wiring and conductors extending to the Elevators from the main line switch in the Project elevator machine room and from the outlets in the hoistways; provided, however, that the main line switch, together with fuses for the mainline switch, are excluded.

1.7 Painting.

Contractor is responsible for keeping the exterior of the Elevator machinery, elevator machine room floors and any other parts of the equipment subject to rust properly painted, identified and presentable at all times. Motor windings and controller coils are to be periodically treated with a proper insulating compound which shall be supplied by Contractor.

1.8 Cleaning.

Contractor shall, during the course of all examinations, remove and discard immediately, all accumulated dirt and debris from the pit areas and machinery spaces. Prior to each anniversary of the Commencement Date of the Agreement, or at other frequencies mutually agreed upon by Manager and Contractor, Contractor shall thoroughly clean the entire hoistway (including hatch door guides, thresholds and door grabs) of all accumulated dirt, grease, dust and debris. All hazardous or toxic materials, substances or wastes which are or become regulated by any federal, state or local governmental authority (including without limitation waste oils) (collectively, "Hazardous Materials") resulting from normal operations and maintenance shall be disposed of by Contractor at its sole cost and in accordance with all applicable laws, codes, regulations or ordinances. Contractor shall be responsible for the proper storage, handling, and disposal of such Hazardous Materials in a properly licensed

waste disposal facility authorized to accept such Hazardous Materials. Contractor shall indemnify and hold harmless Owner, Manager and all other Indemnitees against any Claims arising from or in connection with the storage, handling, release, discharge or disposal of such Hazardous Materials. Contractor shall not be responsible for contamination of the land beneath or other areas of the Project where such contamination is not the fault of Contractor.

h. Emergency Customer Response Service.

Contractor shall have available crews to provide emergency minor adjustment call-back service. Contractor shall promptly dispatch qualified employees in response to requests from Manager, by telephone or otherwise, for emergency adjustment call-back service on any day of the week, at any hour, day or night. Emergency minor repairs shall be made to restore the equipment to operating order. If repairs are necessary and cannot be made immediately, Contractor's mechanic shall notify the watch personnel for the Project that repair cannot be completed and shall provide such engineer with a reasonable timetable for completion of required repairs. It is understood and agreed that this shall constitute twenty-four hour call-back service for all Elevator cars (gearless or geared traction and hydraulic) within the Project ("Twenty-Four Hour Callback Service"). Maximum permitted response time to a trouble call shall be 1 hour after notification and no more than thirty (30) minutes for a passenger entrapment, subject to delays beyond the reasonable control of the responding service personnel which may include severe weather conditions, earthquake, traffic congestion and civil commotion. Owner shall be entitled to three (3) Twenty-Four Hour Callback Service calls per year at no extra cost. Twenty-Four Hour Callback Service calls or labor hours in excess of the preceding sentence shall be subject to overtime rates and billed at the hourly rate of the appropriate service personnel set forth on Exhibit B, Section B.

i. Safety Testing.

Contractor shall periodically examine all safety devices and governors and conduct annual no-load tests, and five-year full load, full speed tests of safety mechanisms, overhead speed governors, car and counterweight buffers as required and as suggested by the manufacturer, and by federal, state and local law, including, without limitation in accordance with applicable California law. The car balance will be checked, and the governor set by Contractor. The governor will be recalibrated and sealed for proper tripping speed, as required. Contractor shall perform annual tests of the elevator fire safety system; i.e., manual recall and firemen's elevator operation (Phase I and II firefighter's features) in the designated Elevators. Testing of firefighter's service shall be performed monthly.

j. Performance Times, Leveling and Contract Speed.

The control system of the Elevators shall be maintained to provide smooth acceleration and deceleration. Contractor must maintain elevators in accordance with building performance specifications. Contractor agrees to maintain the original contract speed in feet per minute, original performance time, including acceleration and retardation as designed and installed by the original manufacturer and to perform the necessary adjustments as required to maintain the original door opening and closing times within limits of applicable codes. Contractor also agrees to check the group dispatching systems and make necessary tests to

ensure that all circuits and time settings are properly adjusted and that the systems perform as designed and installed by the original manufacturer. All manufacturer's specifications (including floor to floor times, door timing, rated speed, group supervisory system, etc.) to be maintained by Contractor. The door close pressure must never exceed 30 pounds.

k. Supervisory System.

The Group Supervisory System shall be checked and tested as needed, but at least quarterly, to ensure that all circuits and time settings are properly adjusted, and that the system performs as designed and installed by the manufacturer. A written report shall be forwarded to Owner upon completion of testing. Group systems reports shall be limited to the equipment capabilities.

l. Notice by Authority or Manager or Insurer to Repair or Replace.

Contractor shall comply with the regulations of all governmental agencies having legal jurisdiction, and with the written recommendation of Manager and/or Contractor's insurance carrier with respect to repairs covered herein; provided, however Contractor is not required under these specifications to alter, update, modernize or install new attachments on the Elevators parts other than those now constituting the Elevator equipment.

m. Repairs, Renewals and Replacements.

Repairs, renewals, and replacements shall be made by the Contractor as soon as examinations reveal the necessity therefor. Repairs, renewals, and replacements shall be made in accordance with the highest standards of preventive maintenance practice and repairs and renewals of parts made shall be equal or superior in design, workmanship, quality, finish, fit, adjustment, operation, and appearance to the original installation and replacements shall be new or newly repaired and genuine parts equal or superior to those parts supplied by the manufacturer of the original Elevator equipment. The aforementioned shall apply to the repair, renewal or replacement of all mechanical, electronic, and electrical parts, including, but not limited to, the following:

- i. Automatic power operated door operator, car door hanger, car door contact, door protective device, load weighing equipment, car frame, car safety mechanism, platform, elevator car guide shoes, gibs or rollers.
- ii. Machine, worm, gear, thrust bearings, drive sheave, drive sheave shaft bearings, brake pulleys, brake coil, brake contact, shoes and linings, and component parts.
- iii. Motor, motor generator, motor windings, rotating element, commutator, field coil, brushes, brush holders and bearings, rotors, stators, slip rings.
- iv. Pumps, pump motors, operating valves, valve motors, motor windings, leveling valves, plunger packings, exposed piping and hydraulic fluid tanks.
- v. Controller, selector and dispatching equipment, all relays, solid state components, resistors, condensers, transformers, contacts, leads, dashpots, timing devices,

computer devices, insulators, solenoids, resistance grids, and mechanical and electrical driving equipment.

- vi. Governor, governor sheave and shaft assembly, bearings, contacts, and governor jaws. Seismic/earthquake devices.
 - vii. Deflector or secondary sheave, bearings, car and counterweight buffers, top and bottom limit switches, governor tension sheave assembly, counterweight and counterweight guide shoes, including rollers and gibs.
 - viii. Hoistway door interlocks, hoistway door hangers, bottom door guides, and auxiliary door closing devices.
 - ix. Hall lanterns, Main Lobby fixtures, Main Auxiliary Car operating panel, car position indicator, electric door operators, safety edge and photo eyes.
 - x. The elevator communication system.
 - xi. Contractor shall be responsible to re-lamp all lighting fixtures in the pit, and hoistway (excluding cab lighting) as required. Owner/Manager shall provide such lamps upon request of Contractor's service personnel.
 - xii. The following items of Elevator equipment are excluded: car enclosures (including removable panels, suspended ceilings, light diffusers, etc.), car doors, hoistway enclosures, hoistway doors, door frames and sills, fluorescent light tubes, deck covers, moldings, interior panels, skirt panels, wedge guards, wellway enclosures, fixture faceplates and electric power feeders to controller.
 - xiii. Contractor must maintain all Elevators in accordance with the manufacturer's performance specifications.
- n. Maintenance Records and Inventory.

A complete permanent record of inspection, maintenance, lubrication and call-back service for each of the Elevators under service shall be maintained by Contractor. These records are to be available to Manager and Owner at all times. Each entry shall indicate the reason Contractor's mechanic was in the Project, the arrival and departure time, and the work performed.

Contractor shall maintain a complete set of updated electrical wiring diagrams and drawings on file with the Project office. All records, reports, log books, programs, compilations, diagrams and drawings required hereunder shall be the property of Owner and shall be surrendered to Owner upon termination of the Agreement.

- (a) Documentation. The Subcontractor shall provide copies of the inspection report to the CTM within 3 working days of completion of the inspection. A copy of each certificate issued by the State Elevator Inspectorate shall be posted in its respective elevator with the original submitted to the CTM within 24 hours of

issuing the certificate. Subcontractor shall provide an annual summary of all elevator permits to JPL no less than once a year (Jan 1) to assure permit compliance.

- (b) Scheduling Requirements. The schedules in the appendices indicate the minimum required frequencies of the inspections and tests. Within 30 calendar days after award of the Subcontract, the Subcontractor shall submit for the CTM's approval, a proposed schedule for the accomplishment of all such inspections and tests. The schedule shall indicate the proposed date of each inspection or test for each specific system. Changes to the approved schedule proposed by the Subcontractor shall be submitted for the CTM's approval at least 3 working days in advance of the proposed inspection/test date.
 - (c) Elevator's Equipped for Firefighter's Service. For elevators so equipped, testing of firefighters' service shall be performed monthly.
 - (d) Routine and Periodic Inspection and Test Requirements. Routine inspection and testing of the traction and hydraulic elevators, dumb waiters, and chair lifts listed in Appendix 20 shall be performed in accordance with State of California Elevator Safety Orders and the ASME Elevator Safety Codes.
 - (e) Obsolesces. Any parts which are considered to be obsolete or difficult to obtain shall be identified. JPL shall be advised of all such issues.
- o. All elevators/lifts modernized and/or upgraded by other/non-on-site elevator service providers, the on-site elevator service company of record shall be required to assume full service/responsibility of modernized/upgraded elevators/lifts. The incumbent elevator provider has the right to inspect and test any elevator modernized/upgraded to assure that the said work is performed in compliance with current code requirements and work was performed to an acceptable level before accepting responsibility.

13. Built-In Cranes, Hoists, Monorails, and Jibs Maintenance and Repair

- a. General Requirements. Equipment systems covered under this section are listed and described in Appendix A.14. The Subcontractor shall maintain and repair cranes, hoists, monorails, and jibs, and perform load tests as required by the State of California Title 8, Subchapter 7, Group 13 and the NASA Safety Standard 8719.9 and subsequent revisions of these standards.
- b. Performance Criteria. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
- c. Operation Procedures. Work shall be accomplished in accordance with the subcontractor's OPP. The plan shall identify all requirements for safe, reliable, efficient operation of cranes, hoists, monorails, and jibs at JPL. The Plan shall address the following:
 - (1) Procedures for all maintenance and repair, including emergency repairs and responses.
 - (2) Plan and procedures for systems testing, inspection and certification.
 - (3) Procedures for safety and accident response and reporting.
 - (4) Methods for working on cranes located in clean rooms and high bays.
 - (5) Certified staffing levels and procedures for maintaining current code compliance for cranes and hoists in accordance with NASA, State of California, local, and national codes, as well as interaction with State of California and procedures for responding to and correcting citations.
 - (6) Methods of disposal of hazardous materials and containment of oil spills.
 - (7) Methods for ensuring comprehensive crane, hoist, and lift maintenance/repair.
 - (8) Methods for ensuring that crane workers do not cause any collateral damage (e.g., floors, ceilings, and walls).
 - (9) Methods for performing quality control and for obtaining and exercising warranties.
 - (10) Process for identifying crane equipment for refurbishment.
 - (11) Method for ensuring all operating Crane/Hoist assets in Maximo will have current and up-to-date images populating the image feature in the Assets application in Maximo.
- d. Warranted Equipment. Equipment, components, and parts, other than those installed under the Subcontract, shall not be removed or replaced, or have deficiencies corrected, while still under warranty of the manufacturer or the installer without prior approval of the CTM. See Article 1, Paragraph 1.5.
- e. Subcontractor Certification and Licensing. The Subcontractor shall be licensed by the State of California to provide the maintenance, inspecting, testing and repair services specified in this Subcontract. All work shall be performed by journeyman crane mechanics specifically qualified, trained, and experienced to work on crane systems and related equipment. Evidence of all required licenses, as well as documentation of the qualifications of personnel, shall be provided.

f. Requirements for Crane Recurring and Non-recurring Work.

- (1) PM. The Subcontractor shall perform PM work on each of the cranes, hoists, monorails, and jibs listed in Appendix 20. Work shall consist of maintaining this equipment in a safe, reliable, and satisfactory operating condition.
 - (a) Scope. PM work shall include periodic Subcontractor operation, inspection, checks, adjustments, and maintenance of systems to ensure that each system complies with applicable JPL, State of California, NASA, and manufacturers' standards of safety and reliability, and is maintained in satisfactory operating condition. PM work shall be performed in accordance with the appropriate PM checklist in Appendix A.1. The intent shall be to provide routine maintenance services that permit the early detection and correction of items that, if deficient or defective, would: (a) endanger life and/or property; (b) interfere with the normal effective operation of the crane; or (c) involve high cost or long-lead time for repair. Work shall include, but not be limited to: comprehensive operational inspection, load testing, and adjustments to ensure the satisfactory functioning of machinery and controls, trolley, bridge and hoist brakes, gears and bearings, hooks and wire rope, limit switches and emergency stop switches, conductors, etc.; detecting and correcting the causes of unusual noises or vibrations; manufacturers' recommended machinery lubrication; adjustments to bring the system operation within the manufacturers' specifications; repairs including defective part and component replacements; equipment cleaning; and other services to maintain all systems in a safe and acceptable operating condition. Depending on the nature of the PM adjustments or repairs, the crane may require recertification to remain in service. The Subcontractor shall take whatever remedial action is necessary to ensure the system is code compliant and recertifiable within 5 calendar days of failing any certification inspection. Key replacement parts that are normal-inspection or code-required items shall be labeled to indicate the part replacement date.
 - (b) Documentation. Facility Maintenance History Files shall include records of the following work:
 1. PM work including monthly hook and wire rope inspections.
 2. Safety inspection, testing, load testing, certification, and interim recertification work.

Original documents shall be submitted to the CTM within 5 calendar days of expiration or termination of the Subcontract. Required records shall be maintained in a readable, complete, orderly, timely, and accurate manner at all times.
 - (c) PM Work Quality Standards. The Subcontractor shall meet the following PM work quality standards:
 1. PM checklist work items are to be satisfactorily accomplished: All internal and external components, parts, assemblies, and subassemblies forming a part of each crane system or necessary for its safe operation are inspected, adjusted, lubricated, repaired, or replaced as necessary to ensure the system is

functioning as designed, and to ensure that there is no unusual machinery wear, noise, or vibration.

2. The machinery house and accesses are to be clean and tools are properly stored.
 3. The certification is to be posted in the operator's cab along with load-rating charts. For units without cabs, certifications shall be posted on the wall next to the disconnect for the electric hoist or in another conspicuous location for non-motorized cranes.
 4. All operational and general safety devices are to be in place and functioning.
 5. All controls and brakes are to be operating freely, and are to be maintained in a safe, operational condition.
 6. Trolley wheels and bearings shall show no wear or damage.
 7. All limit switches are to be maintained in excellent condition and operate properly.
 8. All indicator and warning lights are to be operational.
 9. All slings, hooks, fasteners, harnesses, wire rope cables and other auxiliary devices are to be in good, kink-free condition.
- (2) Inspections and Testing. The Subcontractor shall provide copies of the inspection report to the CTM within 3 working days of completion of the inspection. As part of the test, deficiencies discovered during testing shall be corrected to keep them capable of providing their initially designed capacity, speed, and performance in a safe and efficient manner.
- (a) Outside Cranes. In addition to the requirements above, the Subcontractor, after the inspection, shall ensure that gaskets on motor and control cabinets are firmly in place and all control units are secure and watertight.
 - (b) Hooks and Wire Rope. The Subcontractor shall annually check, correct and record any deformations found in hooks and wire rope. Magnetic particle crack detection shall be included and performed as part of the annual inspection.
 - (c) Additional Scheduling Requirements. As part of the Transition Period activities, the Subcontractor shall review the current certification status of all cranes and weight-handling systems. As part of the Annual Work Schedule, the Subcontractor shall provide a schedule for ensuring that all certifications remain current and complete.

14. Potable Water Distribution System Maintenance and Repair

- a. General Requirements. The work shall include the distribution of potable water via above- and below-ground waterlines; maintenance of three potable water storage facilities consisting of two high-ground-level tanks of 650,000 gallons capacity and one of 1,000,000-gallon capacity; PM and repair of distribution and storage systems including domestic water booster pumps; annual flushing of potable water systems; and system monitoring to provide potable water 24 hours per day, 7 days per week as requested by JPL. See subcontract Attachment 4 for water distribution site plan.
- b. Performance Criteria. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
- c. Operation Procedures. Work shall be accomplished in accordance with the subcontractor's Operation Procedures Plan. The OPP shall describe how work on the potable water distribution system at JPL is to be accomplished. The objective is to perform potable water distribution system-related work that is safe, reliable, efficient, and without preventable interruption. The Plan shall address:
 - (1) Procedures for systems operating and monitoring, including temporary and emergency procedures.
 - (2) Plan and procedures for systems testing and inspection to meet quality standards, system pressures, etc.
 - (3) Methods to ensure the quality of potable water. Measures to deal with any contamination.
 - (4) Procedures for safety and accident response and reporting.
 - (5) Conservation measures to be adopted.
 - (6) Water storage tanks at B267, B258, and B175 are to be inspected and addressed (internally/externally) every 5 years per NFPA water storage tank guidelines inclusive of interior video/photos and complete analysis.
- d. Interfaces. The Subcontractor shall not interact with outside JPL officials, such as the City of Pasadena Department of Water and Power, without prior approval of JPL Environmental Affairs Program Office and JPL CTM.
- e. Safety. To prevent the contamination of fresh water by backflow or back siphon age, backflow prevention devices or equivalents shall be installed and tested where the possibility of cross connection may exist. Annual certification of these devices shall be required in order to comply with Los Angeles County regulations. In addition, a cross contamination program shall be developed, implemented and managed per State of California regulations.
- f. Performance Requirements. The Subcontractor shall ensure efficient conveyance of potable water in meeting all end-user requirements. The Subcontractor shall maintain flow within JPL properties so as to prevent interruptions of service, potable water contamination, and to ensure compliance with applicable health and regulatory agency standards at all times. At no time shall the Subcontractor allow the water level in any of the storage tanks to fall below 20 feet.

- g. Temporary and Emergency Services. Temporary and emergency potable water services may be necessary to accomplish certain repairs, maintenance efforts, and new service connections. Such temporary and emergency services shall be coordinated with the CTM and shall be accomplished using methods to avoid service interruptions where possible, or to minimize system downtime where such interruptions of service are unavoidable. The CTM shall be notified of scheduled temporary service conditions at the time of job scheduling and shall be notified of all service interruptions as soon as possible, with notification time not to exceed 1 hour after Subcontractor identification of an emergency.
- h. Potable Testing Services. Testing of the potable water system shall consist of water sampling throughout the water distribution system to be collected on a random basis.

Each month a minimum of 8 random samples shall be sent to an independent lab to verify water purity levels are within established EPA, ACWA parameters ANSI/AWWA Standard C651-92.

Each month Chlorine water levels samples are to be performed at locations mutually agreed upon with JPL M&O (1-3 locations).

All water samples shall also be saved monthly onto the shared folder.
- i. Cross Connection Program. The contractor shall prepare and maintain a cross connection program to include all necessary code compliant requirements. The program must be administered by a certified cross connection compliant person.

15. Wastewater Collection and Disposal System Operation, Maintenance, and Repair

- a. General Requirements. The Subcontractor shall monitor the wastewater collection system to ensure that the system provides wastewater collection and disposal capability throughout JPL 24 hours per day, 7 days per week. The Subcontractor shall comply with all applicable rules and regulations of the Los Angeles County Sanitation Districts (LACSD) and collect and submit required monitoring data to JPL as per Exhibit 2, SDRL. All new industrial wastewater discharges to the sanitary sewer by the Subcontractor (e.g., discharge from cleaning a boiler or cooling tower) shall be identified in writing to the CTM. The Subcontractor shall support the JPL EAPO in its National Pollutant Discharge Elimination System (NPDES) and storm water management program.
- b. Performance Criteria. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
- c. Operation Procedures. The OPP shall describe how work on the wastewater collection and disposal system at JPL will be accomplished. The objective is to perform wastewater collection and disposal system-related work to ensure that it is safe, statute-compliant, reliable, efficient, and without preventable interruption. The Plan shall address:
 - (1) Procedures, including temporary and emergency, for systems operating and monitoring.
 - (2) Schedule of compliance measures in accordance with LACSD (including flowmeter calibration, sewage sampling, and chemical analysis).
 - (3) Inspection plan to ensure that all pumping stations are in good working order.
 - (4) Procedures for safety, accident response, and permit reporting.
- c. Interfaces. The Subcontractor shall only interact with approved regulatory points of contact outside JPL.
- d. Safety. The Subcontractor shall obtain a Confined Space Entry Permit from the JPL Occupational Safety Program Office (OSPO) prior to entering any confined space such as manholes, crawl spaces, utility tunnels etc.
- e. Regulatory Agency Compliance.
 - (1) The Subcontractor shall advise the JPL CTM within 2 hours of learning of any known violations of statutory parameters, of any lift station bypassing, and of any other types of illegal discharges. This notification shall describe the discharge, the cause of noncompliance, and the period of noncompliance including exact dates and times (or if not corrected, the duration of noncompliance and measurements being taken to reduce and arrest the discharge and prevent recurrences).
 - (2) The Subcontractor shall be responsible for meeting all applicable regulatory agency requirements. In the event that a regulatory agency assesses a monetary fine against JPL for violations caused by Subcontractor negligence, the Subcontractor shall reimburse JPL for the amount of that fine.

- (3) The Subcontractor shall comply with JPL OSPO instructions with respect to the avoidance of conditions that create a nuisance or may be hazardous to the health of personnel at JPL.
- f. System Performance Requirements. The Subcontractor shall provide the following specific services relating to the wastewater collection and disposal systems:
- (1) General Services. Wastewater collection and pumping system operations shall provide continuous, cost-effective, and efficient conveyance of all JPL-generated wastewater to LACSD sewer lines; and storm water to point of discharge beyond JPL boundaries. Within JPL properties, flow shall be maintained so as to prevent nuisance odors, to prevent interruptions of service, and to ensure compliance with applicable health and regulatory agency standards at all times. Systems shall be maintained to minimize unsatisfactory service conditions including flooding conditions, pump station failures, pipe blockages, and excessive infiltration and inflow conditions. All transportation and disposal practices shall be in accordance with all applicable LACSD and environmental regulations. Subcontractor shall add up to 100 gallons of chlorine annually as needed upon JPL EAPO request.
 - (2) PM Program. PM shall include inspections and services of lubrication, minor adjustment, cleaning of the flume, clearing of blockages, and minor repair of components. Refer to Appendix A.1. The Subcontractor shall update schedules as necessary to reflect any changes in LACSD regulations, equipment changes, or operations.

Annually add 25 gallons of chlorine in each of the 2 sewage lift stations (224 and 308) and 10 gallons of chlorine in 2 selected areas on the upper part of the lab. The chlorine shall be added in the evening of a week day and shall be done in conjunction with JPL M&O.
 - (3) Temporary and Emergency Services. Temporary and emergency collection services may be necessary to accomplish certain repairs, maintenance efforts, and new service connections. Such temporary and emergency services shall be coordinated with the CTM and shall be accomplished using methods to avoid service interruptions, where possible, or to minimize system downtime where such interruptions of service are unavoidable. JPL CTM shall be notified of scheduled temporary service conditions at the time of job scheduling and shall be notified of all service interruptions as soon as possible, with notification time not to exceed 1 hour after Subcontractor identification of an emergency.
 - (4) LACSD Reporting. The Subcontractor shall prepare all relevant data to the CTM for use in the preparation of annual wastewater surcharge reports.
 - (a) Sampling. The Subcontractor shall collect and analyze sewage samples at the frequencies stipulated by LACSD. The sampling and analysis shall be in accordance with the requirements for compliance with LACSD permit regulations.
 - (b) Storm Water Discharged from Secondary Containment Areas. The Subcontractor shall not release storm water from secondary containment areas without prior approval of the JPL EAPO.

- (c) Consultant Review. The subcontractor shall engage a third-party sewage waste environmental engineer for review, preparation and validation of sewage data submission to the LACSD.
- (c) Documentation. The Subcontractor shall provide the JPL CTM the results of sewage analysis within 2 weeks of sample collection in accordance with Exhibit 2, SDRL.

The Subcontractor shall document all actions within 1 working day of each action and shall maintain all records up-to-date such that the information can be easily and promptly reviewed by JPL at any time.

16. Grounds Maintenance and Repair

- a. General Requirements. These operations shall be performed to the areas of JPL indicated in Subcontract Attachment 2 and comply with Appendix A.1, JPL Grounds Care Requirements. TC work and recurring work performed by Grounds Maintenance operations personnel shall be classified as Grounds work.
- b. Performance Criteria.
 - (1) Quality. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
 - (2) Documentation. The Subcontractor shall enter tree trimming, removals, relocation, and new installations into the tree maintenance management system database. The Subcontractor shall retain and maintain all documentation from the maintenance performed, including herbicide use records (see paragraph d (2)). Subcontractor shall record dates and areas fertilized on a site plan and a copy given to JPL CTM or designate on the first day of each month when fertilization has taken place. Subcontractor shall support JPL with irrigation water usage reports as requested via the Calsense System.
- c. Operation Procedures. Work shall be accomplished in accordance with the subcontractor's Operation Procedures Plan. The OPP shall identify the requirements to perform grounds maintenance work that meets the quality, aesthetic requirements and expectations and is performed safely, efficiently and without preventable interruption to the day-to-day operations of JPL. The OPP shall be developed using the guidelines and requirements from (1) Executive Memorandum of April 26, 1994 entitled *Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds* and (2) Executive Order 13693 of March 19, 2015 entitled *Planning for Federal Sustainability in the Next Decade*. The OPP shall address the following:
 - (1) Procedures and schedules for accomplishing the grounds maintenance program with minimal interruption to JPL employees and visitors.
 - (2) Procedures for seasonal activities (such as renewing plant material). Schedule for grass cutting. Procedure for green waste disposal.
 - (3) Procedures for minimizing dust and noise pollution when engaging in grounds maintenance.
 - (4) Procedures for inspection and repair of retaining walls, culverts, storm drains, flumes, etc.
 - (5) Procedures and schedules for applying fertilizers.
 - (6) Procedures for herbicide management and weed-spraying.
 - (7) Procedures for safety during tree pruning activities and other grounds maintenance tasks.
- d. Herbicide Management. The Subcontractor shall be licensed by the State of California to provide vegetation control in the categories specified in this Subcontract. All tanks, hoses, pumps, control valves, and gauges shall be free of visible deterioration, shall not leak, and

shall operate at the manufacturers' recommended rates and pressures. Equipment that has failed shall be replaced and/or repaired by the Subcontractor prior to resuming operations. Extreme care shall be exercised to avoid the entry of herbicides into drainage structures, ditches, and similar facilities. Regarding the use of herbicides for weed control and its related restrictions.

- (1) Control Methods. The Subcontractor shall use only herbicides approved by the EPA and the State of California for the intended use. The Subcontractor shall verify manufacturer-supplied SDSs with their respective herbicide label data and submit them for CTM approval 7 working days prior to the use of each herbicide. Use shall be in strict compliance with label directions for the control of target weeds. Any proposed changes in approved herbicide usage shall be submitted for CTM approval at least 7 working days in advance of anticipated need.
- e. Xeriscaping. The Subcontractor shall comply with requirements identified in the Executive Memorandum of April 26, 1994 on the subject of *Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds*. A successful xeriscaping program results in reduced water use, decreased energy use from reduced pumping and pre-treatment requirements, decreased storm water and irrigation runoff, less landscaping waste, and lower labor and maintenance costs.
- f. Grounds Maintenance Requirements. Attachment 2 provides information on the location and geographic boundaries of paved areas, sidewalks, entrances, outside patios, culverts, and fencing at JPL.
 - (1) Sweeping Operations.
 - (a) Hard Surface Sweeping. The Subcontractor shall keep clean all JPL sidewalks, entrance steps, the mall area, and outside patio areas by sweeping or air blowing. (See Appendix A.1.) The cleaning shall be done daily and as needed, to ensure the required cleanliness; with special attention to clear high-risk walkways of debris (e.g. sloped paths under trees which shed pine needles, amber liquid balls, etc.). The cleaning shall remove all sand, soil, aggregates (rocks, pebbles, etc.) and any other debris and shall be broom clean, cleaned as if it had been swept with a broom. The Subcontractor shall log any unusual deterioration of pavement surfaces or of the development of "fish-pond" depressions in surfaces that cause difficulties in wet weather sweeping. The Subcontractor shall maintain on a Subcontractor-prepared form or log sweeping data and furnish a copy of the data to the JPL CTM on request. Leaf Blower tools shall be low noise output and electric battery operated as indicated by local regulations. The Subcontractor is restricted to running air blowers, weed wackers, lawn mowers street sweeping in the vicinity of residential areas bordering JPL premises only between the times and days stated below.
 - Monday - Friday, 7:00 am - 6:00 pm (7:00 am - 7:00 pm during Daylight Savings Time)
 - Saturday, 9:00 am - 5:00 pm
 - No noisy construction on Sundays
 - No noisy construction on any recognized federal, state or local holiday
 - Should be included for all M&O services

The Subcontractor shall use low-pollution, low-noise air blowers.

- (b) Power Sweeping of Roads, Streets, and Parking Areas. Sweeping services for roads, streets, and parking areas shall be provided in accordance with the schedule in Appendix A.1. Debris shall not be disposed of at JPL. Sweeping shall be completed on each parking lot area or Parking Structure on the same day that the sweeping of that area began. Three (3) times per year pressure wash exterior concrete surfaces including steps and sidewalks (64,325 sq. ft.) for a total of 192,975 SF each year and pick up all water and detergent. Locations and schedules to be approved by JPL.
- (c) Property Damage. The Subcontractor shall be liable for and reimburse JPL for the actual cost of repair to JPL property damaged due to Subcontractor negligence during sweeping operations, including, but not limited to signs, JPL-owned vehicles, and any private property belonging to JPL employees and visitors.
- (2) Grass Cutting. Grass shall not be allowed to exceed the heights specified in the Appendix A.1. Grass areas close or adjacent to buildings and fencing are included in these mowing requirements and require trimming.
 - (a) Grass cutting is to be accomplished free of scalping, rutting, bruising, and uneven and rough cutting. After cutting, grass shall have a uniform height. Grass clippings and trimmings, if any, shall be removed from sidewalks and other paved areas.
 - (b) Trimming around poles, walls, valves, hydrants, and other similar objects shall match the height and appearance of the surrounding mowed grass. Grassed areas killed or damaged as a result of the Subcontractor's work shall be repaired or replaced by the Subcontractor at Subcontractor's expense. Grass cutting shall not be considered complete until all trimming operations have been accomplished.
 - (c) Vegetation around explosive storage areas and explosive use facilities shall be controlled to provide at least a 50 feet area free of combustible materials and growth.
- (3) Grounds Cover Maintenance. All areas of ground cover shall be maintained free of weeds, leaves, and debris. Ground cover weeding shall be performed in a manner that removes weeds, including roots. Line trimmers (weed whackers) shall not be used.
- (4) Edging. All sidewalks, driveways, street edges, curbs, and other paved areas shall be edged. (See Appendix A.1.) Edged lines shall be neat and clean and shall be free of scalping, rutting, bruising, and uneven and rough cutting. Vegetation that has encroached onto paved areas shall be removed.
 - (a) All edging shall be performed by mechanical (non-herbicidal) means.
 - (b) In conjunction with edging operations, all vegetation shall be removed from expansion joints and cracks in all paved and concrete surfaces, including parking, roads, walkways and stairs. Approved herbicides may be used to reduce the amount of mechanical work required in paved areas.
 - (c) Debris generated by edging operations shall be turned into mulch and left on lab at a location to be determined by JPL.

- (5) Shrub Pruning. Shrubs shall be pruned at the frequency required for each particular variety to maintain healthy growth and appearance in accordance with the JPL-provided schedule in Appendix A.1. All clippings and debris shall be removed from JPL and disposed on the same day as the pruning. Pruning shall be accomplished so as to:
- (a) Remove dead, damaged, or diseased wood. If the entire shrub should die, the Subcontractor shall remove the entire shrub. Dead shrubs shall be replaced by the Subcontractor with the same kind of plant, in a 15-gallon container, minimum size.
 - (b) Remove vines, sprouts, ground cover, and any other extraneous vegetative growth from under, on, or within the shrub.
 - (c) Prune or remove growth against structures, in front of windows, over roofs, over entryways or walks, or where vision is obstructed at street intersections.
- (6) Tree Pruning. The Subcontractor shall prune trees in accordance with the Appendix A.1. and the following guidelines to selectively remove unwanted growth and to encourage trees to grow or respond in a desired manner. All tree pruning shall be accomplished under the supervision of a certified arborist provided by the Subcontractor. The Subcontractor shall prune trees according to their natural growth habit to evenly form and balance the tree, promote proper health and growth, respond to damage inflicted by natural or human causes, and prevent interference with pedestrian and vehicular traffic. The Subcontractor shall remove and dispose of all clippings and debris. Pruning shall be accomplished in a manner so as to:
- (a) Remove dead, damaged, or diseased wood; or structurally weak limbs that may cause a safety hazard or unsightly appearance.
 - (b) Remove branches that extend over or against buildings, thus endangering building components such as roofs, eaves, exterior lighting and windows; or that hang within 12 feet vertically of sidewalks and 16 feet above roads and parking surfaces.
 - (c) All trees not covered in (b) above shall be cut to a minimum of 6 feet above grade.
 - (d) Three Hundred (300) trees per year shall have a full trim. Clearance trims shall be completed as needed. JPL CTM or delegate and subcontractor. JPL CTM or delegate will designate the trees. Subcontractor shall enter data into JPL's ArboPro database.
 - (e) Remove the growth of small trees in front of windows, over entranceways or walks, and those that obstruct vision at street intersections.
 - (f) Remove sprouts and suckers (runners) growing from tree bases, trunks, and branches.
- (7) Landscape Irrigation. The Subcontractor shall manage the irrigation of JPL landscaping to promote healthy plants, turf, and trees while conserving water and minimizing waste. Grassed areas, shrubs, trees, and ground cover plants shall be irrigated in accordance with the following:
- (a) The Subcontractor shall operate (Calsense) automatic irrigation systems to gain maximum, deep-watering benefit. Manual irrigation operations (checking

conditions, sprinkler-head maintenance, moisture sensors, etc.) shall be conducted during regular working hours. Frequencies and duration of water application shall be closely monitored to ensure that landscape plants receive adequate, but not excessive, water. Only new plantings shall be watered daily. Established plants shall be watered less often to promote deep rooting.

- (b) The Subcontractor shall be responsible for any damage to plants, lawns, or buildings caused by the careless handling of irrigation equipment. Sprinkler settings shall be set in such a position as to not throw water into doorways, windows, porches, parked cars, and parking areas, or to impede vehicular or pedestrian traffic.
 - (c) Installed sprinkler systems including the piping system, riser connections, and sprinkler heads shall be maintained, repaired, or replaced by the Subcontractor to eliminate obstructions, leaks, and other defects that would prevent proper operation. Where an installed sprinkler system does not cover an area adequately, the Subcontractor shall provide sprinklers to irrigate the entire area uniformly. Replaced piping and pipefittings shall be the same size and meet the same specifications as the replaced system components in accordance with JPL Facilities Design Standards. Replaced sprinkler heads shall be of the same make, manufacturer, and model as existing heads keeping the integrity of the implemented water saving heads with flow control valve or as specified by CTM or delegate.
 - (d) The Subcontractor shall provide manual irrigation as necessary. Landscape areas shall be inspected for ponding and run-off conditions. Hoses, portable sprinklers, portable pipe, and similar irrigation equipment shall be removed at the end of each workday or when it is not actually in use. All valves, covers, and valve box covers shall be closed at all times except when they are in use.
- (8) Cultivation and Mulching of Shrubs, Flowerbeds, and Planters.
- (a) Cultivation. Cultivate shrubs, flowers, and other plants to ensure healthy growth. All extraneous vegetation, such as weeds and sprouts shall be removed by the roots. Cultivation debris shall be removed and disposed of from the job site in a trash disposal unit on the same day that it is collected.
 - (b) Flowerbed and Planter Edges. All edges shall be worked to a neat and true line. All timber, brick, concrete, aluminum, or plastic bed edging shall be maintained in an aligned manner.
 - (c) Mulching. Mulch shall be placed around all shrubs and flowerbeds to maintain a maximum depth of 1-1/2 inches. Mulch shall consist of forest litter, hay straw, or other collected organic material. Mulches shall not contain sticks larger than 1/4 inch in diameter, stones, clay or other foreign material that will prevent the eventual decay of the mulch.
- (9) Fertilization. The Subcontractor shall furnish and uniformly apply fertilizer to grass and plants at the frequency required by Appendix A.1. The Subcontractor shall deliver fertilizer to the site in the original, unopened containers bearing the manufacturers' chemical analysis, name, trade name, trademark, and indication of conformance to

federal and state laws. Fertilizer shall be applied only when grass blades are free of moisture. Ground cover plants and shrubbery beds shall be fertilized concurrently with lawn applications and at the rates recommended by the Appendix A.1. The Subcontractor's monthly work schedule (MWS) shall reflect planned fertilization dates. After fertilizer is applied, it shall be "watered in." Subcontractor shall record dates and areas fertilized on a site plan and a copy shall be given to JPL CTM or designate on the first day of each month when fertilization has taken place.

- (10) Trash and Litter Collection and Disposal. The Subcontractor shall dispose of trash and litter from all grassed areas, flower and shrub beds, open areas, sidewalks, streets, outside patios, and along building and fence lines to keep the areas free of trash and litter. Trash and litter does not include living natural vegetation, but does include natural debris such as branches. All trash and litter shall be disposed of on the same day that it is collected.
- (11) Tree, Shrub, and Plant Replacement. Dead trees, shrubs, and plants shall be replaced with trees, shrubs, and plants of similar type unless otherwise directed by the JPL CTM or designate. All replacement trees, shrubs, and plants shall be nursery-grown and bear certification indicating species, common name, and grade. Plants shall be healthy, premium grade stock. Planting procedures shall be in accordance with accepted nursery standards supervised by the Subcontractor's full-time on-site Certified Arborist, and shall be approved by the JPL CTM or designate.
- (12) Drainage Culvert and Open Channel Cleaning. All drainage culverts and open channels shall be cleaned by the Subcontractor in October and as necessary during the rainy season (October through April). Vegetative growth in drainage ditches (bottom and sides) shall be removed and herbicide applied. All cuttings, trash, and debris shall be removed and disposed of on the same day of cleaning. Inlets and outlets of culverts and open channels shall be cleared of sediment, vegetation, and debris to allow unrestricted flow of water. Where ditch bottoms are paved, all sediment, sand and debris shall be removed from the paved surface and disposed of on the same day of cleaning. Where channel bottoms are not paved, sand, sediment or debris shall be removed to allow unrestricted flow of water.
- (13) Fence Line Maintenance. Fence line maintenance shall consist of the removal of (to ground or pavement level) grass, weeds, trees (less than 2 inches in diameter at ground level), and all other vegetative growth within 10 feet on both sides of fence lines and 8 feet above the top of the fence. This work shall be done in May or June. Unless otherwise specified, removal shall be by manual, mechanical, or chemical methods approved by the JPL CTM. All clippings, trimmings, and accumulated vegetation shall be removed to a trash disposal unit.

If, during fence line cleaning, a need for fence repair is evident or it can be seen that fill dirt is required at the fence base, the Subcontractor shall correct the condition as part of fence line maintenance. If there is a suspected breach of security, the Subcontractor shall make an immediate report to the CTM. This shall be followed by a memorandum of findings addressed to JPL Security and Protective Services with an information copy to the CTM. The Subcontractor shall remove and properly dispose of debris generated by fence line maintenance operations.

- (14) Regular Planting of Annual Flowers. The Subcontractor shall be required to plant annual flowers per Appendix A.1.13.
- (15) Erosion Control. The Subcontractor shall repair soil erosion damage by filling in washed-out and bare areas with soil to return the area to normal ground elevation using jute, erosion blankets, and/or hydro seed. Sandbags, stacked rock, and lumber and pipe structures for run-off and erosion control may be required to be constructed. Repaired areas shall be watered and otherwise cared for until normalcy is firmly established.
- (16) Prevention Programs. The subcontractor shall apply once a year fruit tree suppression on Olive trees and tree seed pod suppression on Liquidambar trees. Trees which are located in high traffic areas shall be treated.

17. Energy and Water Conservation

- a. General Requirements. The Subcontractor shall support and implement JPL's comprehensive energy and water conservation program as described in the *JPL Center Energy Efficiency and Water Conservation*. The Subcontractor's efforts shall comply with the following:

- State of California Title 24 and local requirements
- Executive Order 14057 and memoranda/guidance
- *Energy Policy Act of 2005*
- NASA directives including NPR 8570.1B–*NASA Energy and Water Management Program*, NPR 8831.2F–*Facilities Maintenance and Operations Management*.

The objective of this Section is to describe required energy and water conservation services. The Subcontractor shall proactively minimize energy and water consumption without impacting safety or mission operations and shall maximize energy- and water-use efficiency. The Subcontractor shall assist the JPL Energy Manager in promoting energy awareness at JPL. JPL personnel and JPL subcontractors are to be aware of the importance of limiting energy and water use to the fullest extent practical in order to facilitate JPL in meeting its energy and water reduction goals established by EO 14057.

The Subcontractor shall develop and maintain a program centered on the following:

- Using energy efficient equipment (consistent with *JPL Facilities Design Standard*)
 - Implementing energy-efficient practices and procedures in the normal operations and maintenance of the facilities to affect a 2.5 percent annual reduction in energy consumption
 - Upgrading facilities with energy-efficient improvements and purchasing energy consuming products that are compliant with the EPA "Energy Star" program when equipment is repaired or replaced
 - Recording and monitoring consumption monthly
 - Reading utility meters
- b. Performance Criteria. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document. Quality shall be measured by the extent to which the Subcontractor meets the goals of energy and water conservation described in the *JPL Center Energy Efficiency and Water Conservation Plan*. Subcontractor quality shall also be measured against performance of JPL progress toward EO 14057 energy and water reduction requirements. The Subcontractor shall achieve award by submitting monthly building lighting audit reports.
- c. Operation Procedures. Work shall be accomplished in accordance with the subcontractor's OPP. The objective is to meet or exceed the energy and water conservation requirements expressed in the *Center Energy Efficiency and Water Conservation Plan*, Executive Orders, and other Federal, State, and local regulations. The Plan shall address:

- (1) Procedures and schedules for achieving energy and water conservation goals and objectives
 - (2) Procedures for gathering energy consumption data (meter readings)
 - (3) Procedures for completing and submitting the monthly Energy Consumption Report
 - (4) Procedures and method for supporting the JPL energy audit
 - (5) Procedures for identifying and implementing energy and water conservation measures during normal operations and maintenance of the facilities
 - (6) Procedures for using the most energy efficient products in the execution of work under this Subcontract.
- d. Compliance. The Subcontractor shall be key in helping JPL address and satisfy the requirements of the Energy Policy Act of 2005 (EPAAct) and Executive Order 14057, which sets energy reduction and efficiency goals for Federal facilities; and with other Federal, State, and Local statutes and regulations.
- e. Energy and Water Conservation Services. The Subcontractor shall provide a point-of-contact to assist the JPL Energy Manager in performing energy management functions at JPL. The point of contact shall attend the weekly EMCS meeting outlined in this TDD. The Subcontractor shall implement the energy and water conservation program at JPL through monitoring metrics, including facility energy efficiency metrics, the amount of energy and water purchased, changes in ambient conditions, changes in plant heat balance, and changes in equipment usage and operational processes. Dynamic or historic trends shall be used to identify potential problem areas. The Subcontract work shall include performing energy and water usage audits and developing and promoting energy and water efficiency awareness programs. The Subcontractor shall perform meter reading, verification of utility bills and analyses, and maintenance and management of a computerized energy management and control system in compliance with this TDD. The Subcontractor shall provide services such as reviewing projects that may impact the energy and water conservation program, installation of high-energy-efficient equipment and devices, and representation at meetings and conferences. This work shall include:
- (1) Monthly Meter Reading. See Appendixes for lists of electrical, natural gas, and water meters. All meters shall be read within 24 hours after meter-readings by the utility companies.
 - (2) Fuel Consumption Report. The Subcontractor shall record and report the monthly fuel consumption and run-time of all generators listed in Appendix 20, *Equipment List*, within the time period shown in Exhibit 2, SDRL.
 - (3) Energy-Saving Lighting Systems. The Subcontractor shall repair or replace lighting with energy-saving lamps and components (e.g., occupancy sensors, photocells, electronic ballasts) complying with State of California Title 24 requirements. Replacement lamps and components shall be per the *JPL Facilities Design Standards*.
 - (4) Installation of Energy-Efficient Devices. The Subcontractor shall ensure compliance with Federal statutes and regulations concerning energy and water conservation requirements. These requirements include but are not limited use of efficient devices such as ultra-low-flush toilets, low-flow showerheads and water-efficient appliances.

Conservation measures shall include (but not limited to) installation of variable-speed drives, energy- efficient motors, low-flow fixtures and appliances, efficient lawn watering irrigation practices, use of low-water-use plants, and xeriscaping, whenever the need to repair or replace existing items arise.

- (5) Energy and Water Conservation Program. The Subcontractor shall participate actively in JPL's energy and water conservation program. The Subcontractor shall maximize energy efficiency and meet those goals without degradation of mission capability, quality of life, or personnel safety and health.
- (6) Computer Products Energy Star Compliance. The Subcontractor shall ensure that all computer equipment purchased for Subcontractor use on site at JPL complies with the EPA Energy Star requirements for energy efficiency in accordance with Executive Order 14057.
- (7) Energy and Water Contingency Plan. The Subcontractor shall prepare and maintain an Energy and Water Contingency Plan for JPL. The Plan shall be consistent with the operational procedures required by this TDD and shall be prepared and delivered under SDRL 9.1, which is due the first of August. Following approval, the Plan shall be included in the OPP and updated as appropriate. The Plan shall include but not be limited to emergency procedures required to be taken in instances of energy or water shortages, and other special circumstances.
- (8) Energy Audit. The Subcontractor shall record all of the energy and water that enter the facility during the year. The Subcontractor shall monitor energy and water usage (in all buildings that have electrical, natural gas, and/or water meters) and enhance conservation efforts. The Subcontractor shall provide support to the JPL Energy Manager in conducting the JPL energy and water audits of each facility listed in Appendix 19, in accordance with the OPP.
 - (a) Comprehensive Audit. The subcontractor shall perform comprehensive audits on 25% of the building square footage annually, completing a full 100% cycle every four years. Building audit list shall be provided by the JPL Energy Manager. Audit reports will have four delivery dates: December 31, March 31, June 30, and September 30. 25% of the annual 25% completion at each date is required, as specified in the audit list provided by the JPL Energy Manager. The audit involves testing and measurement to quantify energy and water uses and losses and a thorough review of energy, water, facility, demographic, environmental, and other meaningful data. The comprehensive audit shall include, but not be limited to, the following:
 1. The type and size of all equipment, energy and water use and performance of the major energy and water using systems and their interaction with the building envelope, the climate and weather influences, usage patterns and related environmental concerns.
 2. Identification of trends, changes and discrepancies with a summary of explanations of what caused the changes and discrepancies.
 3. Recommendations of upgrades with estimated costs, savings, return on investment, simple payback, and other items which will lead to the justification of the upgrade.
 4. Description of the Energy Management Computer System sequence of operations

for each major piece of equipment (chiller, boiler, air-handler units, heat pumps, multizone units, etc.). In addition, the current settings for the major pieces of HVAC equipment such as chilled water set point, CHW reset temperatures, air flow, static pressure setting, space temperature set points, boiler set points, etc..

5. Verification of a point of contact and update of building schedule(s).
 6. Summary of a year's worth of the preventative maintenance that has taken place to the chillers, air-handling units, boilers, pumps, filters, cooling towers.
- (9) Retro-commissioning. The Subcontractor shall enlist the services of a consultant to perform retro-commissioning on at least one building, with total gross square footage not to exceed 300,000 sq. ft., per FY as specified by JPL and provide retro-commissioning services to support the JPL energy program. The subcontractor shall receive and provide to JPL proposals from at least three third-party retro-commissioning consultants, with the primary individuals performing the retro-commissioning holding a Certified Commissioning Professional, Certified Building Commissioning Professional, or Certified Commissioning Authority credential. JPL shall approve the third-party consultant before any proposal is accepted. The services shall be consistent with the practices outlined in the center Energy Efficiency and Water Conservation Plan and meet the requirements specified in the *NASA Commissioning Guide For New and Existing Buildings* (November 2015) "Phase 1: RTCx Study" (pp. H-7 – H-8). SDRL delivery date September 30th of every year.
- (10) Boiler Summer Shutdown. The Subcontractor shall carry out scheduled annual Preventative Maintenance as follows:
- (a) Boiler shutdown:
 - On May 10 or per weather conditions: request boiler summer shutdown spreadsheet including specific shutdown dates from JPL Energy Manager.
 - Shut down boilers according to boiler summer shutdown spreadsheet and requested shutdown dates.
 - Enter actual shutdown dates into boiler shutdown spreadsheet and provide updated spreadsheet to JPL Energy Manager.
 - (b) Boiler startup:
 - On October 1 or per weather conditions: request boiler summer shutdown spreadsheet including specific startup dates from JPL Energy Manager.
 - Start-up boilers according to boiler summer shutdown spreadsheet and requested startup dates.
 - Enter actual startup dates into boiler shutdown spreadsheet and provide updated spreadsheet to JPL Energy Manager.

- (11) Utility Bill Verification. The Subcontractor shall review the monthly utility bill to verify consumption compared with past history and established standards. The Subcontractor shall provide an electronic copy of the utility bill verification to the relevant JPL technical points of contact as specified by JPL Section 282.
 - (12) Additional Reports. The Subcontractor shall provide additional ad-hoc reports to the CTM or JPL Energy Manager, upon request.
 - (13) Energy Savings Performance Contract (ESPC) and Utility Energy Services Contract (UESC). The Subcontractor shall comply with configuration requirements of an ESPC or UESC between JPL and a third party. The Subcontractor shall practice the energy conservation measures outlined in the respective contracts. (a) The Subcontractor shall immediately report any deviation from the operation strategy outlined in any active ESPC or UESC to the JPL Energy Manager. At that time, the Subcontractor shall also identify a root cause for the deviation and a schedule by which the system will be returned to operational compliance.
- f. Energy Management and Control System (EMCS). See Section 20 of this TDD.
 - g. Energy Savings Performance Contracts (ESPC). Any configuration changes to an ESPC sequence of operation must be approved in writing by JPL M&O Management. JPL M&O shall submit any potential modifications to NOJMO and the ESPC contractor for acceptance. Water Management. The Subcontractor shall implement a water conservation program at JPL. The Subcontractor shall develop, implement and document in the OPP a program that defines the priorities where the greatest payback and benefit would occur; water conservation baselines; how water conservation technologies and measures will be selected, funded, and implemented; and a schedule for implementing those measures on an annual basis. The Subcontractor shall ensure compliance with EPC Act 2005 and Executive Order 14057 requirements, including purchasing products in the upper quartile of energy and water efficiency.
 - (1) Oversight, Assessment, and Metrics. The Subcontractor shall monitor and assess regularly the success of the implemented water conservation program compared with the 2016 JPL water baseline. The Subcontractor shall provide the results monthly to the Subcontracts Manager in the form of the Monthly Energy Report (comprised of individual building water consumption (as available from meters); see Exhibit 2, SDRL). This assessment shall reveal the areas where measures are successful or ineffective and where program modifications are required. The assessment shall determine the program's effectiveness relative to the following: goals and established baselines, cost savings, program participation, political acceptance, public image, and supply and demand issues. Before implementing replacement measures, the Subcontractor shall submit a life-cycle cost analysis to the Subcontracts Manager for approval.
 - (2) Xeriscaping. The Subcontractor shall comply with the Executive Memorandum of April 26, 1994 on the subject of *Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds*.
 - (3) Awareness Program. The Subcontractor shall carry out the plans specified in the

OPP to increase energy and water conservation awareness. The Subcontractor shall support the JPL Energy Manager in awareness activities and efforts. An effective awareness program increases motivation toward conservation, results in proactivity, and decreases energy and water consumption.

- (4) Communication. The Subcontractor shall communicate to JPL personnel JPL's facility energy and water conservation policies and goals, on-going energy and water conservation activities and shall summarize and publicize energy and water conservation achievements. The communication effort shall provide for the conspicuous displaying of the energy and water usage data and trends in each of the top ten user buildings within 30 days of data availability. The Subcontractor will identify these buildings based on data gathered on a monthly basis. The Subcontractor shall make available to all personnel at JPL, educational materials such as newsletters, e-mail notices, homepage articles, posters and other public awareness literature that communicate conservation goals and user participation procedures.

18. Disaster and Potential Disaster Response

- a. General Requirements. The Subcontractor shall support, as necessary, the JPL Emergency Operations Center Team, the JPL Urban Search and Rescue Team, and the JPL Hazardous Materials Emergency Response Team in the event of natural and/or human-caused disasters. The Subcontractor should expect to operate within the ICS. A “disaster” is defined as a sudden calamitous event bringing great damage resulting from a Homeland Security emergency, natural disaster, criminal conduct, mass destruction, civil disturbance, major hazardous material spill or toxic release, or similar type of event as declared by the JPL Emergency Preparedness Administrator or alternate. The Subcontractor shall also work in close coordination with the JPL Fire Department, the JPL OSPO, the JPL EAPO, and/or the designated JPL Response Team Leader in case of a disaster response.
- b. Performance Criteria. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
- c. Operation Procedures. Work shall be accomplished in accordance with the subcontractor’s OPP. The OPP shall identify the requirements for responsiveness and availability based on prescribed JPL emergency response procedures and the requirements of this Technical Description Document. The OPP shall address:
 - (1) Plans for Subcontractor personnel assigned for disaster response, including areas of expertise and special skills, procedures for training/conducting drills for response personnel and ensuring their current knowledge of JPL’s facility systems
 - (2) Procedures for contacting JPL Emergency Operations Center disaster response personnel and other subcontractors in the event of a disaster and tracking labor and material usage, procedures for ensuring the availability and readiness of the Subcontractor’s personal protective equipment (PPE).
- d. Emergency Response Team. The Subcontractor, as directed by the Emergency Operations Center Team Leader, shall respond to all emergencies and disasters at JPL for all facilities and equipment for which the Subcontractor has maintenance and/or repair responsibilities per the Emergency Response Plan for Facilities Division 2800. The Subcontractor shall be responsible for isolating and making safe utilities such as electrical power, natural gas, and water during emergency and disaster situations as well as helping to mitigate additional damages. The Subcontractor shall have personnel available or on call who are familiar with JPL’s Emergency Operations Center and Incident Command Post operations in the event that these resources are utilized.
- e. PPE. The Subcontractor shall provide PPE to the Subcontractor's disaster and emergency response staff. This shall include (but not be limited to) flashlights, rain gear, safety helmets, goggles, respiratory devices, steel-tipped shoes, and gloves.
- f. Responsiveness. The Subcontractor shall respond to all disasters without regard to when they occur. The Subcontractor will be notified of the disaster by the Emergency Operations Center Team.

19. Environmental Management Support

- a. General Requirements. The Subcontractor shall comply with the requirements of the JPL Environmental Compliance Program and with established JPL Policies and procedures, during the performance of the Subcontractor's work at JPL.
- b. Performance Criteria. Workmanship and material quality shall be provided in accordance with the definitions, procedures, standards, and codes specified in Article 1, Statement of Work and this Technical Description Document.
- c. Operation Procedures. Work shall be accomplished in accordance with the subcontractor's OPP. The OPP shall address:
 - (1) Procedures and schedules for achieving compliance with environmental policies, plans, directives, etc.
 - (2) Procedures for identifying and reporting operations that may result in the generation, storage, and discharge of hazardous materials.
 - (3) Procedures for maintaining SDS files current for all materials used.
- d. Compliance. The Subcontractor shall ensure that work completed at JPL is in compliance with the *National Environmental Policy Act*, the *Resource Conservation and Recovery Act* (RCRA); the *Clean Air Act*; the *Endangered Species Act*, the *National Historic Preservation Act*, and with other statutes, regulations, instructions, and Executive memoranda.
 - (1) NEPA. For all projects that have the potential to adversely impact the environment, the Subcontractor shall submit JPL Form 39 (Request for Environmental Impact Analysis) to the CTM prior to planning and scheduling the project. Upon approval by the JPL CTM, the Subcontractor shall implement the environmental protection measures in accordance with the approved JPL Form 39.
 - (2) Air Quality. All permitting activities and contacts with the various regulatory agencies will be the exclusive responsibility of the JPL EAPO, except as directed by that office. All equipment requiring a permit from the SCAQMD shall be coordinated with the JPL EAPO at least 90 calendar days before the equipment is brought on site. Once the permit has been obtained by the JPL EAPO, the Subcontractor shall comply with all operational conditions stated on the permit including, but not limited to, ensuring the equipment has best-available air emissions control technology; maintaining monthly fuel usage and hours of operation records; paint and associated products usage records; and boiler maintenance records. Paints and associated products must comply with the volatile organic compounds (VOC) limits established by the SCAQMD. Note: There is a single Title V/RECLAIM Facility Permit issued by the SCAQMD, which may be amended up to two times annually.
 - (3) Environmental Controls. The Subcontractor shall establish and maintain internal environmental compliance controls encompassing both management and functional responsibilities for its own operations at JPL. The Subcontractor shall provide timely responses and appropriate remedial actions to address environmental requirements, and recycling.
 - (4) Natural and Cultural Resources. The Subcontractor shall comply with all applicable rules, regulations laws or other requirements, including but not limited to, the National

Historic Preservation Act (NHPA) for all work conducted at JPL. The Subcontractor shall not adversely affect historic resources at JPL whether they are eligible for, or listed on, the National Register of Historic Places.

- e. Hazardous Materials. The Subcontractor shall not perform any work on known asbestos-containing materials (ACM), asbestos-contaminated materials, materials that might release polychlorinated biphenyl (PCB) or chlorofluorocarbons (CFCs), ozone-depletion substances (ODS), radioactive materials, radioactive sources, or oil-containing PCBs or lead without prior approval from the JPL CTM.
 - (1) Business/Personal Licenses and Certification. The Subcontractor shall obtain licenses and permits required to conduct business and to handle, store, package, transport, transfer, or otherwise interact with hazardous materials.
 - (2) HAZMAT Training and Certification. The Subcontractor shall ensure that all employees directly involved with the handling, packaging, storage, shipping, receiving and transportation of hazardous materials are trained and certified in HAZMAT operations in accordance with Federal, State, and Local laws and regulations.
 - (3) Hazardous Materials Notification. The Subcontractor shall notify the CTM in writing of all known usage and disposal of hazardous materials including, but not limited to, areas of asbestos contamination, PCB equipment, lead-based paint, CFC chillers, ODSs, and radioactive sources. These records shall be updated within 30 calendar days after discovery, disturbance, or removal of any hazardous material. The Subcontractor shall annually provide reportable quantities for hazardous materials equal to or greater than:
 - 55 gallons of a liquid
 - 500 pounds of a solid
 - 200 cubic feet of a compressed gas
 - A hazardous compressed gas in any amount
 - Extremely hazardous substances above the threshold planning quantities (TPQs)
 Quantities shall be provided to EAPO at the beginning of each calendar year.
 - (4) Asbestos Management and Documentation. The Subcontractor shall abate, remediate, and/or encapsulate friable ACM encountered during the course of performing normal maintenance work. The Subcontractor shall record and submit a report of any changes to the ACM to the JPL CTM.
 - (5) ODS. The Subcontractor shall implement policies to reduce ODS emissions, shall recycle ODSs, and shall not procure products containing or manufactured with ODSs. The Subcontractor shall maintain an inventory of ODSs in accordance with Executive Order 12893, tracking use, loss, and disposal and shall report monthly to the CTM in a format approved by the JPL EAPO. A complete list of all systems containing ODS shall be maintained by contractor in Maximo.
 - (6) Hazardous Material Cleanup. The Subcontractor's trained personnel, under the direction of the JPL EAPO, shall clean up any hazardous material spills that result from the performance of the Subcontractor's responsibilities under this Subcontract.

- (7) Hazardous Waste. The Subcontractor shall ensure that all hazardous waste has either laboratory analysis data that documents the chemical content or a generator's signed documentation that identifies the chemical contents of the waste prior to disposal.
 - (a) The Subcontractor shall dispose of all hazardous waste generated through routine operations in a manner approved by the JPL CTM.
 - (b) The Subcontractor shall document the waste type, collection start date, quantity, location, and personnel/Subcontractor/organization and agency responsible for generating the waste, and shall submit reports to the JPL EAPO in an approved format.
 - (c) Subcontractor personnel shall wear or use PPE such as clothing, respiratory devices, protective shields, etc., appropriate to the task being performed.
- f. Recycling. The Subcontractor shall adhere to the JPL recycling program policies and procedures.
- g. Reporting. The Subcontractor shall report any identified environmental protection problems to the JPL CTM.
- h. Liability. The Subcontractor shall reimburse JPL for any monetary fines paid by JPL to regulatory agencies for environmental violations caused by the Subcontractor.

20. Energy Management Control System Hardware and Software Configuration Control

- a. General. The JPL Energy Management Control System (EMCS also referred to as BMS, OT/ICS, SCADA) shall be operated and maintained as a joint effort between the Subcontractor and JPL Facilities EMCS Engineering. The JPL EMCS consists of front-end computer systems that are networked to Tridium Niagara JACEs and Zigbee Wireless Gateways in buildings, which are networked using a serial field bus technology such as LON, BACnet, or Modbus to controllers used to control building HVAC systems. JPL and the subcontractor will administer the front-end software, computers, and field equipment. The Subcontractor, using JPL-provided workstations, shall be responsible for EMCS monitoring, troubleshooting, maintenance and repair of all EMCS hardware and software including field panels and all associated control devices. Additionally, the Subcontractor shall be responsible for after-hours system operation, monitoring, repair, and alarm response. The Subcontractor will also support JPL EMCS Operations in the administration of the front-end software as detailed in section b. Roles / Descriptions below. All work performed on the EMCS by the Subcontractor shall be in compliance with the JPL EMCS/BAS Controls Requirements document available from JPL Document Control.
- b. Roles / Descriptions. All software installation, modifications, or configuration of the workstations, Niagara Supervisors will be jointly performed by JPL EMCS operations and the Subcontractor. The Subcontractor will support modifications and configuration changes to the software only after receiving written authorization from JPL Facilities EMCS Engineering. JPL EMCS Engineering shall solely be responsible for the authorization of additions / deletions of EMCS users including level of EMCS system rights. The Subcontractor will submit EMCS user and level of rights changes to JPL Facilities EMCS Engineering as required. JPL Facilities EMCS Engineering will be responsible for performing the following tasks as well as authorizing and/or requesting the Subcontractor to support specific tasks within JPL Facilities EMCS Engineering's scope of responsibilities:
 - (1) New/Retro-fit design, system integration, commissioning and acceptance.
 - (2) System configuration
 - (3) Demand response configuration
 - (4) Integration of energy consumption and monitoring tracking software for reporting
 - (5) System standards and device specifications.
 - (6) System operational changes, scheduling, setpoints, etc.
 - (7) Trending/alarm configuration
 - (8) Graphic generation, as needed
 - (9) After-Hours request processing and implementation
 - (10) Auto-Demand response implementation
 - (11) Uploading and control as-builts for web access etc.
 - (12) Password issuing and maintenance to appropriate personnel

The Subcontractor shall:

- (1) Provide EMS Programming support to JPL Facilities EMCS Engineering in support of items 1-3, 6-14 above.
- (2) Troubleshoot and repair all EMCS-related controls and systems.
- (3) Acknowledge and respond to alarms
- (4) Generate TCs, to be identified and discussed during the weekly EMCS meetings.
- (5) Utilize interactive display for daily duties. The Subcontractor shall not change system programming or graphics unless authorized by JPL Facilities EMCS Engineering.
- (6) The Subcontractor shall advise/notify, via email to JPL Facilities EMCS Engineering on any proposed system programming or graphics change and/or modification being considered for approval by JPL Facilities EMCS Engineering.
- (7) Monitor workstations for system irregularities, alarms, etc.
- (8) Maintain and update mechanical equipment down list.
- (9) Procure and manage weekly status EMCS meeting and, agenda and list of items for discussion.
- (10) The M&O contractor shall maintain a daily operational log at each command center location (B200 & B230). All anomalies shall be documented as they occur or no later than at the end of each shift and communicated to JPL Facilities EMCS Engineering and others as requested via email.
- (11) Data from Critical areas which are to be alarmed 24/7 shall be recorded and managed using the “critical building notification list”. The lists are to be posted in the EMCS Control Rooms and updated by the M&O subcontractor. The list shall be updated no less than annually or as changes occur. The list of areas can vary based on location of flight hardware or on-going projects. As of 3/4/25 the areas of interest include; B103/144/150/179/230/233/264/300/302/306/318/355 and data centers at B126 and B171).
- (12) Maximo work orders shall be created for all issues that cannot be fully addressed by the EMCS operators in real time within two hours. All associated Niagara Alarm Records shall be annotated in the Notes field with the Work Order Number.
- (13) Maintain critical alarm monitors located in B200 EMCS room and SFOF operations room. Displays shall be on and with live data 24/7.

c. Categories / Descriptions

- (1) Workstations.
 - (a) Three Niagara Supervisors, and one Niagara Workstation will be provided to the M&O Subcontractor for use in Building 200 for day-to-day monitoring and operation of the Energy Management and Control System(s).

- (b) One Niagara workstation will be provided to the M&O Subcontractor for use in Building 230 for after-hours building monitoring, operation, and alarm response.
 - (c) JPL supplied laptops licensed as Niagara engineering tools with the Niagara Workbench shall be furnished by the M&O Subcontractor for use in maintaining the EMCS.
- (2) Event Log / (Digital) Equipment Down List. Maintained by the M&O Subcontractor in digital format, the event log captures all system events such as system alarms and equipment failures. The event log shall reflect TC priority level. The Equipment down list shall be updated during weekly system status meetings and on case by case basis upon approval from JPL Facilities EMCS Engineering.
 - (3) Weekly Meeting. JPL Facilities EMCS Engineering and the Subcontractor shall meet weekly to discuss system events, configuration issues, upcoming projects, and designs and collaborate on system integration and upkeep.
 - (4) Repair Protocols. The Subcontractor shall be responsible for all field repairs, warranty issues, and troubleshooting. The subcontractor shall perform system software updates, troubleshooting and tuning. The Subcontractor shall utilize JPL-provided EMCS workstations to assist with field response TC generation, etc.
 - (5) Fieldwork / Warranty Issues. Field troubleshooting shall be performed by the Subcontractor on EMCS controllers and devices. The Subcontractor shall replace and repair equipment when required. The Subcontractor shall pursue warranty issues. The Subcontractor shall inspect equipment and determine if warranty repair is applicable. The Subcontractor shall enter a TC into the CMMS for warranty repair on any system hardware or software and related issues identified by JPL. The Subcontractor shall be responsible for all warranty issues. The subcontractor will be responsible for the repair/replacement of controllers, JACEs, ancillary devices, sensors, relays, instrumentation, etc. for all warranty issues. The subcontractor will be responsible for the repair/replacement of DDC Controllers, JACEs, Power Supplies, Sensors, Instrumentation, control devices, etc.
 - (6) Server Maintenance and IT. JPL Facilities EMCS Engineering will address networking issues with the JPL Ethernet Backbone and JPL owned computer hardware and operating system issues. The Subcontractor will be responsible to maintain the current patch level for Windows Updates for all PCs which support the EMCS and for maintaining JPL and NASA Cybersecurity compliance. The Subcontractor shall be responsible for notifying JPL of any observed system IT issues. The Subcontractor will also be responsible to maintain the current software/firmware patch levels for all ancillary controllers in the EMCS Framework.
 - (7) Alarm Response. The Subcontractor shall digitally track alarms with the Tridium Niagara web-enabled alarm portal monitoring system. Critical alarms shall generate appropriate level TCs for Subcontractor response. All alarms shall be acknowledged within one minute and not more than five unacknowledged alarms at any one time shall be present on the Niagara Alarm Console. No Off Normal alarms shall remain on the Niagara Alarm Console for more than fourteen days. All Alarm Records that remain

on the Niagara Alarm Console for longer than two hours shall have a Work Order Number assigned and noted in the Notes for the specific Alarm Record.

- (8) System Configuration. System configuration (graphics, trends etc.) will be performed by JPL Facilities EMCS Engineering and the subcontractor. The Subcontractor shall provide system configuration and programming support, as appropriate. The Subcontractor shall not make physical or logical changes to the EMCS without written authorization by JPL Facilities EMCS Engineering.
- (9) After-Hours Air Conditioning Requests. The Subcontractor shall utilize the JPL online HVAC request system. The JPL Energy Manager will maintain the HVAC request system and process requests.
- (10) Training. The Subcontractor shall provide training as needed, based on upgrades and/or changes to the EMCS made by the M&O Subcontractor. JPL Facilities EMCS Engineering will engage the Subcontractor to schedule training for relevant personnel. The Subcontractor shall provide a minimum of two Niagara 4 TCP and Distech 6001 Certified operators, each operator shall have a minimum 5 years hands-on EMCS Integration experience.

d. EMCS Access

The JPL Facilities EMCS Engineering ISO must approve all access to the EMCS. Several levels of access can be granted from “read-only” level access to a full “M&O Admin” access level. Access will be granted based on qualifications set forth by JPL Facilities EMCS Engineering. Each category shall provide the user the level of access to the EMCS as needed to perform the authorized work. Categories are as follows:

- 1) M&O Admin: Personnel that meet these qualifications: Tridium Niagara TCP and Distech 6001 Certified, acquire a JPL badge, JPL domain username, password, email address RSA token, and have a NASA LOC 50 (MBI) Security Clearance.
- 2) HVAC Users: This category is predominantly for JPL HVAC Maintenance and Operations technicians.
- 3) Read-Only: This category is for building managers that have a need to monitor building functions to support critical flight activities such as Space Flight Operations, Environmental Testing, and Spacecraft Assembly Facilities.

e. User List

The M&O Subcontractor’s user list shall be maintained by the Maintenance and Operations contractor EMCS Administration. Additions to the list must be approved by the JPL Facilities EMCS System Information System Owner (ISO). Upon notification of an affiliate leaving the employ of the M&O Contractor, or an installing contractor JPL shall be notified immediately and the user will be removed. JPL Facilities EMCS Engineering ISO and the M&O EMCS Administration shall review the users list quarterly.

f. Passwords

All users are required to utilize a password that is consistent with Niagara “Strong Password” requirements: 8 alphanumeric characters.

g. Lockout

Users shall be locked out in the event that an incorrect password is entered 3 times within a 5-minute time span. The automatic lockout duration shall be 168 hours or until JPL Facilities EMCS Engineering ISO clears the lockout.

h. JPL IT Security Requirements

The M&O Subcontractor must comply with all applicable JPL, NASA, and NIST Cybersecurity Requirements.

i. Physical Security

EMCS Network Controllers (JACEs) which are connected to the JPL Ethernet Infrastructure shall be located behind locked doors, gates, or in locked enclosures to prevent unauthorized access. All locks to the EMCS equipment shall be keyed to a “UM” key by the JPL lock shop. Any wireless or Optical Ethernet connectivity shall be disabled. When authorized personnel are not in the immediate vicinity of the Network Controllers, access shall be limited by locking the doors, gates or enclosures. Any change of devices or nodes connected to the JPL Ethernet infrastructure shall be coordinated with JPL Facilities EMCS Engineering. Removed devices such as JACEs shall be turned over to JPL Facilities EMCS Engineering for disposal. Any time the MAC address of a node/device changes that must be immediately communicated to JPL Facilities EMCS Engineering.

j. Configuration Control

The JPL EMCS/SCADA is under NASA required configuration change control. Any proposed modifications will be submitted to JPL Facilities EMCS Engineering in the format required by JPL Document Control for review and approval by the EMCS/SCADA Change Control Board. Only in the event to protect life or property shall changes be made “on the fly” and immediate notification of JPL Facilities EMCS Engineering shall occur.

21. Power Control Console System Configuration Control

- a. General Requirements. The SFOF's Power Control Center (PCC) Console system monitors and controls various power requirements and equipment in Buildings 230 and 264 through the use of customized software and specialized hardware. When a power outage occurs, or when the line power source is unstable, the PCC Console must detect these conditions and start the electrical generators and establish synchronized and stable power to these two buildings.

In order for the PCC Console to be available and reliable 24 hours a day, 7 days a week (24×7), the Subcontractor shall provide a qualified system programmer/control engineer (SP/CE), knowledgeable in the control logic of the PCC Console software and its interface with the electrical systems to perform periodic tests and maintain and repair the PCC Console according to the manufacturer's maintenance and repair guidelines.

- b. SP/CE Requirements. Any software installation, modifications, or programming on PCC Console workstations shall be performed solely by the Subcontractor SP/CE. The SP/CE shall have at least 3 years of relevant technical experience and training to fully understand the electrical systems in Buildings 230 and 264, logic ladders, programmable logic computers (PLC), and power-loss programming and shall have access to other personnel who have special knowledge of this system. The SP/CE shall also have general knowledge of how the workstations interface with power breakers and generators, i.e., in terms of control voltages, relays, and interface panels.
- c. Workstation Configuration. The SFOF workstations (in B230-47) will be provided by JPL and shall be configured to run and generate alarms via the monitor and printer on a 24×7 basis. These workstations shall also be properly configured to control the automatic startup and control of the engine/generators and associated power breakers on a 24×7 basis. Each workstation shall be configured to have the capability to operate in either automatic or semi-automatic mode. The normal system configuration shall be for automatic operation during loss of power transfer to generator and semi-automatic transfer back to utility upon restoration of power.
- d. Additions, Deletions, or Modifications to Hardware or Software. Additions, deletions, or modifications to PCC Console hardware or software shall require prior written approval from the JPL CTM. Upon approval, the changes shall be performed by the SP/CE.
- e. Database Maintenance. Access to the PCC Console shall be restricted to only the SP/CE and the CTM designee for the purposes of system database maintenance and report extraction. The SP/CE shall backup all data and ensure data integrity prior to and after modifications or every month, whichever occurs sooner.
- f. Server Maintenance. Server maintenance shall be performed in accordance with Appendix A.1.
- g. System Access. PCC Console workstation operation shall be restricted to the SP/CE and qualified JPL-approved operators. The operators shall be provided with individual login names and passwords to maintain system integrity.

22. Power Measurement System Configuration Control

In an effort to monitor power quality and energy loading at the Laboratory, JPL has installed the EcoStruxure Power Monitoring Expert System by Schneider Electric to track and record the electrical loads on selected banks and substations. The purpose of this document is to convey the importance of maintaining the configuration of the PML server and associated equipment.

- a. Power Measurement System (PMS) System Administrator. It is necessary that the PMS be checked and maintained by a Subcontractor system administrator (SA) with EcoStruxure Power Monitoring Expert software experience (or equivalent). The SA duties will include notification of system issues to JPL, and routine checks for system and field consistency. Maintenance of the PMS shall be coordinated by the subcontractor in cooperation with the JPL SA and CTM. Also included in this responsibility is the installation, maintenance, and repair of the I/O modules, and PMS communication features in the power meters monitoring the building consumption and power quality in the field.
- b. Programming, Graphics, Point Additions, Deletions, or Modifications. The Subcontractor is to report to JPL SA any system discrepancies between the field and system diagrams. The subcontractor is responsible for monitoring the system and addressing any electrical load issues that arise.

All physical changes to the monitored electrical equipment shall be approved by the JPL SA and CTM and require updates (graphics and point information/parameters) in the Power Logic system. Should the JPL SA determine external resources be utilized the subcontractor is to administer the action. Updating the graphics or point information shall occur no more than two weeks after a change has been affected in the field.

- c. Server Maintenance. EcoStruxure Power Monitoring Expert software resides on JPL institutional servers with no subcontractor interaction. The server hardware is supported entirely by JPL.
- d. System Access. EcoStruxure Power Monitoring Expert software is web enabled such that any JPL intranet-enabled PC can access the system with various levels of access determined by the JPL SA.

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Appendix A.1 Job Plans (PMs)

Appendix A.1.1 Cafeteria Equipment PM

1	AIR SCREEN	ANNUAL
1.1.	CHECK BEARINGS AND LUBE PER MFG. RECOMMENDATIONS.	
1.2.	CLEAN BLOWER WHEEL(S).	
1.3.	CLEAN INTAKE AND SUPPLY LOUVERS.	
1.4.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
1.5.	OPERATE AND CHECK FOR EXCESSIVE VIBRATION.	
1.6.	SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
2	BEVERAGE DISPENSERS (JUICE/COKE MACHINES)	SEMI-ANNUAL
2.1.	CALIBRATE /REPAIR/REPLACE OPERATING THERMOSTAT.	
2.2.	CALIBRATE /REPAIR/REPLACE SAFETY CONTROLS.	
2.3.	CHECK FOR PROPER OPERATION.	
2.4.	CHECK WATER FILTER - REPLACE AS NEEDED.	
2.5.	CLEAN /INSPECT/REPAIR/REPLACE CONDENSATE PAN AND DRAIN LINES.	
2.6.	CLEAN CONDENSERS.	
2.7.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
2.8.	INSPECT/REPAIR/REPLACE ALL OPERATOR SAFETY ITEMS.	
2.9.	LEAK CHECK/REPAIR WATER /CO2/ LINE.	
2.10.	LUBRICATE/REPAIR/REPLACE FAN MOTORS.	
2.11.	REPAIR REFRIGERANT LEAKS.	
2.12.	SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
3	COFFEE URNS/COFFEE MAKERS/ICE TEA MAKERS	QUARTERLY

3.1.	INSPECT/REPAIR/REPLACE ALL OPERATOR SAFETY ITEMS.	
3.2.	INSPECT/REPAIR/REPLACE ELECTRICAL CORDS AND SWITCHES.	
4	DISHWASHER	MONTHLY
4.1.	CALIBRATE / REPAIR/ REPLACE OPERATING SAFETY CONTROLS.	
4.2.	CHECK FOR PROPER OPERATION.	
4.3.	CHECK FOR PROPER WATER TEMP. - 180° F.	
4.4.	INSPECT/REPAIR/REPLACE ALL OPERATOR SAFETY ITEMS.	
4.5.	INSPECT/REPAIR/REPLACE SEALS ON PUMPS.	
5	GARBAGE DISPOSER	QUARTERLY
5.1.	CHECK FOR PROPER OPERATION.	
5.2.	INSPECT/REPAIR/REPLACE ALL OPERATOR SAFETY ITEMS.	
5.3.	INSPECT/REPAIR/REPLACE ELECTRICAL CORDS AND SWITCHES.	
5.4.	INSPECT/REPAIR/REPLACE MOTOR	
6	GAS-FIRED/ELECTRIC APPLIANCES (GRILLS, OVENS, COOKERS, WELLS, WARMERS) 3 MONTHS	QUARTERLY
6.1.	(IF APLLICABLE) CLEAN/ /REPAIR/REPLACE GAS BURNERS.	
6.2.	(IF APLLICABLE) INSPECT/REPAIR/REPLACE GAS REGULATING VALVES.	
6.3.	(IF APLLICABLE) INSPECT/REPAIR/REPLACE PILOT ASSEMBLY.	
6.4.	(IF APLLICABLE) LEAK CHECK/REPAIR GAS LINES.	
6.5.	CALIBRATE /REPAIR/REPLACE OPERATING THERMOSTAT.	
6.6.	CALIBRATE /REPAIR/REPLACE SAFETY CONTROLS.	
6.6.1.	CHECK FOR PROPER OPERATION.	

6.7.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
6.8.	INSPECT/REPAIR/REPLACE ALL OPERATOR SAFETY ITEMS.	
6.9.	INSPECT/REPAIR/REPLACE ELECTRICAL CORDS AND SWITCHES.	
6.10.	SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
7	GREASE HOODS/PIZZA OVEN	QUARTERLY
7.1.	CLEAN GREASE HOODS/PIZZA OVEN IN ACCORDANCE WITH NFPA 96, 11.3 AND 11.4.	
7.2.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
8	ICE MACHINES (ANNUAL)	SEMI-ANNUAL
8.1.	CHECK ALL JOINTS AND FITTINGS FOR LEAKS AND CORROSION - REPAIR AS NECESSARY.	
8.2.	CHECK CONTACTORS, RELAYS, AND WIRING. CLEAN AS NECESSARY.	
8.3.	CHECK OPERATION OF HARVEST/DEFROST SYSTEM.	
8.4.	CHECK WATER FILTER - REPLACE AS NEEDED.	
8.5.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
8.6.	SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
9	ICE MACHINES (QUARTERLY)	QUARTERLY
9.1.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
9.2.	SANITIZE ICE BIN	
9.3.	SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
10	MIXERS/SLICERS/BLENDERS	QUARTERLY

10.1.	INSPECT/REPAIR/REPLACE ALL OPERATOR SAFETY ITEMS.	
10.2.	INSPECT/REPAIR/REPLACE ELECTRICAL CORDS AND SWITCHES.	
11	PIZZA OVENS	QUARTERLY
11.1.	CALIBRATE /REPAIR/REPLACE THERMOSTATS AND SAFETIES.	
11.2.	CHECK FOR PROPER OPERATION.	
11.3.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
11.4.	INSPECT/REPAIR/REPLACE ALL OPERATOR SAFETY ITEMS.	
11.5.	INSPECT/REPAIR/REPLACE BURNERS.	
11.6.	INSPECT/REPAIR/REPLACE GAS REGULATING VALVES.	
11.7.	INSPECT/REPAIR/REPLACE PILOT ASSEMBLY.	
11.8.	INSPECT/REPAIR/REPLACE REFRACTORY.	
11.9.	SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
12	REFRIGERATORS	SEMI-ANNUAL
12.1.	CALIBRATE /REPAIR/REPLACE THERMOSTATS AND SAFETIES.	
12.2.	CHECK FOR PROPER OPERATION.	
12.3.	CHECK OPERATING REFRIGERANT CHARGE.	
12.4.	CLEAN /INSPECT/REPAIR/REPLACE CONDENSATE PAN AND DRAIN LINES.	
12.5.	CLEAN EVAPORATOR/CONDENSOR.	
12.6.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
12.7.	DOOR AND CASE GASKETS / REPLACE IF WORN DAMAGED OR LEAKING	
12.8.	LUBRICATE FAN MOTORS.	
12.9.	REPAIR REFRIGERANT LEAKS.	

12.10.	SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
13	SANITIZING SYSTEM, HIGH PRESSURE - ANNUAL MAINTENANCE	MONTHLY
13.1.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
13.2.	DE-LIME AS NECESSARY.	
13.3.	INSPECT ALL QD PLUGS AT THE MACHINE AND AT REMOTE PANELS FOR EXCESSIVE WEAR. REPLACE IF DENTED OR DAMAGED.	
13.4.	INSPECT FITTINGS AND HOSES FOR LEAKS. TIGHTEN OR REPLACE IF NECESSARY.	
13.5.	INSPECT FLOAT TANK. FLOAT VALVE SHOULD OPEN AS WATER LEVEL DROPS.	
13.6.	INSPECT TWO FILTER SCREENS. CLEAN OR REPLACE AS NECESSARY.	
13.7.	REBUILD THE BYPASS UNLOADER VALVE WITH APPROVED UNLOADER REBUILD KIT. SEE INSTRUCTION MANUAL.	
13.8.	REBUILD THE HIGH-PRESSURE PUMP WITH APPROVED VALVE KIT. SEE INSTRUCTION MANUAL.	
13.9.	REPLACE THE MACHINE OIL. TAKES @ 1.25 PINTS OF SAGE SYSTEM OIL OR ANY ISO VG68 OIL.	
13.10.	SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
14	TOASTER/TOASTER CONVEYOR	QUARTERLY
14.1.	CHECK FOR PROPER OPERATION.	
14.2.	INSPECT/REPAIR/REPLACE ELECTRICAL CORDS AND SWITCHES.	
14.3.	INSPECT/REPAIR/REPLACE OPERATOR SAFETY ITEMS.	
15	TRAY CONVEYOR	MONTHLY
15.1.	CHECK FOR PROPER OPERATION.	

15.2.	INSPECT/REPAIR/REPLACE ALL OPERATOR SAFETY ITEMS.	
15.3.	INSPECT/REPAIR/REPLACE CONVEYOR BELT.	
15.4.	INSPECT/REPAIR/REPLACE CONVEYOR DRIVES.	
15.5.	INSPECT/REPAIR/REPLACE GEAR BOX.	
15.6.	INSPECT/REPAIR/REPLACE MOTOR.	
15.7.	LUBE WHERE NECESSARY.	
16	UNDER-COUNTER REFRIGERATION UNITS AND DISPLAY CASES	SEMI-ANNUAL
16.1.	CALIBRATE /REPAIR/REPLACE THERMOSTATS AND SAFETIES.	
16.2.	CHECK FOR PROPER OPERATION.	
16.3.	CHECK OPERATING REFRIGERANT CHARGE.	
16.4.	CLEAN /INSPECT/REPAIR/REPLACE CONDENSATE PAN AND DRAIN LINES.	
16.5.	CLEAN EVAPORATOR/CONDENSOR.	
16.6.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
16.7.	DOOR AND CASE GASKETS / REPLACE IF WORN DAMAGED OR LEAKING	
16.8.	LUBRICATE FAN MOTORS.	
16.9.	REPAIR REFRIGERANT LEAKS.	
16.10.	SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
17	WALK-IN BOXES	SEMI-ANNUAL
17.1.	CALIBRATE /REPAIR/REPLACE THERMOSTATS AND SAFETIES.	
17.2.	CHECK FOR PROPER OPERATION.	
17.3.	CHECK OPERATING REFRIGERANT CHARGE.	
17.4.	CLEAN /INSPECT/REPAIR/REPLACE CONDENSATE PAN AND DRAIN LINES.	
17.5.	CLEAN EVAPORATOR/CONDENSOR.	

17.6.	Clean up area and ensure all Maintenance materials and debris are removed properly.	
17.7.	DOOR AND CASE GASKETS / REPLACE IF WORN DAMAGED OR LEAKING	
17.8.	LUBRICATE FAN MOTORS.	
17.9.	REPAIR REFRIGERANT LEAKS.	
17.10.	SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	

Appendix A.1.2 **Carpentry PM**

CARPENTRY PM	
1. INSPECTION AND REPAIR OF BUILDINGS AND TRAILERS (PRIOR TO RAINY SEASON AND DURING RAINS AS NEEDED OR DIRECTED BY THE CTM OR DESIGNATE)	ANNUAL
1.1. INSPECT AND REPAIR LADDERS, VENTS, DUCTWORK, HATCHES, CATWALKS, GUARDRAILS AND HANDRAILS.	
1.2. INSPECTION AND REPAIR OF AWNINGS, EXTERIOR and interior DOORS, WINDOWS, SCREENS, AND CAULKING.	
1.3. INSPECTION AND REPAIR OF INTERIOR FLOOR COVERING, STAIRWAYS/ WALKWAYS FOR LOOSE TREADS, WORN NON-SKID MATERIAL, BROKEN STEPS, WEAK WOOD.	
1.4. REPORT AND REPAIR ANY SAFETY HAZARDS AND TERMITE DAMAGE AND RECORD IN THE CMMS.	
2. SAFETY INSPECTION AND REPAIR OF TRAILERS	ANNUAL
2.1. CHECK, SECURE, AND/OR REPLACE ALL DETERIORATED BRACING ON THE UNDERPINNING OF TRAILERS, PLYWOOD PADS, PLATFORMS AND LANDINGS.	
2.2. CHECK POSTS (4" X 4"), STAIRWAYS, STRINGERS ON STAIR TREADS, AND 2" X 4" HAND RAILINGS.	
2.3. CHECK CABLING FOR TIE DOWNS.	
2.4. REPORT AND REPAIR ANY SAFETY HAZARDS AND RECORD IN THE CMMS.	
3. MAINTENANCE AND REPAIR OF TEAK FURNITURE	
3.1. REFINISH ALL TEAK CHAIRS, TABLES AND BENCHES	ANNUAL
3.2. INSPECT/REPAIR ANY FURNITURE/ UMBRELLAS AS NEEDED	AS NEEDED
3.3. CLEAN/STORE ALL UMBRELLAS/BASES PRIOR TO SEASONAL STORAGE. REPLACE IN ORIGINAL LOCATION.	SEMI- ANNUAL
3.4. INVENTORY/PLACEMENT OF TEAK FURNITURE IN HIGH-PROFILE LOCATIONS	MONTHLY
4. DEER FENCE	SEMI- ANNUAL
4.1. INSPECT FENCE FOR GAPS BETWEEN GROUND AND BOTTOM OF FENCE. ELIMINATE ALL GAPS SUFFICIENT FOR DEER TO PASS THROUGH. JPL CTM OR DESIGNATE SHALL BE THE AUTHORITY AS TO WHETHER A DEER CAN PASS UNDER A FENCE.	
4.2. INSPECT FOOTINGS/POSTS FOR EROSION AND INSTABILITY. REPAIR/REPLACE FOOTINGS AND POSTS IF NEEDED.	
4.3. INSPECT FABRIC, TENSION WIRE, GATES, AND HASPS. REPAIR/REPLACE IF NEEDED. TIGHTEN FENCING AS DIRECTED BY JPL CTM OR DESIGNATE.	

Appendix A.1.2.1 Roof Inspection PM

ROOF INSPECTION PM		
1. INSPECT AND REPAIR ROOFS (SKYLIGHTS, PARAPET CAPS, PITCH PANS, BASE FLASHINGS, CRACKS, BLISTERS, BUCKLES, AND SPLIT SEAMS, ROOF DRAINAGE, GUTTERS, DOWNSPOUTS AND SCUPPERS), CAULK AS NECESSARY USING MANUFACTURERS SPECIFICATIONS. REMOVE ALL ROOF DEBRIS AND CLEAN DRAINS, ROOF PM WILL BE PERFORMED ANNUALLY UNLESS OTHER WISE STATED BELOW.		ANNUAL
1.1 SEMI-ANNUAL (NOV. AND MAY) ROOF PM BUILDINGS: BLDG. NO. DESC. 82 HIGH VACUUM LABORATORY 83 QUALITY ASSURANCE 84 CHEMICAL MATERIALS LABORATORY 107 LASER RESEARCH LABORATORY 114 ADMINISTRATION 121 ANALYTICAL INSTRUMENTS LABORATORY 126 INFORMATION SYSTEMS DEVELOPMENT 157 APPLIED MECHANICS 167 CAFETERIA 183 PHYSICAL SCIENCES LABORATORY 202 PROCUR. & COMMUNICATIONS SUPPORT 233 SYSTEMS DEVELOPMENT 249 VISITORS RECEPTION 298 FREQUENCY STANDARDS LAB 302 MICRODEVICES LABORATORY		SEMI-ANNUAL
1.2 TRI-ANNUAL (NOV. AND MAY) ROOF PM BUILDINGS: BLDG. NO. DESC. 103 ELECTRONIC FABRICATION SHOP 111 TECHNICAL INFORMATION 186 PUBLIC OUTREACH ADMINISTRATION 277 ISOTOPE THERMOELECTRIC SYS. LAB.		SEMI-ANNUAL

Appendix A.1.3

Crane PM

CRANE PM	
1. CRANE AND HOIST MAINTENANCE	ANNUAL
1.1. LUBRICATE BEARINGS - DO NOT OVER GREASE.	
1.2. PERFORM RATED LOAD TEST AT 100% LOAD ON CRITICAL HOIST AND CRANES AND TITLE 8, SUBCHAPTER 7, GROUP 13 OF STATE OF CALIFORNIA CODE.	
1.3. CHECK UNIT FOR LOOSE BOLTS & RIVETS. CHECK FOR WORN DRUMS OR SHEAVES.	
1.4. CHECK CABLE/CHAIN FOR WEAR OR DAMAGE.	
1.5. CHECK BLOCK HOOK & SAFETY LATCH FOR CRACKS, BROKEN OR MISSING HARDWARE.	
1.6. CONDUCT ANNUAL INSPECTION PER TITLE 8, SUBCHAPTER 7, GROUP 13 OF STATE OF CALIFORNIA CODE OR LATEST CODE.	
1.7. DYE PENETRANT LOAD HOOKS	
1.8. 100% LOAD TEST FOR ALL CRITICAL CRANES AND HOIST	
1.9. INSPECT MOTOR BRAKES AND ADJUST AS REQUIRED. OPERATIONAL TEST ALL BRAKES FOR POSSIBLE NEED OF REPLACEMENT OF BRAKE LININGS, BRAKE SHOES, DISCS.	
1.10. OPEN CONTROL BOXES AND CHECK ALL CONTACTS FOR WEAR AND ADJUSTMENT.	
1.11. INSPECT COLLECTOR SHOES, BRUSHES OR WHEELS FOR ARCING AND/OR WEAR.	
1.12. INSPECT COLLECTOR SHOES, BRUSHES OR WHEELS FOR ARCING AND/OR WEAR.	
1.13. INSPECT ALL EQUIPMENT OIL/LUBE RESERVOIR LEVELS; ADD OIL/LUBE AS REQUIRED; REPORT ANY EXCESSIVE LEAKAGE.	
1.14. VISUALLY INSPECT CABLES, SHEAVES, AND DRUMS FOR WEAR, PROPER CONDITION, AND LUBRICATION.	
1.15. INSPECT LOAD BLOCK AND HOOK FOR DISTORTION AND EXCESSIVE WEAR.	
1.16. INSPECT HOISTS AND TROLLEY FRAMES, CATWALKS, AND HANDRAILS FOR LOOSE BOLTS, BROKEN PARTS, MISALIGNMENT AND BROKEN WELDS.	
1.17. INSPECT SAFETY EQUIPMENT AND ACCESSORIES (e.g. LIMIT SWITCHES) FOR PROPER OPERATIONS, AND ADJUST AS NECESSARY.	
1.18. INSPECT MOTORS, COUPLINGS AND EXTERNAL WIRING FOR WEAR AND DETERIORATION.	
1.19. INSPECT ACCESSORY EQUIPMENT FOR GENERAL CONDITION AND REPAIR.	
1.20. INSPECT END STOPS, RAIL SWEEPS, DROP LUGS, AND SHOCK ABSORBING BUMPERS FOR GENERAL CONDITION.	
1.21. VISUALLY INSPECT CONTROL FUNCTIONS ON VARIABLE AND/ OR SINGLE SPEED CRANES (e.g., PUSH BUTTONS AND CONTACTORS) FOR SMOOTHNESS OF TRAVEL.	

CRANE PM	
1.22. INSPECT FOR OIL LEAKS AND MECHANICAL IRREGULARITIES NOT PREVIOUSLY REPORTED.	
1.23. VERIFY FINAL UPPER LIMIT SWITCH.	
2. CRANE TESTING AND INSPECTION	QUADRENNIAL
2.1. PROOF TEST, INSPECT, CERTIFY PER TITLE 8, SUBCHAPTER 7, GROUP 13 OF STATE OF CALIFORNIA CODE. 100% LOAD FOR 3 TONS & UNDER, 125% OVER 3 TONS	
2.2. CHECK UNIT FOR LOOSE BOLTS & RIVETS. CHECK FOR WORN DRUMS OR SHEAVES.	
2.3. CHECK CABLE/CHAIN FOR WEAR OR DAMAGE.	
2.4. CHECK BLOCK HOOK & SAFETY LATCH FOR CRACKS, BROKEN OR MISSING HARDWARE.	
2.5. CONDUCT ANNUAL INSPECTION PER TITLE 8, SUBCHAPTER 7, GROUP 13 OF STATE OF CALIFORNIA CODE.	
2.6. DYE PENETRANT LOAD HOOKS	
2.7. 100% LOAD TEST FOR ALL CRITICAL CRANES AND HOIST	
2.8. INSPECT MOTOR BRAKES AND ADJUST AS REQUIRED. OPERATIONAL TEST ALL BRAKES FOR POSSIBLE NEED OF REPLACEMENT OF BRAKE LININGS, BRAKE SHOES, DISCS.	
2.9. OPEN CONTROL BOXES AND CHECK ALL CONTACTS FOR WEAR AND ADJUSTMENT.	
2.10. INSPECT COLLECTOR SHOES, BRUSHES OR WHEELS FOR ARCING AND/OR WEAR.	
2.11. (LUBRICATE MACHINE ELEMENTS AND ACCESSORIES ACCORDING TO MANUFACTURER'S SPECIFICATIONS.)	
2.12. INSPECT ALL EQUIPMENT OIL/LUBE RESERVOIR LEVELS; ADD OIL/LUBE AS REQUIRED; REPORT ANY EXCESSIVE LEAKAGE.	
2.13. VISUALLY INSPECT CABLES, SHEAVES, AND DRUMS FOR WEAR, PROPER CONDITION, AND LUBRICATION.	
2.14. INSPECT LOAD BLOCK AND HOOK FOR DISTORTION AND EXCESSIVE WEAR.	
2.15. INSPECT HOISTS AND TROLLEY FRAMES, CATWALKS, AND HANDRAILS FOR LOOSE BOLTS, BROKEN PARTS, MISALIGNMENT AND BROKEN WELDS.	
2.16. INSPECT SAFETY EQUIPMENT AND ACCESSORIES (e.g. LIMIT SWITCHES) FOR PROPER OPERATIONS, AND ADJUST AS NECESSARY.	
2.17. INSPECT MOTORS, COUPLINGS AND EXTERNAL WIRING FOR WEAR AND DETERIORATION.	
2.18. INSPECT ACCESSORY EQUIPMENT FOR GENERAL CONDITION AND REPAIR.	
2.19. INSPECT END STOPS, RAIL SWEEPS, DROP LUGS, AND SHOCK ABSORBING BUMPERS FOR GENERAL CONDITION.	

CRANE PM	
2.20. VISUALLY INSPECT CONTROL FUNCTIONS ON VARIABLE AND/ OR SINGLE SPEED CRANES (e.g., PUSH BUTTONS AND CONTACTORS) FOR SMOOTHNESS OF TRAVEL.	
2.21. INSPECT FOR OIL LEAKS AND MECHANICAL IRREGULARITIES NOT PREVIOUSLY REPORTED.	
2.22. VERIFY FINAL UPPER LIMIT SWITCH.	
3. CRANE AND HOIST MAINTENANCE	MONTHLY
3.1 (LUBRICATE MACHINE ELEMENTS AND ACCESSORIES ACCORDING TO MANUFACTURER'S SPECIFICATIONS.)	
3.2 INSPECT ALL EQUIPMENT OIL/LUBE RESERVOIR LEVELS; ADD OIL/LUBE AS REQUIRED; REPORT ANY EXCESSIVE LEAKAGE.	
3.3 VISUALLY INSPECT CABLES, SHEAVES, AND DRUMS FOR WEAR, PROPER CONDITION, AND LUBRICATION.	
3.4 INSPECT LOAD BLOCK AND HOOK FOR DISTORTION AND EXCESSIVE WEAR.	
3.5 INSPECT HOISTS AND TROLLEY FRAMES, CATWALKS, AND HANDRAILS FOR LOOSE BOLTS, BROKEN PARTS, MISALIGNMENT AND BROKEN WELDS.	
3.6 INSPECT SAFETY EQUIPMENT AND ACCESSORIES (e.g. LIMIT SWITCHES) FOR PROPER OPERATIONS, AND ADJUST AS NECESSARY.	
3.7 INSPECT MOTORS, COUPLINGS AND EXTERNAL WIRING FOR WEAR AND DETERIORATION.	
3.8 INSPECT ACCESSORY EQUIPMENT FOR GENERAL CONDITION AND REPAIR.	
3.9 INSPECT END STOPS, RAIL SWEEPS, DROP LUGS, AND SHOCK ABSORBING BUMPERS FOR GENERAL CONDITION.	
3.10 VISUALLY INSPECT CONTROL FUNCTIONS ON VARIABLE AND/ OR SINGLE SPEED CRANES (e.g., PUSH BUTTONS AND CONTACTORS) FOR SMOOTHNESS OF TRAVEL.	
3.11 INSPECT FOR OIL LEAKS AND MECHANICAL IRREGULARITIES NOT PREVIOUSLY REPORTED.	
3.12 VERIFY FINAL UPPER LIMIT SWITCH.	
4. CRANE AND HOIST MAINTENANCE	QUARTERLY
4.1 INSPECT MOTOR BRAKES AND ADJUST AS REQUIRED. OPERATIONAL TEST ALL BRAKES FOR POSSIBLE NEED OF REPLACEMENT OF BRAKE LININGS, BRAKE SHOES, DISCS.	
4.2 OPEN CONTROL BOXES AND CHECK ALL CONTACTS FOR WEAR AND ADJUSTMENT.	
4.3 INSPECT COLLECTOR SHOES, BRUSHES OR WHEELS FOR ARCING AND/OR WEAR.	
4.4 (LUBRICATE MACHINE ELEMENTS AND ACCESSORIES ACCORDING TO MANUFACTURER'S SPECIFICATIONS.)	

CRANE PM	
4.5 INSPECT ALL EQUIPMENT OIL/LUBE RESERVOIR LEVELS; ADD OIL/LUBE AS REQUIRED; REPORT ANY EXCESSIVE LEAKAGE.	
4.6 VISUALLY INSPECT CABLES, SHEAVES, AND DRUMS FOR WEAR, PROPER CONDITION, AND LUBRICATION.	
4.7 INSPECT LOAD BLOCK AND HOOK FOR DISTORTION AND EXCESSIVE WEAR.	
4.8 INSPECT HOISTS AND TROLLEY FRAMES, CATWALKS, AND HANDRAILS FOR LOOSE BOLTS, BROKEN PARTS, MISALIGNMENT AND BROKEN WELDS.	
4.9 INSPECT SAFETY EQUIPMENT AND ACCESSORIES (e.g. LIMIT SWITCHES) FOR PROPER OPERATIONS, AND ADJUST AS NECESSARY.	
4.10 INSPECT MOTORS, COUPLINGS AND EXTERNAL WIRING FOR WEAR AND DETERIORATION.	
4.11 INSPECT ACCESSORY EQUIPMENT FOR GENERAL CONDITION AND REPAIR.	
4.12 INSPECT END STOPS, RAIL SWEEPS, DROP LUGS, AND SHOCK ABSORBING BUMPERS FOR GENERAL CONDITION.	
4.13 VISUALLY INSPECT CONTROL FUNCTIONS ON VARIABLE AND / OR SINGLE SPEED CRANES (e.g., PUSH BUTTONS AND CONTACTORS) FOR SMOOTHNESS OF TRAVEL.	
4.14 INSPECT FOR OIL LEAKS AND MECHANICAL IRREGULARITIES NOT PREVIOUSLY REPORTED.	
4.15 VERIFY FINAL UPPER LIMIT SWITCH.	
4.16	
5 DEMAG CRANE MAINTENANCE	SEMI-ANNUAL
5.1 CHECK PLASTIC COMPONENTS OF LIMIT SWITCH FOR CORROSION	
5.2 CHECK EXTERNAL FAN FUNCTION	
6 DEMAG CRANE MAINTENANCE	ANNUAL
6.1 CHECK EMERGENCY STOP DEVICE	
6.2 CHECK ROPE SECURING DEVICES AND ROPE GUIDE	
6.3 CHECK ROPE FOR DAMAGE AND BROKEN WIRES	
6.4 CHECK CONTROL CABLE AND CONTROL UNIT HOUSING FOR DAMAGE	
6.5 CHECK OPERATION OF THE LIMIT SWITCHES FOR LIFTING AND LOWERING	
6.6 CHECK THE SLIPPING CLUTCH FUNCTION FOR FITTING THE LOAD HANDLING ATTACHMENT	
6.7 CHECK OPERATION OF THE BRAKE	
6.8 CHECK QUICK-CHANGE COUPLING	
6.9 CHECK HOOK AND HOOK SAFETY CATCH	

CRANE PM		
6.10	READ OPERATING HOURS FOR DETERMINING THE REMAINING DURATION OF SERVICE AND READ THE C SWITCHING CYCLES	
6.11	CHECK OPERATION OF THE SLIPPING CLUTCH	
6.12	CHECK ALL CONNECTIONS (BOLTS, WELD SEAMS ETC.)	
6.13	LUBRICATE ROPE	
6.14	CHECK TROLLEY, LOAD BAR AND STATUS OF BUFFERS	
6.15	CHECK LOAD HOOKS FOR CRACKS, DEFORMATION AND WEAR	
6.16	CHECK HOOK SAFETY CATCH FOR DEFORMATION	
6.17	CHECK HOOK BEARING FOR WEAR	
6.18	CHECK SUSPENSION, SECURING ELEMENTS (CLIPS, BOLTS, ETC.) FOR TIGHT FIT AND CORROSION	
6.19	CHECK AND APPLY OR SUPPLEMENT CORROSION PROTECTION, AS REQUIRED	
6.20	CLEAN AND OIL LIMIT SWITCH RODS	
6.21	SEALINGS OF ELECTRICAL CONNECTIONS AND CONNECTION ENCLOSURES	
6.22	CHECK ELECTRICAL ENCLOSURE AND GEARBOX FOR LEAKAGE	
6.23	CHECK ELECTRICAL SWITCHGEAR	
7	DEMAG CRANE MAINTENANCE	TRIENNIAL
7.1	CHECK BRAKE DISPLACEMENT	
8	DEMAG CRANE MAINTENANCE	5 YEARS
8.1	RENEW OIL/GREASE LUBRICATION	
9	DEMAG CRANE MAINTENANCE	10 YEARS
9.1	CHECK BRAKE WEAR	

Appendix A.1.4 **Electrical PM**

ELECTRICAL PM	
	FREQUENCY
1. GENERATORS: STANDBY	WEEKLY
1.1. REVIEW SAFETY PLAN	
1.2. CHECK ENGINE OIL LEVEL AND RECORD IN THE CMMS AND ON THE LOG SHEET	
1.3. CHECK BATTERY ELECTROLYTE LEVEL AND RECORD IN THE CMMS AND ON THE LOG SHEET	
1.4. CHECK BATTERY CHARGER FOR PROPER OPERATION AND RECORD IN THE CMMS AND ON THE LOG SHEET	
1.5. CHECK ELECTRICAL CONNECTIONS AND RECORD IN THE CMMS AND ON THE LOG SHEET	
1.6. DRAIN FUEL SYSTEM PRIMARY FILTER/WATER SEPARATOR AND RECORD IN THE CMMS AND ON THE LOG SHEET	
1.7. DRAIN FUEL TANK WATER AND SEDIMENT AND RECORD IN THE CMMS AND ON THE LOG SHEET	
1.8. INSPECT HOSES AND CLAMPS. REPLACE AS NEEDED. RECORD IN THE CMMS AND ON THE LOG SHEET	
1.9. WALK-AROUND INSPECTION	
1.10. CHECK FUEL TANK LEVEL AND RECORD IN THE CMMS AND ON THE LOG SHEET	
1.11. CHECK CASE HEATER USING INFARED THERMOMETER AND RECORD IN THE CMMS AND ON THE LOG SHEET	
1.12. ENSURE ON-SITE LOG SHEET IS UPDATED AND SECURE IN ITS LOCATION.	
1.13. ENSURE ASSET IS LABELED CORRECTLY AND HAS A GREEN TAG. SIGN, INDICATE SERVICE PERFORMED, AND DATE GREEN TAG AT COMPLETION OF PM/PGM/PTL.	
1.14. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.	
1.15. REPORT ALL DEFICIENCIES TO MAINTENANCE MANAGER	
2. GENERATORS: STANDBY	MONTHLY
2.1. REVIEW SAFETY PLAN	
2.2. CHECK ENGINE OIL LEVEL, RECORD IN CMMS METER AND ON LOG SHEET	
2.3. CHECK COOLANT LEVEL, RECORD IN CMMS METER, AND ON LOG SHEET	
2.4. MAKE SURE RADIATOR INTAKE IS CLEAR OF DEBRIS	
2.5. CHECK AIR CLEANER, RECORD CONDITION IN CMMS METER, AND ON LOG SHEET	
2.6. INSPECT HOSES AND CLAMPS, RECORD CONDITION IN CMMS METER, AND ON LOG SHEET	

ELECTRICAL PM	
2.7. INSPECT BELTS, RECORD CONDITION IN CMMS METER, AND ON LOG SHEET	
2.8. CHECK BATTERY FOR LOOSE CONNECTIONS, CORROSION, AND LEAKS, RECORD CONDITION IN CMMS METER	
2.9. CHECK ELECTRICAL CONNECTIONS AND RECORD CONDITION IN CMMS METER	
2.10. CHECK BATTERY ELECTROLYTE LEVEL AND RECORD IN CMMS METER	
2.11. CHECK BATTERY VOLTAGE, RECORD IN CMMS METER AND ON LOG SHEET	
2.12. CHECK BATTERY CHARGER FOR PROPER OPERATION AND RECORD CONDITION IN CMMS METER	
2.13. CHECK CONTROL PANEL FOR WARNINGS OR ALARMS	
2.14. TEST CONTROL PANEL LIGHTING	
2.15. DRAIN FUEL SYSTEM PRIMARY FILTER/WATER SEPARATOR AND RECORD IN CMMS METER	
2.16. DRAIN FUEL TANK WATER AND SEDIMENT IF APPLICABLE AND RECORD IN CMMS METER	
2.17. CHECK FUEL LEVEL AND RECORD IN CMMS METER READINGS FUELSTOR AND ON LOG SHEET SHOULD MAINTAIN 7/8 LEVEL	
2.18. CHECK CASE HEATER USING INFARED THERMOMETER AND RECORD IN CMMS METER	
2.19. WALK-AROUND INSPECTION	
2.20. RUN GENERATOR AT 30% OF NAMEPLATE RATING FOR 30 MINUTES WITH LOAD BANK AND RECORD LOAD KW READING IN THE CMMS AND LOG SHEET	
2.21. CHECK FOR UNUSUAL VIBRATION	
2.22. CHECK COOLANT TEMPERATURE AND RECORD IN CMMS METER AND ON LOG SHEET	
2.23. RECORD RUN TIME READING IN CMMS METER HOURS RUN AND ON LOG SHEET	
2.24. (IF APPLICABLE) TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS	
2.25. ENSURE ON-SITE LOG SHEET IS UPDATED AND SECURE IN ITS LOCATION.	
2.26. VALIDATE THAT A VALID AQMD PERMIT IS LOCATED WITHIN VICINITY OF EMERGENCY GENERATOR	
2.27. INSPECT AND ENSURE SECONDARY CONTAINMENT TANK IS IN GOOD CONDITION. RECORD CONDITION IN THE CMMS.	
2.28. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
2.29. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.	
2.30. MAKE SURE EMERGENCY STOP BUTTON ISN'T PUSHED	
2.31. MAKE SURE GENERATOR SWITCH IS IN THE AUTO POSITION	

ELECTRICAL PM	
2.32. IF EQUIPPED, REMOVE AND INSPECT ALL ELECTRONIC LEAK DETECTION SENSORS. ENSURE ALL ARE PRESENT AND ARE OPERATING PROPERLY BY MANUALLY ACTUATING, CONFIRMING THAT THE ALARM APPEARS ON LOCAL ALARM PANEL.	
2.33. TEST REMOTE NOTIFICATION DEVICES WHERE APPICABLE.	
3. GENERATORS: STANDBY	QUARTERLY
3.1. INSPECT SLIP RINGS FOR PITTING OR GROOVING	
3.2. CHECK BRUSHES FOR PROPER LENGTH.	
3.3. CHECK THAT BRUSHES RIDE FREE IN BRUSH HOLDER PER OEM.	
3.A GENERATORS LESS THAN 10KW	QUARTERLY
3.4. RUN FOR 30 MINUTES WITH LOAD.	
3.5. RECORD RUN TIME READING.	
3.6. CHECK ALL POWER AND CONTROL CIRCUIT TERMINALS.	
3.7. TEST CONTACTS AND BREAKERS ON OUTPUT CIRCUIT.	
3.8. CHECK BATTERIES, FILL WITH DISTILLED WATER.	
3.9. CHECK FUEL LEVEL.	
3.10. PERFORM GENERAL CLEANING.	
3.11. RECORD RUN TIME ON P.M. SHEETS.	
3.12. RECORD RUN LOG SHEET AT EACH GENERATOR.	
4. GENERATORS: STANDBY - CRITICAL GENERATORS	QUARTERLY
4.1. REVIEW SAFETY PLAN	
4.2. CHECK ENGINE OIL LEVEL, RECORD IN CMMS METER AND ON LOG SHEET	
4.3. CHECK COOLANT LEVEL, RECORD IN CMMS METER, AND ON LOG SHEET	
4.4. MAKE SURE RADIATOR INTAKE IS CLEAR OF DEBRIS	
4.5. CHECK AIR CLEANER, RECORD CONDITION IN CMMS METER, AND ON LOG SHEET	
4.6. INSPECT HOSES AND CLAMPS, RECORD CONDITION IN CMMS METER, AND ON LOG SHEET	
4.7. INSPECT BELTS, RECORD CONDITION IN CMMS METER, AND ON LOG SHEET	
4.8. CHECK BATTERY FOR LOOSE CONNECTIONS, CORROSION, AND LEAKS, RECORD CONDITION IN CMMS METER	

ELECTRICAL PM	
4.9. CHECK ELECTRICAL CONNECTIONS AND RECORD CONDITION IN CMMS METER	
4.10. CHECK BATTERY ELECTROLYTE LEVEL AND RECORD IN CMMS METER	
4.11. CHECK BATTERY VOLTAGE, RECORD IN CMMS METER AND ON LOG SHEET	
4.12. CHECK BATTERY CHARGER FOR PROPER OPERATION AND RECORD CONDITION IN CMMS METER	
4.13. CHECK CONTROL PANEL FOR WARNINGS OR ALARMS	
4.14. TEST CONTROL PANEL LIGHTING	
4.15. DRAIN FUEL SYSTEM PRIMARY FILTER/WATER SEPARATOR AND RECORD IN CMMS METER	
4.16. DRAIN FUEL TANK WATER AND SEDIMENT IF APPLICABLE AND RECORD IN CMMS METER	
4.17. CHECK FUEL LEVEL AND RECORD IN CMMS METER READINGS FUELSTOR AND ON LOG SHEET SHOULD MAINTAIN 7/8 LEVEL	
4.18. CHECK CASE HEATER USING INFARED THERMOMETER AND RECORD IN CMMS METER	
4.19. WALK-AROUND INSPECTION	
4.20. RUN GENERATOR AT 30% OF NAMEPLATE RATING FOR 30 MINUTES WITH LOAD BANK AND RECORD LOAD KW READING IN THE CMMS AND LOG SHEET	
4.21. CHECK FOR UNUSUAL VIBRATION	
4.22. CHECK COOLANT TEMPERATURE AND RECORD IN CMMS METER AND ON LOG SHEET	
4.23. RECORD RUN TIME READING IN CMMS METER HOURS RUN AND ON LOG SHEET	
4.24. (IF APPLICABLE) TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS	
4.25. ENSURE ON-SITE LOG SHEET IS UPDATED AND SECURE IN ITS LOCATION.	
4.26. VALIDATE THAT A VALID AQMD PERMIT IS LOCATED WITHIN VICINITY OF EMERGENCY GENERATOR	
4.27. INSPECT AND ENSURE SECONDARY CONTAINMENT TANK IS IN GOOD CONDITION. RECORD CONDITION IN THE CMMS.	
4.28. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
4.29. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.	
4.30. MAKE SURE EMERGENCY STOP BUTTON ISN'T PUSHED	
4.31. MAKE SURE GENERATOR SWITCH IS IN THE AUTO POSITION	
4.32. IF EQUIPPED, REMOVE AND INSPECT ALL ELECTRONIC LEAK DETECTION SENSORS. ENSURE ALL ARE PRESENT AND ARE OPERATING PROPERLY BY MANUALLY ACTUATING,	

ELECTRICAL PM	
CONFIRMING THAT THE ALARM APPEARS ON LOCAL ALARM PANEL.	
4.33. REPORT ALL DEFICIENCIES TO THE MAINTENANCE MANGER	
5. GENERATORS: STANDBY	ANNUAL
5.1. PERFORM THE MONTHLY CHILD WORK ORDER TASKS	
5.2. INSPECT ALTERNATOR AND RECORD THE CONDITION IN THE CMMS	
5.3. INSPECT AND ADJUST BELTS. REPLACE AS NECESSARY. RECORD THE CONDITION IN THE CMMS	
5.4. OBTAIN COOLANT SAMPLE FOR TESTING	
5.5. CLEAN ENGINE	
5.6. INSPECT ENGINE MOUNTS. RECORD THE CONDITION IN THE CMMS	
5.7. OBTAIN ENGINE OIL SAMPLE FOR TESTING	
5.8. REPLACE OIL AND OIL FILTER	
5.9. REPLACE FUEL SYSTEM PRIMARY FILTER ELEMENT	
5.10. TEST AND RECORD GENERATOR SET VIBRATION. RECORD IN THE CMMS	
5.11. TEST GENERATOR WINDING INSULATION AND RECORD THE CONDITION IN THE CMMS	
5.12. CHECK ROTATING RECTIFIER AND RECORD THE CONDITION IN THE CMMS	
5.13. INSPECT STARTING MOTOR AND RECORD THE CONDITION IN THE CMMS	
5.14. INSPECT WATER PUMP AND RECORD THE CONDITION IN THE CMMS	
5.15. RUN GENERATOR AT 30% OF NAMEPLATE RATING FOR 30 MINUTES WITH LOAD BANK AND RECORD LOAD KW READING IN THE CMMS AND LOG SHEET	
5.16. PERFORM AND DOCUMENT GENERATOR INJECTION TIMING CERTIFICATION	
5.17. ENSURE ON-SITE LOG SHEET IS UPDATED AND SECURE IN ITS LOCATION.	
5.18. ENSURE ASSET IS LABELED CORRECTLY AND HAS A GREEN TAG. SIGN, INDICATE SERVICE PERFORMED, AND DATE GREEN TAG AT COMPLETION OF PM/PGM/PTI.	
5.19. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.	
6. GENERATORS (SFOF)	WEEKLY
6.1. REVIEW SAFETY PLAN	
6.2. CHECK ENGINE OIL LEVEL AND RECORD IN THE CMMS AND ON THE LOG SHEET	

ELECTRICAL PM	
6.3. CHECK BATTERY ELECTROLYTE LEVEL AND RECORD IN THE CMMS AND ON THE LOG SHEET	
6.4. CHECK BATTERY CHARGER FOR PROPER OPERATION AND RECORD IN THE CMMS AND ON THE LOG SHEET	
6.5. CHECK ELECTRICAL CONNECTIONS AND RECORD IN THE CMMS AND ON THE LOG SHEET	
6.6. DRAIN FUEL SYSTEM PRIMARY FILTER/WATER SEPARATOR AND RECORD IN THE CMMS AND ON THE LOG SHEET	
6.7. DRAIN FUEL TANK WATER AND SEDIMENT AND RECORD IN THE CMMS AND ON THE LOG SHEET	
6.8. INSPECT HOSES AND CLAMPS. REPLACE AS NEEDED. RECORD IN THE CMMS AND ON THE LOG SHEET	
6.9. WALK-AROUND INSPECTION.	
6.10. CHECK FUEL TANK LEVEL AND RECORD IN THE CMMS AND ON THE LOG SHEET	
6.11. CHECK CASE HEATER USING INFRARED THERMOMETER AND RECORD IN THE CMMS AND ON THE LOG SHEET	
6.12. ENSURE ON-SITE LOG SHEET IS UPDATED AND SECURE IN ITS LOCATION.	
6.13. ENSURE ASSET IS LABELED CORRECTLY AND HAS A GREEN TAG. SIGN, INDICATE SERVICE PERFORMED, AND DATE GREEN TAG AT COMPLETION OF PM/PGM/PTL.	
6.14. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.	
6.15. REPORT ALL DEFICIENCIES TO MAINTENANCE MANAGER	
7. GENERATORS (SFOF)	MONTHLY
7.1. REVIEW SAFETY PLAN	
7.2. IS THERE WATER/LIQUID IN THE SECONDARY/SPILL CONTAINMENT OR INTERSTICE?	
7.3. IS THERE DEBRIS OR FIRE HAZARD IN THE CONTAINMENT AREA?	
7.4. IS THE BERM VALVE DRAIN OPERABLE AND CLOSED?	
7.5. IS THE BERM IN GOOD CONDITION-ABSENT OF VISABLE SIGNS OF LEAKAGE?	
7.6. IS SECONDARY CONTAINMENT TANK IN GOOD CONDITION?	
7.7. IS THE ABOVEGROUND STORAGE TANK APPROPRIATELY LABELED?	
7.8. IS ABOVEGROUND STORAGE TANK IN GOOD CONDITION-ABSENT OF VISABLE SIGNS OF LEAKAGE?	
7.9. ARE ABOVEGROUND STORAGE TANK FOUNDATIONS, SUPPORTS, LADDERS, AND PLATFOM IN GOOD CONDITION?	
7.10. IS THE TANKLIQUID LEVEL GUAGE READABLE AND IN GOOD CONDITION?	
7.11. ARE ALL TANK OPENINGS PROPERLY SEALED?	

ELECTRICAL PM	
7.12. IS PIPING IN GOOD CONDITION-ABSENT OF VISABLE SIGNS OF LEAKAGE?	
7.13. RUN GENERATOR AT 30% OF NAMEPLATE RATING FOR 30 MINUTES WITH LOAD BANK AND RECORD LOAD KW READING IN THE CMMS AND LOG SHEET	
7.14. RECORD RUN TIME READING IN CMMS METER HOURS RUN	
7.15. (IF APPLICABLE) TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS	
7.16. RECORD RUN LOG SHEET AT EACH GENERATOR.	
7.17. ENSURE ON-SITE LOG SHEET IS UPDATED AND SECURE IN ITS LOCATION.	
7.18. VALIDATE THAT A VALID AQMD PERMIT IS LOCATED WITHIN VICINITY OF EMERGENCY GENERATOR	
8. GENERATORS (SFOF)	ANNUAL
8.1. PERFORM THE MONTHLY CHILD WORK ORDER TASKS	
8.2. INSPECT ALTERNATOR AND RECORD THE CONDITION IN THE CMMS	
8.3. OBTAIN COOLANT SAMPLE FOR TESTING	
8.4. CLEAN ENGINE	
8.5. INSPECT ENGINE MOUNTS. RECORD THE CONDITION IN THE CMMS	
8.6. OBTAIN ENGINE OIL SAMPLE FOR TESTING	
8.7. REPLACE OIL AND OIL FILTER	
8.8. REPLACE FUEL SYSTEM PRIMARY FILTER ELEMENT	
8.9. REPLACE FUEL SYSTEM SECONDARY FILTER	
8.10. TEST AND RECORD GENERATOR SET VIBRATION. RECORD IN THE CMMS	
8.11. TEST GENERATOR WINDING INSULATION AND RECORD THE CONDITION IN THE CMMS	
8.12. CHECK ROTATING RECTIFIER AND RECORD THE CONDITION IN THE CMMS	
8.13. INSPECT STARTING MOTOR AND RECORD THE CONDITION IN THE CMMS	
8.14. INSPECT WATER PUMP AND RECORD THE CONDITION IN THE CMMS	
8.15. WALK-AROUND INSPECTION	
8.16. RUN GENERATOR (FROM ATS) FOR 60 MINUTES WITH BUILDING LOAD. RECORD LOAD KW READING IN THE CMMS AND LOG SHEET.	
8.17. CHECK FOR UNUSUAL VIBRATION	
8.18. CHECK ENGINE COOLANT TEMPERATURE AND RECORD IN CMMS AND ON LOG SHEET	

ELECTRICAL PM	
8.19. CHECK EXHAUST TEMP (LEFT). RECORD IN CMMS AND ON LOG SHEET	
8.20. CHECK EXHAUST TEMP (RIGHT). RECORD IN CMMS AND ON LOG SHEET	
8.21. CHECK ENGINE OIL PRESSURE. RECORD IN CMMS AND ON LOG SHEET	
8.22. CHECK ENGINE OIL TEMPERATURE. RECORD IN CMMS AND ON LOG SHEET	
8.23. CHECK ENGINE OIL DIFFERENTIAL. RECORD IN CMMS AND ON LOG SHEET	
8.24. CHECK ENGINE FUEL PRESSURE. RECORD IN CMMS AND ON LOG SHEET	
8.25. CHECK ENGINE FUEL FILTER DIFFERENTIAL. RECORD IN CMMS AND ON LOG SHEET	
8.26. CHECK KILOWATTS. RECORD IN CMMS AND ON LOG SHEET	
8.27. CHECK K V A. RECORD IN CMMS AND ON LOG SHEET	
8.28. RECORD RUN TIME READING IN CMMS AND ON LOG SHEET	
8.29. TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS	
8.30. PERFORM AND DOCUMENT GENERATOR INJECTION TIMING CERTIFICATION	
8.31. ENSURE ON-SITE LOG SHEET IS UPDATED AND SECURE IN ITS LOCATION.	
8.32. ENSURE ASSET IS LABELED CORRECTLY AND HAS A GREEN TAG. SIGN, INDICATE SERVICE PERFORMED, AND DATE GREEN TAG AT COMPLETION OF PM/PGM/PTI.	
9. VISUAL INSPECTION SUB STATION / BANKS	MONTHLY
9.1. INSPECT/RECORD TRANSFORMERS FOR OIL LEAKS, TEMPERATURE (NOT TO EXCEED 75° C), OIL LEVEL, OXYGEN, NITROGEN, CONNECTIONS, PRESSURE AND VACUUM.	
9.2. INSPECT SWITCHGEAR FOR CLEANLINESS AND HOTSPOTS.	
9.3. INSPECT AREA FOR CLEANLINESS, WEEDS AND OTHER NATURAL GROWTH.	
10. READ WATER, GAS, AND ELECTRIC METER	MONTHLY
10.1. READ AND RECORD ALL WATER, ELECTRIC, AND GAS METER READINGS.	
10.2. CONFIRM THAT METERS ARE WORKING; AND REPAIR AS NECESSARY, VALIDATE ACCURACY.	
11. EMERGENCY BATTERY BANKS AND SUBS	MONTHLY
11.1. MAINTENANCE AND TESTING REPORTS SHALL COMPLY WITH THE LATEST AND GREATEST ANSI/NETA MTS	

ELECTRICAL PM	
MAINTENANCE TESTING SPECIFICATIONS FOR ELECTRICAL POWER DISTRIBUTION EQUIPMENT AND SYSTEMS	
11.2. CHECK CHARGER.	
11.3. CHECK ELECTROLYTE AND SPECIFIC GRAVITY. NOT APPLICABLE TO GEL FILLED.	
11.4. CHECK AND RECORD VOLTAGE AND TEMPERATURE IN CMMS FOR AB, BC, CA	
11.5. (IF APPLICABLE) TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS	
11.6. CHECK ALL CONNECTIONS AND WIRING.	
11.7. CLEAN RACK, REMOVE ANY CORROSION.	
11.8. CHECK WATER LEVEL AND ADD DISTILLED WATER WHERE REQUIRED.	
11.9. ACTIVATE SYSTEMS, CHECK OPERATION OF ALL LIGHTS.	
12. EMERGENCY FLUORESCENT/LED BATTERY PACKS - MONTHLY TEST AND INSPECTION	MONTHLY
12.1. REVIEW SAFETY PLAN	
12.2. PERFORM MONTHLY FUNCTIONAL TEST ON EMERGENCY FLUORESCENT/LED LIGHT FIXTURES TO ENSURE LIGHTS OPERATE FOR NOT LESS THAN 30 SECONDS AND MAINTAINS ADEQUATE ILLUMINATION	
12.3. TEST FOR AUTOMATIC EMERGENCY OPERATION AND ENSURE EMERGENCY FLUORESCENT/LED LIGHTS OPERATE FOR 30 SECONDS ON BATTERY POWER BY PRESSING THE "TEST" BUTTON OR BY TURNING "OFF" THE CIRCUIT BREAKER FOR 30 SECONDS.	
12.4. PERFORM INSPECTIONS ON THE EMERGENCY FLUORESCENT/LED LIGHT FIXTURES DURING THE 30 SECOND TEST TO ENSURE THAT THE LIGHTS DIDN'T FAIL OR OUTPUT BECAME VISIBLY VERY LOW TO THE NAKED EYE BY COMPARISON TO OTHER SIMILAR/IDENTICAL EMERGENCY LIGHTS	
12.5. AFTER 30 SECONDS RESTORE INCOMING UTILITY POWER TO THE EMERGENCY FLUORESCENT/LED LIGHT FIXTURE BY SWITCHING CIRCUIT BREAKER TO "ON" POSITION TO END THE TEST OR IF TEST BUTTON FUNCTIONALITY WAS USED, WAIT TILL IT AUTOMATICALLY ENDS THE TEST	
12.6. CREATE A CM WORK ORDER FOR FAILURES AND IDENTIFY TO THE FIXTURE ASSET NUMBER	
12.7. PERFORM ABOVE MENTIONED REQUIRED TASKS TO TEST ALL FLUORESCENTS/LEDS	
13. EMERGENCY FLUORESCENT/LED BATTERY PACKS – ANNUAL TEST AND INSPECTION	ANNUAL

ELECTRICAL PM	
13.1. REVIEW SAFETY PLAN	
13.2. PERFORM ANNUAL FUNCTIONAL TESTS ON THE EMERGENCY LIGHT SYSTEMS FOR EACH EMERGENCY FLUORESCENT/LED LIGHT TO ENSURE EACH EMERGENCY FLUORESCENT/LED LIGHT OPERATE FOR NOT LESS THAN 90 MINUTES.	
13.3. SWITCH THE ASSOCIATED LIGHTING CIRCUIT BREAKER TO THE "OFF" POSITION TO START THE TEST.	
13.4. RECORD THE START TIME IN MAXIMO.	
13.5. PERFORM INSPECTIONS ON THE EMERGENCY LIGHT FIXTURES DURING THE 90 MINUTE TEST TO ENSURE THAT THE LIGHTS DIDN'T FAIL OR OUTPUT BECAME VISIBLY VERY LOW TO THE NAKED EYE BY COMPARISON TO OTHER SIMILAR/IDENTICAL EMERGENCY LIGHTS.	
13.6. AFTER 90 MINUTES SWITCH THE ASSOCIATED LIGHTING CIRCUIT BREAKER TO THE "ON" POSITION TO STOP THE TEST.	
13.7. RECORD THE STOP TIME IN MAXIMO.	
13.8. CREATE A CM WORK ORDER FOR FAILURES AND IDENTIFY TO THE FIXTURE ASSET NUMBER.	
13.9. PERFORM ABOVE MENTIONED REQUIRED TASKS FOR EACH EMERGENCY FLUORESCENT/LED LIGHT.	
14. EMERGENCY LANTERNS TEST AND INSPECTION	MONTHLY
14.1. REVIEW SAFETY PLAN	
14.2. PERFORM MONTHLY FUNCTIONAL TEST ON EMERGENCY LANTERN LIGHT FIXTURES TO ENSURE LIGHTS OPERATE FOR NOT LESS THAN 30 SECONDS AND MAINTAINS ADEQUATE ILLUMINATION	
14.3. TEST FOR AUTOMATIC EMERGENCY OPERATION AND ENSURE EMERGENCY LANTERN LIGHTS OPERATE FOR 30 SECONDS ON BATTERY POWER BY PRESSING THE "TEST" BUTTON OR BY TURNING "OFF" THE CIRCUIT BREAKER FOR 30 SECONDS.	
14.4. PERFORM INSPECTIONS ON THE EMERGENCY LANTERN LIGHT FIXTURES DURING THE 30 SECOND TEST TO ENSURE THAT THE LIGHTS DIDN'T FAIL OR OUTPUT BECAME VISIBLY VERY LOW TO THE NAKED EYE BY COMPARISON TO OTHER SIMILAR/IDENTICAL EMERGENCY LIGHTS	
14.5. AFTER 30 SECONDS RESTORE INCOMING UTILITY POWER TO THE EMERGENCY LANTERN LIGHT FIXTURE BY SWITCHING CIRCUIT BREAKER TO "ON" POSITION TO END THE TEST OR IF TEST BUTTON FUNCTIONALITY WAS USED, WAIT TILL IT AUTOMATICALLY ENDS THE TEST IN 30 SECONDS	
14.6. CREATE A CM WORK ORDER FOR FAILURES AND IDENTIFY TO THE FIXTURE ASSET NUMBER	

ELECTRICAL PM	
15. EMERGENCY LANTERNS TEST AND INSPECTION	ANNUAL
15.1. REVIEW SAFETY PLAN	
15.2. PERFORM ANNUAL FUNCTIONAL TESTS ON THE EMERGENCY LIGHT SYSTEMS FOR EACH EMERGENCY LANTERN LIGHT TO ENSURE EACH EMERGENCY LANTERN LIGHT OPERATE FOR NOT LESS THAN 90 MINUTES.	
15.3. SWITCH THE ASSOCIATED LIGHTING CIRCUIT BREAKER TO THE "OFF" POSITION TO START THE TEST.	
15.4. RECORD THE START TIME IN MAXIMO.	
15.5. PERFORM INSPECTIONS ON THE EMERGENCY LANTERN LIGHT FIXTURES DURING THE 90 MINUTE TEST TO ENSURE THAT THE LIGHTS DIDN'T FAIL OR OUTPUT BECAME VISIBLY VERY LOW TO THE NAKED EYE BY COMPARISON TO OTHER SIMILAR/IDENTICAL EMERGENCY LIGHTS.	
15.6. AFTER 90 MINUTES SWITCH THE ASSOCIATED LIGHTING CIRCUIT BREAKER TO THE "ON" POSITION TO STOP THE TEST.	
15.7. RECORD THE STOP TIME IN MAXIMO.	
15.8. CREATE A CM WORK ORDER FOR FAILURES AND IDENTIFY TO THE FIXTURE ASSET NUMBER.	
15.9. PERFORM ABOVE MENTIONED REQUIRED TASKS FOR EACH EMERGENCY LANTERN LIGHT.	
16. EXIT LIGHTS TEST AND INSPECTION	MONTHLY
16.1. REVIEW SAFETY PLAN	
16.2. PERFORM MONTHLY FUNCTIONAL TEST ON EMERGENCY EXIT SIGN LIGHT FIXTURES TO ENSURE LIGHTS OPERATE FOR NOT LESS THAN 30 SECONDS AND MAINTAINS ADEQUATE ILLUMINATION	
16.3. REPLACE LIGHT BULBS AS REQUIRED	
16.4. TEST FOR AUTOMATIC EMERGENCY OPERATION AND ENSURE EMERGENCY EXIT SIGN LIGHTS OPERATE FOR 30 SECONDS ON BATTERY POWER BY PRESSING THE "TEST" BUTTON OR BY TURNING "OFF" THE CIRCUIT BREAKER	
16.5. PERFORM INSPECTIONS ON THE EMERGENCY EXIT SIGN LIGHT FIXTURES DURING THE 30 SECOND TEST TO ENSURE THAT THE LIGHTS DIDN'T FAIL OR OUTPUT BECAME VISIBLY VERY LOW TO THE NAKED EYE BY COMPARISON TO OTHER SIMILAR/IDENTICAL EMERGENCY LIGHTS	
16.6. AFTER 30 SECONDS RESTORE INCOMING UTILITY POWER TO THE EMERGENCY EXIT SIGN LIGHT FIXTURE BY SWITCHING CIRCUIT BREAKER TO "ON" POSITION TO END THE TEST OR IF TEST BUTTON FUNCTIONALITY WAS USED, WAIT TILL IT AUTOMATICALLY ENDS THE TEST IN 30 SECONDS	
16.7. CREATE A CM WORK ORDER FOR FAILURES AND IDENTIFY TO THE FIXTURE ASSET NUMBER	

ELECTRICAL PM	
17. EXIT LIGHTS TEST AND INSPECTION	ANNUAL
17.1. REVIEW SAFETY PLAN	
17.2. PERFORM ANNUAL FUNCTIONAL TESTS ON THE EMERGENCY LIGHT SYSTEMS FOR EACH EMERGENCY EXIT SIGN LIGHT TO ENSURE EACH EMERGENCY EXIT LIGHT OPERATE FOR NOT LESS THAN 90 MINUTES.	
17.3. SWITCH THE ASSOCIATED LIGHTING CIRCUIT BREAKER TO THE "OFF" POSITION TO START THE TEST.	
17.4. RECORD THE START TIME IN MAXIMO.	
17.5. PERFORM INSPECTIONS ON THE EMERGENCY EXIT SIGN LIGHT FIXTURES DURING THE 90 MINUTE TEST TO ENSURE THAT THE LIGHTS DIDN'T FAIL OR OUTPUT BECAME VISIBLY VERY LOW TO THE NAKED EYE BY COMPARISON TO OTHER SIMILAR/IDENTICAL EMERGENCY LIGHTS.	
17.6. AFTER 90 MINUTES SWITCH THE ASSOCIATED LIGHTING CIRCUIT BREAKER TO THE "ON" POSITION TO STOP THE TEST.	
17.7. RECORD THE STOP TIME IN MAXIMO	
17.8. CREATE A CM WORK ORDER FOR FAILURES AND IDENTIFY TO THE FIXTURE ASSET NUMBER	
17.9. PERFORM ABOVE MENTIONED REQUIRED TASKS FOR EACH EMERGENCY EXIT SIGN LIGHT.	
17.10. CHECK FOR NORMAL ILLUMINATION.	
18. EMERGENCY LIGHTS INVERTER SYSTEMS TEST AND INSPECTION	MONTHLY
18.1. REVIEW SAFETY PLAN	
18.2. PERFORM MONTHLY FUNCTIONAL TESTS ON THE EMERGENCY LIGHT INVERTERS BY SWITCHING CIRCUIT BREAKER TO "OFF" TO START THE TEST. ENSURE EMERGENCY LIGHTS OPERATE FOR NOT LESS THAN 30 SECONDS AND RECORD THE START/STOP TIMES BY COMPLETING THE FOLLOWING TASKS	
18.3. DISCONNECT INCOMING UTILITY POWER FROM THE EMERGENCY LIGHTING INVERTER TO SIMULATE A POWER OUTAGE BY SWITCHING CIRCUIT BREAKER TO THE "OFF" POSITION TO START THE TEST OR USE THE LIGHTING INVERTER TEST FUNCTIONALITY AS APPLICABLE	
18.4. PERFORM INSPECTIONS ON THE EMERGENCY LIGHT FIXTURES (FLUORESCENTS/LEDS/LANTERNS/EXIT SIGNS) DURING THE 30 SECOND TEST TO ENSURE THE LIGHTS DIDN'T FAIL OR OUTPUT BECAME VISIBLY VERY LOW TO THE NAKED EYE COMPARISON TO SIMILAR/IDENTICAL EMERGENCY LIGHTS	
18.5. AFTER 30 SECONDS RESTORE INCOMING UTILITY POWER TO THE EMERGENCY LIGHTING INVERTER BY SWITCHING CIRCUIT BREAKER TO "ON" POSITION TO END THE TEST OR IF	

ELECTRICAL PM	
TEST BUTTON FUNCTIONALITY WAS USED, WAIT TILL IT AUTOMATICALLY ENDS THE TEST IN 30 SECONDS	
18.6. INSPECT INVERTER INDICATOR LIGHTS IF APPLICABLE	
18.7. INSPECT INVERTER TEST BUTTON IF APPLICABLE	
18.8. CREATE A CM WORK ORDER FOR FAILURES AND IDENTIFY TO THE FIXTURE ASSET NUMBER	
19. EMERGENCY LIGHTS INVERTER SYSTEMS TEST AND INSPECTION	ANNUAL
19.1. REVIEW SAFETY PLAN	
19.2. PERFORM ANNUAL FUNCTIONAL TEST ON EMERGENCY LIGHTING INVERTER TO ENSURE LIGHTS OPERATE FOR NOT LESS THAN 90 MINUTES AND MAINTAINS ADEQUATE ILLUMINATION.	
19.3. DISCONNECT INCOMING UTILITY POWER TO THE EMERGENCY LIGHTING INVERTER TO SIMULATE A POWER OUTAGE BY SWITCHING CIRCUIT BREAKER TO THE "OFF" POSITION TO START THE TEST OR USE THE LIGHTING INVERTER TEST START FUNCTIONALITY AS APPLICABLE.	
19.4. RECORD THE START TIME IN MAXIMO.	
19.5. PERFORM INSPECTIONS ON THE EMERGENCY LIGHT FIXTURES (FLUORESCENTS/LEDS/LANTERNS/EXIT SIGNS) DURING THE 90 MINUTE TEST TO ENSURE THAT THE LIGHTS DIDN'T FAIL OR OUTPUT BECAME VISIBLY VERY LOW TO THE NAKED EYE BY COMPARISON TO OTHER SIMILAR/IDENTICAL EM	
19.6. AFTER 90 MINUTES RESTORE INCOMING UTILITY POWER TO THE EMERGENCY LIGHTING INVERTER BY SWITCHING CIRCUIT BREAKER TO THE "ON" POSITION TO END THE TEST RESTORING THE SIMULATED POWER OUTAGE OR USE THE LIGHTING INVERTER TEST END FUNCTIONALITY AS APPLICABL	
19.7. RECORD THE STOP TIME IN MAXIMO.	
19.8. INSPECT INVERTER INDICATOR LIGHTS IF APPLICABLE.	
19.9. INSPECT INVERTER TEST BUTTON IF APPLICABLE.	
19.10. CREATE A CM WORK ORDER FOR FAILURES AND IDENTIFY TO THE FIXTURE ASSET NUMBER.	
20. WISCONSIN ENGINE/COMPRESSOR (BLDG. 230)	QUARTERLY
20.1. CHECK CRANKCASE OIL ON ENGINE AND COMP. REPLACE OIL IF DIRTY.	
20.2. CHECK AIR CLEANER ON ENGINE AND COMP. REPLACE IF NECESSARY.	
20.3. CHECK COMP. PRESSURE SWITCH FOR PROPER OPERATION.	
20.4. PERFORM GENERAL CLEANING OF EQUIPMENT.	

ELECTRICAL PM	
21. GENERATOR AUTO START RESET (DAYLIGHT SAVINGS CHANGE)	SEMI-ANNUAL
21.1. RESET GENERATOR.	
21.2. EXERCISE TIMER.	
22. TIME CLOCKS MAR/NOV	SEMI-ANNUAL
22.1. CHANGE SETTING FOR DAYLIGHT SAVINGS TIME.	
22.2. CHECK AND SET SKIP A DAY SETTINGS.	
22.3. CHECK OPERATION.	
22.4. CHECK CONTACTS.	
23. ELECTRICAL HANDHOLES (APR/OCT). ONE P.M. SHOULD BE PERFORMED IN OCTOBER BEFORE START OF RAINY SEASON AND THE OTHER IN APRIL	SEMI-ANNUAL
23.1. CHECK WIRING.	
23.2. CHECK DRAINAGE.	
23.3. CLEAN OUT DEBRIS	
24. ELECTRICAL MANHOLES (APR/OCT). ONE P.M. SHOULD BE PERFORMED IN OCTOBER BEFORE START OF RAINY SEASON AND THE OTHER IN APRIL	SEMI-ANNUAL
24.1. CHECK WIRING	
24.2. CHECK DRAINAGE	
24.3. CLEAN OUT DEBRIS	
24.4. CHECK SUMP PUMP FOR PROPER OPERATION	
12.5 ADVISE JPL CTM PRIOR TO PERFORMING WORK	
25. VARIABLE FREQUENCY DRIVES	ANNUAL
25.1. CHECK OPERATION OF DRIVES.	
25.2. VERIFY SENSORS CONTROLLING DRIVES ARE CALIBRATED.	
25.3. TIGHTEN ELECTRICAL CONNECTIONS.	
25.4. DUST AND CLEAN.	
26. AUTOMATIC TRANSFER SWITCH MAINTENANCE	MONTHLY
26.1. INSPECT PHYSICAL AND MECHANICAL CONDITION AND RECORD CONDITION IN THE CMMS.	

ELECTRICAL PM	
26.2. INSPECT ANCHORAGE, ALIGNMENT, GROUNDING, AND REQUIRED CLEARANCES.	
26.3. VERIFY THAT MANUAL TRANSFER WARNINGS ARE ATTACHED AND VISIBLE.	
27. AUTOMATIC TRANSFER SWITCH MAINTENANCE - VISUAL AND MECHANICAL	ANNUAL
27.1. DE-ENERGIZE ALL SOURCES OF POWER.	
27.2. INSPECT PHYSICAL AND MECHANICAL CONDITION AND RECORD CONDITION IN THE CMMS.	
27.3. INSPECT ANCHORAGE, ALIGNMENT, GROUNDING, AND REQUIRED CLEARANCES.	
27.4. PRIOR TO CLEANING THE UNIT, PERFORM AS-FOUND TESTS.	
27.5. CLEAN THE UNIT.	
27.6. INSPECT AND CHECK CONDITION OF CONTACTS. RECORD CONDITION OF CONTACTS IN CMMS.	
27.7. USE APPROPRIATE LUBRICATION ON MOVING CURRENT-CARRYING PARTS AND ON MOVING AND SLIDING SURFACES.	
27.8. VERIFY THAT MANUAL TRANSFER WARNINGS ARE ATTACHED AND VISIBLE.	
27.9. MANUALLY TEST PTS	
27.10. INSPECT BOLTED ELECTRICAL CONNECTIONS FOR HIGH RESISTANCE USING ONE OR MORE OF THE FOLLOWING METHODS IN TASKS 101, 102 OR 103.	
27.11. USE OF A LOW-RESISTANCE OHMMETER IN ACCORDANCE WITH NETA SECTION 7.22.3.B.1	
27.12. VERIFY TIGHTNESS OF ACCESSIBLE BOLTED ELECTRICAL CONNECTIONS BY CALIBRATED TORQUE WRENCH METHOD	
27.13. PERFORM A THERMOGRAPHIC SURVEY IN ACCORDANCE WITH NETA SECTION 9.	
27.14. PERFORM MANUAL TRANSFER OPERATION.	
27.15. VERIFY POSITIVE MECHANICAL INTERLOCKING BETWEEN NORMAL AND ALTERNATE SOURCES.	
27.16. PERFORM AS-LEFT TESTS.	
28. AUTOMATIC TRANSFER SWITCH MAINTENANCE - ELECTRICAL	
28.1. DE-ENERGIZE ALL SOURCES OF POWER AND COMPARE ALL TEST VALUES TO THE ATTACHED NETA DOCUMENT.	
28.2. PERFORM RESISTANCE MEASUREMENTS THROUGH BOLTED CONNECTIONS WITH A LOW-RESISTANCE OHMMETER IN ACCORDANCE WITH SECTION 7.22.3.A.8.1.	
28.3. PERFORM INSULATION RESISTANCE TESTS ON ALL CONTROL WIRING WITH RESPECT TO GROUND. THE APPLIED	

ELECTRICAL PM	
POTENTIAL SHALL BE 500 VOLTS DC FOR 300-VOLT RATED CABLE AND 1000 VOLTS DC FOR 600-VOLT RATED CABLE.	
28.4. TEST DURATION SHALL BE ONE MINUTE. FOR UNITS WITH SOLID-STATE COMPONENTS OR FOR RECOMMENDATION.	
28.5. PERFORM A CONTACT/POLE-RESISTANCE TEST.	
28.6. VERIFY SETTINGS AND OPERATION OF CONTROL DEVICES.	
28.7. CALIBRATE AND SET ALL RELAYS AND TIMERS IN ACCORDANCE WITH SECTION 7.9.	
28.8. PERFORM AUTOMATIC TRANSFER TESTS PER TASKS 191 - 194.	
28.9. SIMULATE LOSS OF NORMAL POWER.	
28.10. RETURN TO NORMAL POWER.	
28.11. SIMULATE LOSS OF EMERGENCY POWER.	
28.12. SIMULATE ALL FORMS OF SINGLE-PHASE CONDITIONS.	
28.13. VERIFY CORRECT OPERATION AND TIMING OF THE FOLLOWING FUNCTIONS OF TASKS 201 - 208.	
28.14. NORMAL SOURCE VOLTAGE-SENSING AND FREQUENCY SENSING RELAYS.	
28.15. ENGINE START SEQUENCE.	
28.16. TIME DELAY UPON TRANSFER.	
28.17. ALTERNATE SOURCE VOLTAGE-SENSING AND FREQUENCY SENSING RELAYS.	
28.18. AUTOMATIC TRANSFER OPERATION.	
28.19. INTERLOCKS AND LIMIT SWITCH FUNCTION.	
28.20. TIME DELAY AND RETRANSFER UPON NORMAL POWER RESTORATION.	
28.21. ENGINE COOL DOWN AND SHUTDOWN FEATURE.	
29. POWER TRANSFER SWITCH MAINTENANCE	ANNUAL
29.1. DE-ENERGIZE ALL SOURCES OF POWER.	
29.2. INSPECT AND CHECK CONDITION OF CONTACTS.	
29.3. CLEAN AND SERVICE AS NECESSARY	
29.4. MANUALLY TEST PTS	
29.5. REPLACE COVERS AND CLOSE DOORS.	
29.6. CLOSE CIRCUIT BREAKERS FOR UTILITY AND GENERATOR SOURCES.	
30. MCC PANEL MAINTENANCE	TRIENNIAL
30.1. CHECK VOLTAGES	

ELECTRICAL PM	
30.2. CHECK CURRENTS	
30.3. INSPECT LUGS IN ELECTRIC PANELS FOR TIGHTNESS AND SOLID CONTACT.	
30.4. INSPECT ELECTRIC WIRING FOR WORN/BURNT INSULATION AND LOOSE CONNECTIONS.	
30.5. VERIFY CORRECTNESS OF PANEL DIRECTORY. REPLACE AS REQUIRED.	
30.6. TEST OVERLOADS (WHEN POSSIBLE).	
30.7. CHECK BUSS, HARDWARE, AND CONNECTIONS FOR TIGHTNESS AND DISCOLORATION.	
30.8. CLEAN AND DUST.	
30.9. CHECK MAIN CIRCUIT BREAKERS AND ALL OTHER BREAKERS, INCLUDING AIR AND VACUUM BREAKERS OVER 600 AMPS. USE EXAMPLE SHEET SHOWN IN Appendix A.1.4.1	
BANKS	
6, 7, 8, 9, 10, 14, 16, 13, 19, 20, 24, 25, 27, 30, 33, 34, 44, 45, 46, 47, 48, 51, 52, 55, 56, 58, 59, 60, 63, 64, 65, 68, 69, 72, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83	TRIENNIAL
31. PRIMARY DISTRIBUTION SUBSTATIONS AND BANKS	
31.1. CHECK ALL CONNECTIONS (PRIMARY AND SECONDARY TRANSFORMERS) FOR TIGHTNESS, DISCOLORATION, AND LEAKS.	
31.2. CHECK INSULATORS FOR CRACKS AND BROKEN GLAZE AND CLEAN.	
31.3. TEST OIL FOR ACID AND DIELECTRIC BREAKDOWN. USE EXAMPLE SHEET SHOWN IN Appendix A.1.4.2.	
31.4. FILTER OIL AND/OR ADD AS NECESSARY.	
31.5. MEGGER LINE SIDE IF ACCESSIBLE.	
31.6. COVER WITH NITROGEN WHEN APPLICABLE.	
31.7. CHECK TAP CHANGER RADIATORS AND COOLING FANS.	
31.8. TEST AND CALIBRATE OVERCURRENT RELAYS TO ENGINEERING SPECIFICATIONS. USE EXAMPLE SHEET SHOWN IN Appendix A.1.4.3	
31.9. CHECK FOR GENERAL CONDITION OF SYSTEM AND WARNING SIGNS.	
31.10. INSPECT TRANSFORMER AND SWITCHGEAR SUPPORT PADS AND FOOTINGS.	
31.11. CHECK LIGHTING AND STRIP HEATERS.	
31.12. CLEAN UNIT OF DUST AND DEBRIS. REPLACE ALL AIR FILTERS.	
31.13. CHECK CONTOUR OF LAND AROUND SUBSTATION TO ASSURE DRAINAGE IS AWAY FROM SITE.	
31.14. RECORD DATE AND ELECTRICIAN IN SUB/BANK LOG BOOK.	
31.15. USE EXAMPLE SHEETS SHOWN IN APPENDIXES A.1.4.2, A.1.4.4, AND A.1.4.5, AS REQUIRED	

ELECTRICAL PM	
32. BATTERY STRINGS 1&2 FOR UPS SYSTEM (492 CELLS), BUILDING 230 ROOM 12	MONTHLY
32.1. CLEAN JAR COVERS AND BATTERY RACKS	
32.2. RECORD CHARGER OUTPUT CURRENT AND VOLTAGE	
32.3. RECORD ELECTROLYTE LEVELS AND ADJUST AS NEEDED	
32.4. CHECK FOR CRACKS OR LEAKAGE OF ELECTROLYTE	
32.5. VISUALLY INSPECT INTERCELL/UNIT CONNECTORS, CABLES AND RELATED HARDWARE FOR CORROSION	
32.6. RECORD AMBIENT ROOM TEMPERATURE	
32.7. VISUALLY INSPECT SEDIMENT LEVELS	
32.8. MEASURE AND RECORD THE VOLTAGE ON A MINIMUM OF 10% OF CELLS*	
32.9. MEASURE AND RECORD SPECIFIC GRAVITY ON 10% OF CELLS*	
32.10. MEASURE AND RECORD ELECTROLYTE TEMPERATURE ON 10% OF CELLS*	
32.11. CHECK FOR PROPER VENTILATION AND UNUSUAL ODORS	
32.12. MEASURE AND RECORD TOTAL BATTERY VOLTAGE USING A PRECISION DIGITAL MULTI-METER	
32.13. REVIEW ALL PREVIOUS RECORDS TO IDENTIFY TRENDS	
32.14. * CELLS CHOSEN FOR THESE MEASUREMENTS SHALL INCLUDE ANY CELLS FROM THE PREVIOUS MONTHLY INSPECTION IDENTIFIED AS "ABNORMAL"	
32.15. SUBMIT WRITTEN REPORT OF MONTHLY INSPECTION AND MAINTENANCE ACTIVITIES WITHIN TEN DAYS OF COMPLETION OF MONTHLY INSPECTION	
33. ALCAD LP-200 BATTERY SYSTEM/ BUILDING 230 ROOM B72 FOR BREAKER CONTROL OF SWITCHBOARD 12AB (37 CELLS)	MONTHLY
33.1. CLEAN JAR COVERS AND BATTERY RACKS	
33.2. RECORD CHARGER OUTPUT CURRENT AND VOLTAGE	
33.3. RECORD ELECTROLYTE LEVELS AND ADJUST AS NEEDED	
33.4. CHECK FOR CRACKS OR LEAKAGE OF ELECTROLYTE	
33.5. VISUALLY INSPECT INTERCELL/UNIT CONNECTORS, CABLES AND RELATED HARDWARE FOR CORROSION	
33.6. RECORD AMBIENT ROOM TEMPERATURE	
33.7. VISUALLY INSPECT SEDIMENT LEVELS	
33.8. MEASURE AND RECORD THE VOLTAGE ON A MINIMUM OF 10% OF CELLS*	
33.9. MEASURE AND RECORD SPECIFIC GRAVITY ON 10% OF CELLS*	

ELECTRICAL PM	
33.10. MEASURE AND RECORD ELECTROLYTE TEMPERATURE ON 10% OF CELLS*	
33.11. CHECK FOR PROPER VENTILATION AND UNUSUAL ODORS	
33.12. MEASURE AND RECORD TOTAL BATTERY VOLTAGE USING A PRECISION DIGITAL MULTI-METER	
33.13. REVIEW ALL PREVIOUS RECORDS TO IDENTIFY TRENDS	
33.14. * CELLS CHOSEN FOR THESE MEASUREMENTS SHALL INCLUDE ANY CELLS FROM THE PREVIOUS MONTHLY INSPECTION IDENTIFIED AS “ABNORMAL”	
33.15. SUBMIT WRITTEN REPORT OF MONTHLY INSPECTION AND MAINTENANCE ACTIVITIES WITHIN TEN DAYS OF COMPLETION OF MONTHLY INSPECTION	
34. ALCAD BATTERY SYSTEM FOR SWITCHGEAR /BUILDING 230 ROOMS 14 AND 36 (37 CELLS EACH)	MONTHLY
34.1. CLEAN JAR COVERS AND BATTERY RACKS	
34.2. RECORD CHARGER OUTPUT CURRENT AND VOLTAGE	
34.3. RECORD ELECTROLYTE LEVELS AND ADJUST AS NEEDED	
34.4. CHECK FOR CRACKS OR LEAKAGE OF ELECTROLYTE	
34.5. VISUALLY INSPECT INTERCELL/UNIT CONNECTORS, CABLES AND RELATED HARDWARE FOR CORROSION	
34.6. RECORD AMBIENT ROOM TEMPERATURE	
34.7. VISUALLY INSPECT SEDIMENT LEVELS	
34.8. MEASURE AND RECORD THE VOLTAGE ON A MINIMUM OF 10% OF CELLS*	
34.9. MEASURE AND RECORD SPECIFIC GRAVITY ON 10% OF CELLS*	
34.10. MEASURE AND RECORD ELECTROLYTE TEMPERATURE ON 10% OF CELLS*	
34.11. CHECK FOR PROPER VENTILATION AND UNUSUAL ODORS	
34.12. MEASURE AND RECORD TOTAL BATTERY VOLTAGE USING A PRECISION DIGITAL MULTI-METER	
34.13. REVIEW ALL PREVIOUS RECORDS TO IDENTIFY TRENDS	
34.14. SUBMIT WRITTEN REPORT OF MONTHLY INSPECTION AND MAINTENANCE ACTIVITIES WITHIN TEN DAYS OF COMPLETION OF MONTHLY INSPECTION	
34.15. * CELLS CHOSEN FOR THESE MEASUREMENTS SHALL INCLUDE ANY CELLS FROM THE PREVIOUS MONTHLY INSPECTION IDENTIFIED AS “ABNORMAL”	
35. C&D BATTERY SYSTEM FOR SWITCHBOARD/BUILDING 264 ROOM 132 (24 CELLS)	MONTHLY
35.1. CLEAN JAR COVERS AND BATTERY RACKS	

ELECTRICAL PM		
35.2.	RECORD CHARGER OUTPUT CURRENT AND VOLTAGE	
35.3.	RECORD ELECTROLYTE LEVELS AND ADJUST AS NEEDED	
35.4.	CHECK FOR CRACKS OR LEAKAGE OF ELECTROLYTE	
35.5.	VISUALLY INSPECT INTERCELL/UNIT CONNECTORS, CABLES AND RELATED HARDWARE FOR CORROSION	
35.6.	RECORD AMBIENT ROOM TEMPERATURE	
35.7.	VISUALLY INSPECT SEDIMENT LEVELS	
35.8.	MEASURE AND RECORD THE VOLTAGE ON A MINIMUM OF 10% OF CELLS*	
35.9.	MEASURE AND RECORD SPECIFIC GRAVITY ON 10% OF CELLS*	
35.10.	MEASURE AND RECORD ELECTROLYTE TEMPERATURE ON 10% OF CELLS*	
35.11.	CHECK FOR PROPER VENTILATION AND UNUSUAL ODORS	
35.12.	MEASURE AND RECORD TOTAL BATTERY VOLTAGE USING A PRECISION DIGITAL MULTI-METER	
35.13.	REVIEW ALL PREVIOUS RECORDS TO IDENTIFY TRENDS	
	* CELLS CHOSEN FOR THESE MEASUREMENTS SHALL INCLUDE ANY CELLS FROM THE PREVIOUS MONTHLY INSPECTION IDENTIFIED AS “ABNORMAL”	
35.14.	SUBMIT WRITTEN REPORT OF MONTHLY INSPECTION AND MAINTENANCE ACTIVITIES WITHIN TEN DAYS OF COMPLETION OF MONTHLY INSPECTION	
36.	BATTERY STRINGS FOR UPS SYSTEM IN BUILDING 264 WEST ANNEX (240 CELLS PER EACH STRING – 480 CELLS TOTAL)	MONTHLY
36.1.	CLEAN JAR COVERS AND BATTERY RACKS	
36.2.	RECORD CHARGER OUTPUT CURRENT AND VOLTAGE	
36.3.	RECORD ELECTROLYTE LEVELS AND ADJUST AS NEEDED	
36.4.	CHECK FOR CRACKS OR LEAKAGE OF ELECTROLYTE	
36.5.	VISUALLY INSPECT INTERCELL/UNIT CONNECTORS, CABLES AND RELATED HARDWARE FOR CORROSION	
36.6.	RECORD AMBIENT ROOM TEMPERATURE	
36.7.	VISUALLY INSPECT SEDIMENT LEVELS	
36.8.	MEASURE AND RECORD THE VOLTAGE ON A MINIMUM OF 10% OF CELLS*	
36.9.	MEASURE AND RECORD SPECIFIC GRAVITY ON 10% OF CELLS*	
36.10.	MEASURE AND RECORD ELECTROLYTE TEMPERATURE ON 10% OF CELLS*	
36.11.	CHECK FOR PROPER VENTILATION AND UNUSUAL ODORS	
36.12.	MEASURE AND RECORD TOTAL BATTERY VOLTAGE USING A PRECISION DIGITAL MULTI-METER	

ELECTRICAL PM	
36.13. REVIEW ALL PREVIOUS RECORDS TO IDENTIFY TRENDS	
36.14. SUBMIT WRITTEN REPORT OF MONTHLY INSPECTION AND MAINTENANCE ACTIVITIES WITHIN TEN DAYS OF COMPLETION OF MONTHLY INSPECTION	
* CELLS CHOSEN FOR THESE MEASUREMENTS SHALL INCLUDE ANY CELLS FROM THE PREVIOUS MONTHLY INSPECTION IDENTIFIED AS "ABNORMAL"	
37. GENERATOR RADIATORS (SFOF)	ANNUAL
37.1. FLUSH AND CLEAN RADIATORS.	
37.2. REFILL PER MANUFACTURERS RECOMMENDATIONS.	
38. BUILDING 321 ACCELEROGRAPHS 3 EACH	ANNUAL
The periodic maintenance program consists of the following: As a minimum, the following steps will be performed during each PM visit: After giving JPL or JPL's M&O Subcontractor at least one day's notice of the scheduled inspection date and approximate time, Subcontractor or sub-tier subcontractor will send a trained, certified technical representative (Field Technician) from local facility. After arriving at the job site and meeting with JPL or JPL's M&O Subcontractor, the accelerographs are inspected to see if an event (Earthquake) has been recorded. If so, the additional steps noted in the "Retrieval of Earthquake Records" procedure are followed. Each station is checked to confirm presence of AC power to the battery chargers. Each charger is checked to confirm proper operation. Batteries are tested for proper voltage both open circuit and under load, i.e., accelerograph operating. Batteries are replaced three years after installation or whenever the loaded voltage falls below acceptable limits: 13Vdc+/-1Vdc (Replacement included in fixed contract price.) Check the DC offset of each accelerometer and adjust it if necessary (<+/-50mV) On multiple instrument systems, the entire system is checked to see that it can be triggered from both the basement and middle accelerograph and that the master time is being recorded on all three accelerographs. If the instrument(s) is connected to a telephone line via a modem, then a remote call is initiated from the office to confirm the remote connection. After all tests and adjustments have been completed, the accelerograph is closed and an "as left" Functional Test is recorded. This record is retrieved and left on the accelerograph. Administrative changes that may have occurred affecting the security of the accelerographs or their proper operation are noted on the Inspection Form (i.e., change of door keys or personnel, infringement on the assigned areas etc.) After independent review, a hard copy of the Functional Test and the header of the file records confirming proper functioning of the accelerographs are attached to the original inspection forms and sent directly to the JPL. A copy is sent to the Local building department and another is kept in Subcontractor files for no less than two years.	

Appendix A.1.4.1 Low Voltage Air Circuit Breaker

CUSTOMER:				JOB NUMBER:				
LOCATION:				TEST DATE:				
SUBSTATION:				FEEDER:				
FIELD DATA								
BREAKER INFORMATION				TRIP UNIT INFORMATION				
MANUFACTURER:				MANUFACTURER:				
MODEL:				TRIP UNIT TYPE:				
SERIAL NUMBER:				TIME CURRENT CURVE NO:				
FRAME SIZE:				RATING PLUG:				
INTERRUPTING RATING:				SENSOR TAP RANGES:				
CLOSE COIL VOLTAGE:				SENSOR TAP USED:				
TRIP COIL VOLTAGE:				SETTINGS	AS FOUND	AS LEFT		
INSTRUCTION BOOK:				LD PICKUP:				
OPERATION COUNTER:				LD DELAY:				
OTHER:				SD PICKUP:				
LIMITER INFORMATION				SD DELAY:				
MANUFACTURER:				INSTANTANEOUS:				
CATALOG NUMBER:				GF PICKUP:				
CURRENT RATING:				GF DELAY:				
VISUAL AND MECHANICAL INSPECTION								
CELL CONDITION:				ELECTRICAL OPERATION:				
RACKING MECHANISM:				MAIN CONTACTS:				
INTERLOCKS:				ARCING CONTACTS:				
PRIMARY DISCONNECTS:				CONTACT WIPE:				
SECONDARY DISCONNECTS:				PHASE BARRIERS:				
GROUND CONNECTION:				ARC CHUTES:				
OPERATING MECHANISM:				LATCH MECHANISM:				
ELECTRICAL TEST DATA								
TEST TYPE:				BLOWN FUSE INDICTORS:				
TIMING TESTS	SETTING	TEST %	AMPS	MIN	MAX	PHASE A	PHASE B	PHASE C
LT PICKUP:								
LT DELAY:								
ST PICKUP:								
ST DELAY:								
INST. PICKUP:								
GF PICKUP:								
GF DELAY:								
CONTACT RESISTANCE (micro-OHMS):			PHASE A:		PHASE B:		PHASE C:	
LIMITER RESISTANCE (micro-OHMS):			PHASE A:		PHASE B:		PHASE C:	
			INSULATION RESISTANCE (MEGOHMS)@					VDC
BREAKER CONTACTS CLOSED:			A-G:		B-G:		C-G:	
			A-B:		B-C:		A-C:	
			A-A:		B-B:		C-C:	
BREAKER CONTACTS OPEN:			A-A:		B-B:		C-C:	
COMMENTS AND RECOMMENDATIONS								
TESTED BY:						Document Rev.5 8/03/05		

Appendix A.1.4.2 Oil-Filled Transformer

CUSTOMER:		JOB NUMBER:					
LOCATION:		TEST DATE:					
SUBSTATION:		TRANSFORMER ID:					
EQUIPMENT DATA							
MANUFACTURER:		TYPE:					
SERIAL NUMBER:		IMPEDANCE:					
S.O. NUMBER:		FREQUENCY:					
CLASS:		NUMBER OF TAPS:					
KVA RATING:		CONFIGURATION:					
PHASES:		WINDING MATERIAL:					
TEMP RISE:		OIL TEMP. :					
PRIMARY VOLTAGE:		SEC. VOLTAGE:					
WINDING TEMP:		SYSTEM VOLTAGE:					
PRIMARY BIL:		SECONDARY BIL:					
OIL TYPE:		GAL. OF OIL:					
DATE OF MAN.:		OTHER:					
EQUIPMENT INSPECTION							
VISUAL INSPECTION:		SIGNS OF LEAKING:					
PRESSURE RELIEF DEVICE:		TAP SETTINGS:					
BUSHINGS:		TIGHTNESS OF CONNECTIONS:					
PROPER GROUNDING:		INSULATION AND BARRIERS:					
TERMINATION CLEARANCES:		GENERAL CLEANLINESS:					
LIQUID LEVEL:		FAN OPERATION:					
VACUUM/PRESSURE GAUGE:		DRAIN VALVE:					
RADIATORS:		LIQUID SAMPLE VALVE:					
ELECTRICAL TEST DATA							
URNS RATIO TESTS							
		H1- /X1-		H2- /X2-		H3- /X3-	
TAP POSITION	PRIMARY VOLTAGE	CALC	ACTUAL	CALC	ACTUAL	CALC	ACTUAL
INSULATION RESISTANCE							
MEGGER RESULTS: (MEG-OHMS)	HI TO LO & GND @	LO TO HI & GND @ VDC	HI TO LO @ VDC	CORE GND @ VDC			
ACTUAL VALUE:							
CORRECTED VALUE:							
TAP AS FOUND:		TAP AS LEFT:		POWER FACTOR TEST:			
COOLING CONTROL SETPOINTS:		FANS:		ALARMS:		TRIPS:	
COMMENTS AND RECOMMENDATIONS							
TESTED BY:				Revision 2 04/25/02			

Appendix A.1.4.3 Overcurrent Relay Test Sheet

CUSTOMER:		JOB NUMBER:						
LOCATION:		TEST DATE:						
SUBSTATION:		FEEDER:						
PHASE RELAY DATA								
MANUFACTURE:		STYLE:						
TYPE:		CURVE:						
TAP RANGE:		INSTANT RANGE:						
ICS RANGE:		INSTRUCTIONS:						
GROUND RELAY DATA								
MANUFACTURE:		STYLE:						
TYPE:		CURVE:						
TAP RANGE:		INSTANT RANGE:						
ICS RANGE:		INSTRUCTIONS:						
VISUAL AND MECHANICAL INSPECTIONS								
CASE CONDITION:		WIRING CONNECTIONS:						
GLASS IN CASE:		INDICATORS:						
CORROSION:		CT SHORTING CONN.:						
CONTACTS:		OPERATING COILS:						
DISC MOVEMENT:		CLEANLINESS:						
TEST DATA & RESULTS								
SETTINGS					TEST VALUES			
LOCATION	TAP	DIAL	INST.	ICS	P.U.	TIME	INST.	ICS PU
COMMENTS AND RECOMMENDATIONS								
TESTED BY:						Document Rev.1 06/04/02		

JPL D-40941

Appendix A.1.4.5 Medium Air Voltage Circuit Breaker

CUSTOMER:		JOB NUMBER:	
LOCATION:		TEST DATE:	
EQUIPMENT DATA			
SUBSTATION:		FEEDER:	
MANUFACTURER:		FREQUENCY:	
MODEL:		BIL (Kv):	
SERIAL NUMBER:		MANUFACTURE DATE:	
FRAME SIZE:		FREQUENCY	
RATED VOLTAGE:		OPERATING MECHANISM:	
SYSTEM VOLTAGE:		TRIP COIL RATED VOLTS:	
INTERRUPTING RATING:		CLOSE COIL RATED VOLTS:	
CLOSE AND LATCH RATING:		OP COUNTER AS FOUND:	
MVA RATING:		OP COUNTER AS LEFT:	
VISUAL AND MECHANICAL INSPECTIONS			
CELL CONDITION:		PROTECTION TRIP:	
BUS INSULATION:		ANTI-PUMP OPERATION:	
INTERLOCKS:		CHARGING MOTOR:	
RACKING OPERATION:		GROUND CONNECTION:	
SHUTTER MECHANISM:		LUBRICATION:	
PRIMARY DISCONNECTS:		INDICATORS:	
SECONDARY DISCONNECTS:		CONTACT WIPE:	
PHASE BARRIERS:		PUFFER ASSEMBLY:	
MANUAL OPERATION:		ARC CHUTES:	
ELECTRIC OPERATION:		LATCH MECHANISM:	
MAIN CONTACTS:		ARCING CONTACTS:	
ELECTRICAL TESTS			
CONTACT RESISTANCE (micro-OHMS):	PHASE A:	PHASE B:	PHASE C:
	INSULATION RESISTANCE (MEGOHMS) @ VDC		
BREAKER CONTACTS CLOSED:	A-G:	B-G:	C-G:
	A-B:	B-C:	A-C:
BREAKER CONTACTS OPEN:	A-A:	B-B:	C-C:
	HIGH-POTENTIAL TEST (micro-AMPS) @		
BREAKER CONTACTS CLOSED:	A-G:	B-G:	C-G:
	A-B:	B-C:	A-C:
BREAKER CONTACTS OPEN:	A-A:	B-B:	C-C:
CONTACT TIMING TESTS:	PHASE A:	PHASE B:	PHASE C:
COIL #1 MINIMUM TRIP VOLTAGE:		COIL #2 MINIMUM TRIP VOLTAGE:	
MEGGER CONTROL WIRING @ 500 VDC (MEGOHMS):			
COMMENTS AND RECOMMENDATIONS			
TESTED BY:			Document Rev.3 08/04/05

Appendix A.1.5 Elevators PM

ELEVATORS PM	
1. HYDRAULIC ELEVATOR TASKS	
1.1. MACHINE ROOM CLEANING.	MONTHLY
1.2. VISUAL OPERATION AND INSPECTION.	
1.3. CHECK DOOR OPERATORS FOR CLOSING FORCE UNDER 30 LBS.	
1.4. CHECK DOOR OPERATORS FOR CLOSING SPEED UNDER 1 FOOT/SEC.	
1.5. CHECK SAFETY EDGES TO ENSURE THAT SWITCH ACTIVATES BEFORE 1/3 OF THE SAFETY EDGE TRAVEL.	
1.6. CHECK ALL PUSH BUTTONS AND ASSOCIATED LIGHTING.	
1.7. CHECK ALL POSITION INDICATOR LIGHTING.	
1.8. CHECK EMERGENCY TELEPHONE.	
1.9. CHECK IN-CAR EMERGENCY LIGHTING.	
1.10. CHECK ALL FLOOR LEVELING FOR ACCURACY AND CONSISTENCY OF LEVELING IN BOTH DIRECTIONS.	
1.11. CHECK FIRE EMERGENCY RECALL BY LOBBY SENSORS AND RECALL KEY SWITCH.	
1.12. CHECK FIREMAN'S IN-CAR CONTROL FOR PROPER OPERATION.	
1.13. TIGHTEN ALL CONTROLLER CONNECTIONS.	ANNUAL
1.14. CLEAN HOISTWAY OF ALL DUST GREASE.	
1.15. REPLACE CARPET/FLOORING MATERIAL.	
1.16. RESERVED.	
1.17. CHECK ALL OIL LEVELS ON MACHINE AND GENERATOR.	QUARTERLY
1.18. CHECK ALL CONTACTS FOR WEAR AND BURNING.	
1.19. BLOW OUT CONTROLLERS AND CHECK RELAYS FOR OPERATION.	
1.20. CHECK DOOR HANGER ROLLERS.	
1.21. CHECK DOOR HANGAR KICK-UP ROLLERS.	
1.22. CHECK DOOR RELATING CABLE FOR PROPER TENSION, BROKEN WIRES AND DOOR RELATION.	
1.23. CHECK INTERLOCKS FOR PROPER CONTACT WIPE.	
1.24. CHECK DOOR OPERATOR LINKAGE FOR WORN BEARINGS AND PIVOT POINTS.	
1.25. PITS SHALL BE MAINTAINED IN A CLEAN AND DRY CONDITION.	
1.26. CHECK TIMING OF DOOR OPEN/CLOSE, DOOR HOLD OPEN (BOTH CAR AND HALL CALL) AND FLOOR TO FLOOR.	
1.27. CHECK CAR NUDGING FOR PROPER OPERATION.	

ELEVATORS PM	
1.28. CHECK GROUP OPERATION FOR PROPER CAR SPACING, CAR FAILURE TRANSFER, LOAD WEIGHING, BY-PASS AND DISPATCHING.	
1.29. CHECK FOR PROPER SEQUENCING AND PROPER OPERATION UNDER EMERGENCY POWER CONDITIONS.	
1.30. CHECK RELAY SHUNTS. REPLACE BRITTLE AND BROKEN SHUNTS.	SEMI-ANNUAL
1.31. CLEAN AND LUBRICATE ALL HOISTWAY DOOR HANGAR TRACKS.	
1.32. CHECK CONDITION AND NUMBER OF DOOR GIBS PER PANEL.	
1.33. CHECK TRAVELING CABLES FOR BREAKS AND ABRASION.	
1.34. CHECK HOIST/GOVERNOR ROPES FOR WIRE BREAKS. NOTE ADJACENT WIRE BREAKS IN SAME STRAND.	
1.35. HYDRO TEST, RELIEF VALVE TEST, AND STATIC LOAD TEST.	TRIENNIAL-LY
2. TRACTION ELEVATOR TASKS	
2.1. MACHINE ROOM CLEANING.	MONTHLY
2.2. CHECK FOR MACHINE VIBRATION AND NOISE.	
2.3. CHECK COMMUTATORS FOR SURFACE GLAZE.	
2.4. CHECK BRUSHES FOR PROPER LENGTH AND GLAZE.	
2.5. CHECK LEVELING INDEXING DEVICES FOR PROPER MOVEMENT IN BOTH THE RUNNING/LEVELING MODE.	
2.6. CHECK DOOR OPERATORS FOR CLOSING FORCE UNDER 30 LBS.	
2.7. CHECK DOOR OPERATORS FOR CLOSING SPEED UNDER 1 FOOT/SEC.	
2.8. CHECK SAFETY EDGES TO ENSURE THAT SWITCH ACTIVATES BEFORE 1/3 OF THE SAFETY EDGE TRAVEL.	
2.9. CHECK ALL PUSH BUTTONS AND ASSOCIATED LIGHTING.	
2.10. CHECK ALL POSITION INDICATOR LIGHTING.	
2.11. CHECK EMERGENCY TELEPHONE.	
2.12. CHECK IN-CAR EMERGENCY LIGHTING.	
2.13. CHECK ALL FLOOR LEVELING FOR ACCURACY AND CONSISTENCY OF LEVELING IN BOTH DIRECTIONS.	
2.14. CHECK FIRE EMERGENCY RECALL BY LOBBY SENSORS AND RECALL KEY SWITCH.	
2.15. CHECK FIREMAN'S IN-CAR CONTROL FOR PROPER OPERATION.	
2.16. CHECK ALL OIL LEVELS ON MACHINE AND GENERATOR.	QUARTERLY
2.17. CLEAN BRAKE SOLENOIDS AND PINS.	
2.18. CHECK ALL CONTACTS FOR WEAR AND BURNING.	

ELEVATORS PM	
2.19. BLOW OUT CONTROLLERS AND CHECK RELAYS FOR OPERATION.	
2.20. CHECK ALL SELECTOR BEARINGS, GUIDE MEMBERS, CHAINS AND SPROCKETS.	
2.21. CHECK SELECTOR CARRIAGES FOR PROPER CONTACT MOVEMENT AND ALIGNMENT.	
2.22. TIGHTEN ALL SELECTOR ELECTRICAL CONNECTIONS.	
2.23. CHECK ALL SELECTOR TAPES AND WIRE DRIVES FOR BREAKS.	
2.24. LUBRICATE ALL GOVERNOR PINS, PIVOT POINTS AND MAKE FREE.	
2.25. CHECK DOOR HANGAR ROLLERS.	
2.26. CHECK DOOR HANGAR KICK-UP ROLLERS.	
2.27. CHECK DOOR RELATING CABLE FOR PROPER TENSION, BROKEN WIRES, AND DOOR RELATION.	
2.28. CHECK INTERLOCKS FOR PROPER CONTACT WIPE.	
2.29. CHECK DOOR OPERATOR LINKAGE FOR WORN BEARINGS AND PIVOT POINTS.	
2.30. PITS SHALL BE MAINTAINED IN A CLEAN AND DRY CONDITION.	
2.31. CHECK OIL LEVEL IN BUFFERS.	
2.32. CHECK BUFFER SWITCHES FOR PROPER OPERATION.	
2.33. CHECK TIMING OF DOOR OPEN, DOOR CLOSE, DOOR HOLD OPEN (BOTH CAR AND HALL CALL) AND FLOOR TO FLOOR (BRAKE TO BRAKE).	
2.34. CHECK CAR NUDGING FOR PROPER OPERATION.	
2.35. CHECK GROUP OPERATION FOR PROPER SPACING, CAR FAILURE TRANSFER, LOAD WEIGHING BY-PASS AND DISPATCHING.	
2.36. CHECK SEISMIC SWITCHES AND COUNTERWEIGHT DERAILMENT SWITCHES FOR PROPER OPERATION.	
2.37. CHECK FOR PROPER SEQUENCING AND PROPER OPERATION UNDER EMERGENCY POWER CONDITIONS.	
2.38. ADJUST BRAKE SHOES TO DRUM.	SEMI-ANNUAL
2.39. CHECK RELAY SHUNTS, REPLACE BRITTLE AND BROKEN SHUNTS.	
2.40. CLEAN AND LUBRICATE ALL HOISTWAY DOOR HANGAR TRACKS.	
2.41. CHECK CONDITION AND NUMBER OF DOOR GIBS PER PANEL.	
2.42. CHECK TRAVELING CABLES FOR BREAKS AND ABRASION.	
2.43. CHECK HOIST/GOVERNOR ROPES FOR WIRE BREAKS. NOTE ADJACENT WIRE BREAKS IN SAME STRAND.	
2.44. CHECK MACHINE BEARINGS FOR WEAR.	ANNUAL
2.45. TIGHTEN ALL CONTROLLER CONNECTIONS.	

ELEVATORS PM	
2.46. CHECK MOTORS AND GENERATOR FOR ARMATURE TO FIELD CLEARANCES.	
2.47. TIGHTEN ALL MOTOR AND GENERATOR CONNECTIONS.	
2.48. CHECK ELEVATOR COMPOUNDING.	
2.49. TIGHTEN ALL SELECTOR ELECTRICAL CONNECTIONS.	
2.50. CHECK ALL SELECTOR SLOW DOWN CONTACTS FOR SYMMETRY IN UP AND DOWN.	
2.51. HAND SET GOVERNOR TO ENSURE THAT GOVERNOR WEIGHTS WILL TRIP JAWS FIRMLY AROUND GOV.	
2.52. CLEAN HOISTWAY OF ALL DUST AND GREASE.	
2.53. CHECK DOOR UNLOCKING ROLLERS FOR PROPER CLEARANCE TO CAR VANE.	
2.54. ANNUAL NO LOAD SLOW SPEED SAFETY TEST.	
2.55. TEST CAR AND COUNTERWEIGHT OIL BUFFERS BY RUNNING CAR/COUNTERWEIGHT ON TO FULLY COMPRESS BUFFER.	
2.56. BUFFER SHOULD RETURN WITHIN 180 SECONDS AFTER RELEASE OF CONTACT.	
2.57. REPLACE CARPET/FLOORING MATERIAL	
2.58. TAKE SAMPLE OF OIL FOR TESTING.	5-YEAR
2.59. CHECK WORK AND GEAR MESH.	
2.60. SET MACHINE BRAKE FOR 125% RATED LOAD AND SEAL SETTING.	
2.61. FIVE-YEAR SAFETY TEST WITH FULL LOAD AT RATED SPEED.	

Appendix A.1.6 **EMCS PM**

EMCS PM	
1. EMCS BUILDING AND EQUIPMENT SENSORS	ANNUAL
1.1. VALIDATE THAT SENSOR READS ACCURATE, WITHIN TOLERANCE	
2. EMCS FIELD INTERFACE PANELS	
2.1. DUST AND CLEAN CABINET (INSIDE AND OUT).	
2.2. CAREFULLY CHECK AND TIGHTEN (IF NECESSARY) ALL TERMINAL STRIP SCREWS. WHEN POSSIBLE, CHECK AND TIGHTEN SUB-BASE TERMINATION SCREWS.	
2.3.	
2.4. KEEP WIRES/CABLES CONFINED IN WIRE/CABLE RACEWAYS.	
2.5. SECURE LOOSE RELAYS.	
2.6. SECURE LOOSE WIRE GROUPS.	
3. CBM - VIBRATION ANALYSIS SENSOR CONDITION	ANNUAL
3.1. REVIEW ALL READINGS AND VALIDATE THAT THE PERMANENT VIBRATION SENSORS ARE READING ACCURATELY AND REPORT CONDITION IN THE CBMVSNMETER METER.	

Appendix A.1.7 HVAC PM

1. A/C PACKAGE UNIT	SEMI-ANNUAL
1.1. CHANGE FILTERS.	
1.2. CHECK BELTS AND PULLEYS AND REPLACE / ADJUST IF NECESSARY.	
1.3. CLEAN CONDENSER AND EVAPORATOR.	
1.4. CLEAN CONDENSATE PAN AND DRAIN.	
1.5. ENSURE CONDENSATE DRAIN IS CLEAR. POUR 2 GALLONS OF WATER DOWN DRAIN. IF DRAIN IS SLOW OR PLUGGED, SAFELY USE PRESSURE (COMPRESSED AIR OR NITROGEN) OR A WET VAC TO REMOVE THE STOPPAGE. BE SURE DRAINAGE FROM ONE PAN IS NOT DRAINING INTO ANOTHER PAN.	
1.6. LUBRICATE MOTORS AND BEARINGS PER MANUFACTURES RECOMMENDATIONS IF APPLIES.	
1.7. TIGHTEN ALL ELECTRICAL CONNECTIONS DUST AND CLEAN.	
1.8. CHECK FOR SIGNS OF REFRIGERANT LEAKS AND REPAIR - -.	
1.9. CHECK OPERATION OF ECONOMIZER / SENSORS AND CONTROLS IF	
1.10. CLEAN BURNER AND PILOT, CHECK SAFETIES, IF APPLICABLE.	
1.11. START UNIT / CHECK OPERATING TEMPERATURES AND PRESSURES.	
1.12. VERIFY OPERATION OF THERMOSTAT.	
1.13. ENCAPSULATE/REPAIR ANY DETERIORATED OR TORN INSULATION	
1.14. INSPECT INTERIOR OF AIR HANDLER/FAN, DUCTS, VENTS, AND REGISTERS FOR	
MOLD, MILDEW AND DIRT. NOTIFY MANAGEMENT FOR PROPER TESTING, REMOVAL OF MOLD/MILDEW/DIRT AND PROPER REMEDIATION OF THE	
MOLD/MILDEW/DIRT CAUSALITY.	
1.15. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
2. A/C WINDOW UNIT	ANNUAL
2.1. CLEAN WASHABLE FILTER OR REPLACE DISPOSABLE FILTERS	
2.2. CHECK OPERATION OF TEMPERATURE CONTROL	
2.3. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
3. AIR DRYER (DESICCANT)	ANNUAL
3.1. CHECK DESICCANT. REPLACE IF NECESSARY.	
3.2. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
4. AIR DRYER (REFRIGERATED)	ANNUAL
4.1. CHECK FOR PROPER OPERATION.	

4.2. CHECK REFRIGERATION SYSTEM.	
4.3. CLEAN UNIT AND CONDENSER COIL.	
4.4. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
5. AIR SEPARATOR MAINTENANCE	ANNUAL
5.1. CHECK FOR LEAKS	
5.2. CHECK OPERATION OF AIR BLEED	
5.3. FLUSH AND CLEAR STRAINERS	
6. BLDG. 233-211A, M4895 OSA FILTER BANK FILTERS REPLACEMENT ANNUAL	ANNUAL
6.1. REPLACE OUTSIDE AIR FILTERS IN FILTER BANK ROOM 211A IF DP IS GREATER	
THAN 1" OR IF LAST CHANGE OUT IS OVER ONE YEAR.	
6.2. INSPECT INTERIOR OF FILTER BOX AND DUCTWORK FOR MOLD, MILDEW	
6.3. AND DIRT. NOTIFY MANAGEMENT FOR PROPER TESTING, REMOVAL OF	
6.4. MOLD/MILDEW/DIRT.	
6.5 REPLACE OSA FILTERS B183	
7. BLDG. 238-ROOF, M4189 OSA FILTER REPLACEMENT	SEMI-ANNUAL
7.1. REPLACE OUTSIDE AIR FILTERS IN FILTER BANK ON ROOF	
7.2. INSPECT INTERIOR OF FILTER BOX AND DUCTWORK FOR MOLD, MILDEW	
AND DIRT. NOTIFY MANAGEMENT FOR PROPER TESTING, REMOVAL OF	
MOLD/MILDEW/DIRT.	
8. CHILLED WATER AND HOT WATER EXPANSION TANKS WITHOUT A SIGHT GLASS MONTHLY	
8.1. INSPECT TANKS FOR SIGNS OF LEAKAGE OR CORROSION. REPAIR OR REPLACE. REPAIRING SHALL INCLUDE CLEANING, PRIMING AND PAINTING	
RUSTED CORRODED AREAS ON THE TANK.	
8.2. REPLACE PRESSURE GAUGES AS NECESSARY.	
8.3. OBTAIN EXPANSION TANK PRESSURE AND RECORD THAT PRESSURE IN CMMS	
8.4. INSPECT ALL FITTINGS TO EXPANSION TANK FOR CORROSION	
8.5. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
9. CHILLERS (ROTARY/CENTRIFUGAL/RECIPROCATING)	SEMI-ANNUAL
9.1. CHECK PROPER OPERATION.	
9.2. CHECK OIL LEVEL, REFRIGERANT LEVEL, CONDENSOR. AND EVAPORATOR PRESSURE.	
9.3. CHANGE OIL AND FILTER. REQUEST OIL ANALYSIS, IF APPLICABLE.	
9.4. CHECK FOR LEAKS.	

9.5. CHECK ALL SAFETIES.	
9.6. OPEN AND CLEAN CONDENSOR	
9.7. OPEN AND CLEAN EVAPORATOR EVERY 3 YEAR.	
9.8. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
10. CHILLERS, AIR COOLED,	SEMI-ANNUAL
10.1. VISUALLY INSPECT COILS FOR DIRT AND DEBRIS.	
10.2. CHECK SATURATED CONDENSING TEMPERATURE.	
10.3. COMPARE SATURATED CONDENSING TEMPERATURE TO AMBIENT TEMPERATURE.	
10.4. CLEAR COILS OF DEBRIS WITH VACUUM AND OR BLOW OUT WITH COMPRESSED AIR AS NEEDED.	
10.5. REPEAT STEPS 1 THROUGH 3.	
11. DRINKING FOUNTAINS	ANNUAL
11.1. CHECK - OPERATION OF TEMPERATURE CONTROL.	
11.2. CHECK ELECTRIC CORDS AND PLUGS.	
11.3. REPLACE WATER FILTER CARTRIDGE.	
11.4. VACUUM CONDENSER	
12. DUST COLLECTOR, TORIT	9-MONTH
12.1. EMPTY BAG IF NECESSARY. NOTE!! BAG IS TO BE TREATED AS HAZARDOUS WASTE. TAKE TO BLDG. 305 FOR DISPOSAL.	
12.2. INSPECT BAG FOR LEAKS.	
12.3. CHECK VACUUM FOR NORMAL OPERATION.	
12.4. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
13. ELECTRIC BOILERS	ANNUAL
13.1. REMOVE ELEMENTS AND INSPECT CONDITION OF ELEMENTS. NOTE THE THICKNESS OF SCALE OR DEPTH OF PITTING.	
13.2. IF NECESSARY, APPLY A DESCALING SOLUTION TO THE ELEMENTS PER MANUFACTURERS' SPECIFICATIONS.	
13.3. BRUSH AND FLUSH RESIDUAL SCALE FROM INSIDE OF BOILER.	
13.4. CHECK OPERATION AND CYCLING.	
13.5. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
14. ELECTRIC HOT WATER BOILERS	MONTHLY

14.1. CHECK TEMPERATURE AND HI-LIMIT CONTROL.	
14.2. RECORD TEMPERATURE IN CMMS METER TEMP_ WATER	
14.3. CHECK EXPANSION TANK WATER LEVEL.	
14.4. CHECK BOILER WATER PRESSURE.	
14.5. RECORD BOILER WATER PRESSURE IN CMMS METER BOILER PSI	
14.6. CHECK FEEDWATER SYSTEM.	
14.7. BLOW DOWN AND CHECK LOW-WATER ALARMS/CUT-OFFS.	
14.8. CHECK ELEMENT AMPS. COMPARE TO MFG. SPECIFICATIONS.	
14.9. RECORD ELEMENT AMPS IN CMMS METER AMP_ELE	
14.10. CHECK FOR WIRE TERMINATION DETERIORATION.	
14.11. CHECK FOR RELIEF VALVE LEAKAGE.	
14.12. CLEAN UP BOILER ROOM	
14.13. (IF APPLICABLE) TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS	
14.14. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
15. ELECTRIC STEAM BOILERS	MONTHLY
15.1. CHECK PRESSURE HI-LIMIT CONTROLS.	
15.2. RECORD HI LIMIT PRESSURE CONTROLS IN CMMS METER BOILER PSI	
15.3. (IF APPLICABLE) CHECK ELEMENT AMPS. COMPARE TO MFG. SPECIFICATIONS.	
15.4. RECORD ELEMENT AMPS IN CMMS METER AMP_ELE	
15.5. CHECK FOR WIRE TERMINATION DETERIORATION.	
15.6. CHECK FOR RELIEF VALVE LEAKAGE.	
15.7. CLEAN UP BOILER ROOM.	
15.8. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
16. EVAPORATIVE COOLERS	ANNUAL
16.1. EXAMINE BLOWER.	
16.2. LUBE BEARINGS.	
16.3. CHECK WATER PUMP.	
16.4. REMOVE AND FLUSH SCALE FROM OUTSIDE/INSIDE.	
16.5. REPLACE PADS.	
16.6. INSPECT INTERIOR OF COOLER, DUCTS, VENTS, AND REGISTERS FOR MOLD, MILDEW AND DIRT. NOTIFY MANAGEMENT FOR PROPER TESTING, REMOVAL OF MOLD/MILDEW/DIRT AND PROPER REMEDIATION OF THE MOLD/MILDEW/DIRT CAUSALITY.	
16.7. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	

17. FAN COIL UNIT	SEMI-ANNUAL
17.1. CLEAN CONDENSATE PAN, DRAIN LINE, AND COILS.	
17.2. LUBRICATE FAN MOTOR/BEARINGS PER MANUFACTURERS RECOMMENDATIONS.	
17.3. CHECK BELT WEAR, TENSION, ALIGNMENT. ADJUST/REPLACE IF NECESSARY.	
17.4. CHANGE FILTERS.	
17.5. ENSURE CONDENSATE DRAIN IS CLEAR. POUR 2 GALLONS OF WATER DOWN DRAIN. IF DRAIN IS SLOW OR PLUGGED, SAFELY USE PRESSURE (COMPRESSED AIR OR NITROGEN) OR A WET VAC TO REMOVE THE STOPPAGE. BE SURE DRAINAGE FROM ONE PAN IS NOT DRAINING INTO ANOTHER PAN.	
17.6. VALIDATE SET POINTS AND OPERATION OF MIXING VALVE(S), ECONOMIZER, AND LOCAL CONTROLS.	
17.7. ADD CHEM PACKS TO CONDENSATE TRAY	
17.8. ENCAPSULATE/REPAIR ANY DETERIORATED OR TORN INSULATION	
17.9. INSPECT INTERIOR OF AIR HANDLER/FAN, DUCTS, VENTS, AND REGISTERS FOR MOLD, MILDEW AND DIRT. NOTIFY MANAGEMENT FOR PROPER TESTING, REMOVAL OF MOLD/MILDEW/DIRT AND PROPER REMEDIATION OF THE MOLD/MILDEW/DIRT CAUSALITY.	
17.10. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED	
18. FOR M1718, M1723, M0256, AND M0259 IN BLDG 150. WEEKLY	7-WEEKS
INSPECTION AND BI-WEEKLY CYLINDER REPLACEMENT FREQUENCY OF HUMIDIFIERS 1 & 2 AND FREQUENCY OF HUMIDIFIERS 3 & 4 ARE TO BE (7)	
18.1. INSPECT STEAM CYLINDERS	
18.2. INSPECT FILL VALVE	
18.3. INSPECT DRAIN VALVE	
18.4. INSPECT VAPOR HOSE	
18.5. ENSURE CONDENSATE DRAIN IS CLEAR. POUR 2 GALLONS OF WATER DOWN DRAIN. IF DRAIN IS SLOW OR PLUGGED, SAFELY USE PRESSURE (COMPRESSED AIR OR NITROGEN) OR A WET VAC TO REMOVE THE STOPPAGE. BE SURE DRAINAGE FROM ONE PAN IS NOT DRAINING INTO ANOTHER PAN.	
18.6. INSPECT CONDENSATE PIPING	
18.7. INSPECT SUPPLY WATER PIPING	
18.8. INSPECT DRAIN PIPING	
18.9. VERIFY PROPER OPERATION OF HIGH LIMIT HUMIDISTAT AND AIR PROVING SWITCH (ONLY WHEN THERE IS NO CRITICAL TESTING IN PROGRESS)	
18.10. REPLACE STEAM CYLINDERS AFTER 500 HOURS RUNTIME OR WHEN ELECTRODES HAVE LESS THAN 50% OF THEIR LIFE	
18.11. CHECK AND TIGHTENED ALL ELECTRICAL CONNECTIONS	
18.12. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	

CHECKED	
19. GAS STEAM BOILER MONTHLY JOB PLAN	MONTHLY
19.1. CHECK PRESSURE HI-LIMIT CONTROLS.	
19.2. RECORD HI LIMIT PRESSURE CONTROLS IN CMMS METER BOILER PSI	
19.3. CHECK FLUE GAS READINGS	
19.4. RECORD FLUE GAS READING IN CMMS METER FLUE_GAS	
19.5. (IF APPLICABLE) TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS	
19.6. CHECK FOR WIRE TERMINATION DETERIORATION.	
19.7. CHECK FOR RELIEF VALVE LEAKAGE.	
19.8. CLEAN UP BOILER ROOM.	
19.9. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
20. GAS-FIRED BOILERS	ANNUAL
20.1. PUNCH BOILER TUBES OR APPLY A DESCALING SOLUTION TO THE TUBES (APPROVED BY THE MFG.) TO REMOVE SCALE BUILDUP.	
20.2. INSPECT FIREBOX AND REPAIR IF NECESSARY.	
20.3. PULL BURNER(S) FOR CLEANING. CHECK BURNER ORIFICE(S) AND CLEAN IF NECESSARY.	
20.4. CLEAN PILOT ASSEMBLY AND REMOTE FLAME SENSORS AS APPLICABLE. CHECK WIRING TO PILOT ASSEMBLY AND REMOTE SENSORS.	
20.5. INSPECT/REPLACE RELIEF VALVE.	
20.6. CHECK OPERATION OF ALL SAFETIES.	
20.7. CHECK BURNER FLAME QUALITY.	
20.8. CHANGE FILTERS IN MAKE UP AIR UNIT	
20.9. CHECK WATER TEMP/HI LIMIT/FLAME SAFETY CONTROLS.	
20.10. BLOW DOWN WATER LEGS TO CHECK LOW-WATER ALARMS AND BURNER CUT-OFF.	
20.11. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
21. GAS-FIRED HOT WATER BOILERS	MONTHLY
21.1. CHECK WATER TEMP/HI LIMIT/FLAME SAFETY CONTROLS.	
21.2. RECORD TEMPERATURE IN CMMS METER TEMP_WATER	
21.3. CHECK BURNER FLAME QUALITY.	
21.4. BLOW DOWN WATER LEGS TO CHECK LOW-WATER ALARMS AND BURNER CUT-OFF.	
21.5. LIFT UP PRV TO INSPECT FOR CORROSION	
21.6. CHANGE MAKE-UP AIR FILTERS TO ROOM IF NEEDED.	
21.7. USE ENERAC TO TEST STACK TEMPERATURE AND EFFICIENCY. RECORD RESULTS IN THE CMMS.	

21.8. RECORD STACK TEMPERATURE IN CMMS METER TEMP EXH	
21.9. (IF APPLICABLE) TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS	
21.10. CLEAN BOILER ROOM.	
21.11. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
22. HEATING HOT WATER SYSTEM FLUSH (BY FLOOR)	ANNUAL
22.1. SET UP FOR HHW SYSTEM FLUSH BY PROTECTING ALL FURNITURE AND CARPETING FROM THE FLUSHING MEDIA.	
22.2. CONNECT TO THE HHW SYSTEM VIA A CONNECTION IN THE COFFEE ROOM OR PANTRY, OR CONNECT TO EVERY VAV/FAN COIL WITH A HHW COIL.	
22.3. ONLY FLUSH THE HHW SYSTEM WITH TREATED WATER.	
22.4. FLUSH SYSTEM UNTIL HHW COILS HAVE BEEN THOROUGHLY FLUSHED.	
22.5. SECURE THE CONNECTION POINTS, REMOVE ALL PROTECTIVE COVERINGS, AND MAKE SURE ALL EQUIPMENT AND DEBRIS HAVE BEEN CLEANED UP.	
23. HUMIDIFIERS	QUARTERLY
23.1. CHECK FOR PROPER OPERATION (2 CYCLES).	
23.2. CHECK ALL JOINTS AND FITTINGS FOR LEAKS AND CORROSION. REPAIR AS NECESSARY.	
23.3. TIGHTEN ALL ELECTRICAL CONNECTIONS.	
23.4. CHECK AND CLEAN INJECTORS.	
23.5. CHECK AND CLEAN INJECTORS.	
23.6. ENSURE CONDENSATE DRAIN IS CLEAR. POUR 2 GALLONS OF WATER DOWN DRAIN. IF DRAIN IS SLOW OR PLUGGED, SAFELY USE PRESSURE (COMPRESSED AIR OR NITROGEN) OR A WET VAC TO REMOVE THE STOPPAGE. BE SURE DRAINAGE FROM ONE PAN IS NOT DRAINING INTO ANOTHER PAN.	
23.7. INSPECT TANK/CANISTERS AND CLEAN OR REPLACE AS NECESSARY.	
23.8. INSPECT IN-LINE WATER FILTER AND REPLACE IF NECESSARY	
23.9. IF APPLICABLE, CHECK FLOOR DRAINS (IN MACHINE ROOMS OR ON MEZZANINE) WHERE HUMIDIFIERS DRAIN. CREATE FOLLOW UP IF DRAIN NEEDS TO BE CLEARED	
23.10. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
24. REFRIGERATION UNITS	SEMI-ANNUAL
24.1. CHECK PROPER OPERATION.	
24.2. CLEAN EVAPORATOR AND CONDENSER.	
24.3. CHECK REFRIGERANT CHARGE.	
24.4. CHECK UNIT CONTROLS.	
24.5. OIL FAN MOTOR.	

24.6. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
25. SPACE HEATERS/FURNACES	SEMI-ANNUAL
25.1. CHECK OPERATION OF SPACE HEATER/FURNACE.	
25.2. CHECK PILOT MAIN FLAME AND SAFETIES.	
25.3. IF ELECTRIC, CHECK ELEMENTS, SEQUENCERS, AND SAFETIES.	
25.4. CHECK BLOWER WHEEL, BEARINGS, SHAFT AND BELT.	
25.5. CHANGE FILTER IF APPLIES.	
25.6. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
26. SPLIT A/C SYSTEM	SEMI-ANNUAL
26.1. CHANGE FILTERS.	
26.2. CHECK BELTS AND PULLEYS AND REPLACE/ADJUST IF NECESSARY.	
26.3. CLEAN CONDENSER AND EVAPORATOR.	
26.4. CLEAN CONDENSATE PAN AND DRAIN.	
26.5. LUBRICATE FAN/MOTOR BEARINGS (PER MFG.).	
26.6. DUST, CLEAN, AND TIGHTEN ALL ELECTRICAL CONNECTIONS.	
26.7. CHECK FOR SIGNS OF REFRIGERANT LEAKS AND REPAIR.	
26.8. START UNIT/CHECK OPERATING TEMPERATURES AND PRESSURES.	
26.9. VERIFY OPERATION OF THERMOSTAT.	
26.10. INSPECT INTERIOR OF AIR HANDLER/FAN, DUCTS, VENTS, AND REGISTERS FOR	
MOLD, MILDEW AND DIRT. NOTIFY MANAGEMENT FOR PROPER TESTING,	
REMOVAL OF MOLD/MILDEW/DIRT AND PROPER REMEDIATION OF THE	
MOLD/MILDEW/DIRT CAUSALITY.	
26.11. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
27. SPLIT A/C SYSTEM – CONDENSER	SEMI-ANNUAL
27.1. CLEAN CONDENSER	
27.2. LUBRICATE FAN/MOTOR BEARINGS (PER MFG.). IF APPLICABLE	
27.3. DUST, CLEAN, AND TIGHTEN ALL ELECTRICAL CONNECTIONS.	
27.4. CHECK FOR SIGNS OF REFRIGERANT LEAKS AND REPAIR.	
27.5. START UNIT/CHECK OPERATING TEMPERATURES AND PRESSURES.	
27.6. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	

28. STEAM BOILER CHECKS	DAILY
28.1. CHECK BOILER WATER LEVEL.	
28.2. CHECK STEAM PRESSURE.	
28.3. INSPECT AND BLOW-DOWN LOW-WATER CUTOFF.	
28.4. CHECK FEEDWATER SYSTEM OPERATION.	
28.5. CHECK FOR PROPER BOILER OPERATION AND CYCLING.	
28.6. PERFORM BLOW-DOWN PER BOILER WATER QUALITY REQUIREMENT.	
28.7. CHECK WATER SOFTNESS & TOTAL DISSOLVED SOLIDS.	
28.8. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
29. STEAM CONDENSATE RETURN SYSTEMS	QUARTERLY
29.1. CHECK PUMP FOR PROPER OPERATION.	
30. STEAM TRAPS AND STRAINERS	SEMI-ANNUAL
30.1. CHECK STEAM TRAPS FOR PROPER OPERATION.	
30.2. BLOW DOWN STEAM STRAINERS.	
31. UPDATE CHILLER LOG	WEEKLY
31.1. UPDATE CHILLER LOG.	
31.2. RECORD LOG READINGS IN CMMS METERS	
31.3. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS	
CHECKED	
32. UPDATE CHILLER LOG (EMS MONTHLY)	MONTHLY
32.1. UPDATE CHILLER LOG.	
32.2. LOG SHALL CONTAIN CHILLER READINGS CAPTURED EACH WEEK	
32.3. RECORD LOG READINGS IN CMMS METERS	

Appendix A.1.8

Millwright PM

**1. 5-YEAR HEAT EXCHANGER MAINTENANCE
QUINTENNIAL**

- 1.1. OPEN AND CLEAN PLATES. REPLACE PLATES AND GASKETS AS NECESSARY.
- 1.2. FOLLOW THE CLEANING AND REASSEMBLY INSTRUCTIONS IN THE ATTACHED PDF.
- 1.3. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED
- 1.4. Clean up area and ensure all Maintenance materials and debris are removed properly.

**2. AIR COMPRESSORS
MONTHLY**

- 2.1. VERIFY EQUIPMENT HAS NOT BEEN REMOVED OR REPLACED.
- 2.2. IF MOVED OR REPLACED COPY NAMEPLATE INFORMATION FOR PERMIT.
- 2.3. VERIFY UNIMPEDED INSPECTION ACCESS TO COMPRESSOR AND TANK.
- 2.4. CHANGE OIL AND FILTER AS NEEDED.
- 2.5. CHECK FOR SIGNS OF LEAKAGE, CORROSION AND DISTORTION.
- 2.6. CHECK FOR SIGNS OF LEAKAGE, CORROSION AND DISTORTION.
- 2.7. INSPECT WELDS FOR CRACKS AND UNDERCUTS.
- 2.8. INSPECT WELDS FOR CRACKS AND UNDERCUTS.
- 2.9. INSPECT WELDS FOR CRACKS AND UNDERCUTS.
- 2.10. IF NON-OPERATIONAL CHECK FOR LOCK OUT TAG OUTS.
- 2.11. IF NON-OPERATIONAL CHECK FOR LOCK OUT TAG OUTS.
- 2.12. IF NON-OPERATIONAL CHECK FOR LOCK OUT TAG OUTS.
- 2.13. VERIFY PERMIT NUMBER WITH AIR TANK DOCUMENTATION.
- 2.14. VERIFY PERMIT NUMBER WITH AIR TANK DOCUMENTATION.
- 2.15. VERIFY PERMIT NUMBER WITH AIR TANK DOCUMENTATION.
- 2.16. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**3. BLDG, 183 HYDRO CONSTANT PUMP (M6628) RM. 324
17 WEEKS**

- 3.1. CHECK FOR NORMAL OPERATION.
- 3.2. LUBE PER MANUFACTURER'S SPECIFICATIONS.
- 3.3. CHECK SEALS FOR LEAKAGE.
- 3.4. CHECK COUPLING AND ALIGNMENT.
- 3.5. CHECK BEARINGS ON MOTOR FOR NOISY OPERATION.
- 3.6. INSPECT AND CLEAN MAKE UP STRAINER AT WATER VALVE
- 3.7. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**4. BLDG. 180 SUMP PUMP
MONTHLY**

- 4.1. CHECK CONTROLS BY ADDING WATER TO PUMP.
- 4.2. CLEAN SUMP.
- 4.3. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**5. BLDG. 183 EXHAUST FANS - 5TH/9TH FLOOR
SEMI-ANNUAL**

- 5.1. CHECK FOR PROPER OPERATION.
- 5.2. CHECK BELTS OR DRIVE TRAIN.
- 5.3. LUBE PER MANUFACTURER'S SPECIFICATIONS.
- 5.4. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**6. BLDG. 296 AND BLDG. 315 COOLING TOWER FAN INSPECTION
MONTHLY**

- 6.1. MONTHLY INSPECTION OF FAN BLADES.
- 6.2. CHECK FOR CRACKS, DENTS, PAINT CHIPPING, AND LOOSENESS.
- 6.3. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**7. BLDG. 302 EXHAUST FANS
ANNUAL**

- 7.1. CHECK GENERAL OPERATION.
- 7.2. CHECK DUCT & FILTERS (IF ACCESSIBLE OR APPLICABLE).
- 7.3. CHECK DRIVE BELTS (IF APPLICABLE OR APPLICABLE).
- 7.4. LUBE PER MANUFACTURER'S SPECIFICATIONS.
- 7.5. IF BUILDING SHUTDOWN IS REQUIRED TO P.M. BLOWERS COORDINATE WITH THE BUILDING WARDENS.
- 7.6. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**8. BOLLARD JOB PLAN
QUARTERLY**

- 8.1. CHECK MOUNTS AND ALL HARDWARE FOR TIGHTNESS
- 8.2. CHECK OPERATION OF BOLLARDS THROUGH TWO CYCLES
- 8.3. CHECK HYDRAULIC FLUID LEVELS
- 8.4. CHECK FITTING/HOSES AND FOR LEAKS
- 8.5. CHECK OPERATING PRESSURES
- 8.6. CHECK OPERATING CONTROLS
- 8.7. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**9. COOLING TOWER (BLDG. 315) HEAT EXCHANGER
QUARTERLY**

- 9.1. MEASURE/RECORD PRESSURE DROP ACROSS THE PRIMARY AND SECONDARY CIRCUITS OF HEAT EXCHANGER.
- 9.2. RECORD PRIMARY PRESSURE DROP IN CMMS METER PRIPSIDROP
- 9.3. RECORD SECONDARY PRESSURE DROP IN CMMS METER SECPSIDROP
- 9.4. (IF APPLICABLE) TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS
- 9.5. IF PRESSURE DROP ACROSS EITHER CIRCUIT EXCEEDS 5PSI, CREATE FOLLOW-UP TO SCHEDULE MANUFACTURER RECOMMENDED CLEANING WITH OUTSIDE VENDOR.

9.6. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

10. COOLING TOWERS

SEMI-ANNUAL

- 10.1. CHECK GENERAL OPERATION.
- 10.2. REMOVE COOLING TOWER DIVERTERS AND TAKE THE DIVERTERS TO B315'S WASH BASIN THAT IS PIPED TO B308'S LIFT STATION. CLEAN DIVERTERS IN THE BASIN WITH REDLIME, AND ONCE COMPLETED RETURN THE DIVERTERS TO THE COOLING TOWER.
- 10.3. FLUSH STACK.
- 10.4. CHECK SAFETY ITEMS.
- 10.5. CHECK COUPLINGS, BELTS, AND SHEAVES.
- 10.6. IF APPLICABLE: CLEAN CONDENSER WATER PUMP STRAINER.
- 10.7. CHECK WATER TREATMENT DRUM LEVEL.
- 10.8. CHECK CHEMICAL FEEDER.
- 10.9. CHECK SUMP WATER MAKEUP FLOAT CONTROL VALVE AND ASSEMBLY.
- 10.10. CHECK ALL TOWER CONTROLS AND SETPOINTS. VERIFY CORRECT OPERATION.
- 10.11. CHECK FANS FOR EXCESSIVE SCALE BUILD-UP AND CRACKS.
- 10.12. IF APPLICABLE: INSPECT FOR OIL LEAKAGE.
- 10.13. IF APPLICABLE: CHECK OIL IN GEARBOX AS NEEDED.
- 10.14. CHECK COUPLINGS AND LUBE BEARINGS.
- 10.15. CHECK INTEGRITY OF BOLTS HOLDING FAN BLADES TO HUB.
- 10.16. SCRAPE, REMOVE SCALE, CLEAN, AND PAINT FAN BLADES.
- 10.17. CHECK ALL CHEMICAL FEED TUBING. REPLACE IF NECESSARY.
- 10.18. IF APPLICABLE: CHECK OPERATION OF VALVES (ELECTRIC OR PNEUMATIC).
- 10.19. CALL ELECTRICIAN TO MEGGER PUMP MOTORS.
- 10.20. CHECK ALL JOINTS & FITTINGS FOR LEAKS AND CORROSION. REPAIR AS NECESSARY.
- 10.21. CHECK FLOAT VALVE FOR 100% SHUT-OFF.
- 10.22. CHECK OPERATION OF PUMP AND FAN MOTOR AND GEARBOXES
- 10.23. CHECK COOLING TOWER DRIVE SYSTEMS(VFD). .
- 10.24. DRAIN AND CLEAN BASIN AND TOWER PACKING.
- 10.25. IF APPLICABLE: DRAW OIL SAMPLE FOR ANALYSIS PER APPENDIX A.1.11.3 AN

D RETURN TO PT&I TECHNICIAN

10.26. IF APPLICABLE: CHANGE OIL WITH MANUFACTURER'S RECOMMENDED OIL

10.27. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

11. EXHAUST/SUPPLY FANS MONTHLY

11.1. CHECK BLOWER INTAKE DAMPERS; LUBE, IF APPLICABLE.
CHECK BLOWER INTAKE DAMPERS; LUBE, IF APPLICABLE.

11.2. (IF APPLICABLE) CHECK PULLEYS & SHAFT; LUBE BEARINGS PER MFG RECOMMENDATIONS IF APPLICABLE.

11.3. CHECK & CLEAN HOODS, DUCTS, VENTS, & BLADES OF DIRT, GREASE, &

11.4. CHECK FOR PROPER OPERATION.

11.5. CHECK ALL CONNECTIONS AND CONTROLS CHECK BREAKER & SAFETY DISCONNECTS.

11.6. CHECK TENSION & CONDITION OF BELTS, ADJUST AS REQUIRED IF

11.7. CHECK MOUNTS & ALL HARDWARE FOR TIGHTNESS.

11.8. CHECK AND REPLACE FILTERS ON UNIT OR IN FRESH AIR MAKE-UP DUCT IF THEY EXIST.

11.9. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

12. GATE MAINTENANCE QUARTERLY

12.1. CHECK FOR PROPER OPERATION.

12.2. (IF APPLICABLE) INSPECT TRACK WHEELS; CLEAN & LUBE PER MANUFACTURER'S SPECIFICATIONS.

12.3. (IF APPLICABLE) CHECK OPERATION OF CLUTCH; CLOSE GATE WHILE HOLDING, CLUTCH SHOULD SLIP. (IF APPLICABLE) REINSTALL MOTOR COVER.

12.4. (IF APPLICABLE) CHECK FOR OIL LEAKS AND OR OIL LEVEL.

12.5. (IF APPLICABLE) CHECK FOR BROKEN/MISSING HARDWARE.

12.6. (IF APPLICABLE) INSPECT BEARINGS & CLUTCH ASSEMBLIES; CLEAN & LUBE PER MANUFACTURER'S SPECIFICATIONS.

12.7. (IF APPLICABLE) CHECK SPROCKETS & CHAIN FOR BROKEN LINKS & TEETH; LUBE PER MANUFACTURER'S SPECIFICATIONS.

12.8. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

13. HEAT EXCHANGER

ANNUAL

- 13.1. MEASURE/RECORD PRESS. DROP ACROSS THE PRIM. AND SEC. CIRCUITS OF HEAT EXCHANGER. IF PRESS. DROP ACROSS EITHER CIRCUIT EXCEEDS 5PSI, PERFORM FOLLOWING MFG RECOMMENDED MAINT.
- 13.2. STEP 20-40 APPLICABLE ONLY TO OUTSIDE CONTRACTOR.
- 13.3. DRAIN AND FLUSH HEAT EXCHANGER WITH 110 DEG F WATER
- 13.4. CIRCULATE MANUFACTURER RECOMMENDED CLEANING SOLUTION THROUGH EXCHANGER, REVERSING FLOW TO ENSURE ALL SURFACES ARE
- 13.5. THOROUGHLY FLUSH CLEANING SOLUTION BEFORE RETURNING EXCHANGE TO NORMAL SERVICE.
- 13.6. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

14. LIFT STATIONS (MONDAYS AND FRIDAYS), BUILDINGS 150, 160, 180, 183, WEEKLY 198, 224, 255, 283, 289, 270, AND 308

- 14.1. CHECK PACKING (IF APPLICABLE).
- 14.2. CHECK LUBRICATION.
- 14.3. CHECK FOR NORMAL OPERATION.
- 14.4. CHECK ALL CONTROLS.
- 14.5. CHECK ALARMS.
- 14.6. ALTERNATE PUMPS.
- 14.7. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

15. MAIN LABORATORY AIR COMPRESSORS WEEKLY

- 15.1. CHECK FOR PROPER OPERATION AND OIL LEVEL.
- 15.2. CHECK RELIEF VALVE AND TANK BLOWDOWN.
- 15.3. CLEAN AIR INTAKE FILTER and CONDENSER
- 15.4. CHECK SAFETY ITEMS.
- 15.5. DRAIN CONDENSATE FROM TANK.
- 15.6. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

16. NITROGEN TANKS (SEISMIC VALVE ACTIVATION AT LOCATIONS 267, 175, 258 WEEKLY

- 16.1. CHECK NITROGEN TANKS.
- 16.2. CHANGE IF TANK PRESSURE BELOW 250 LBS.

- 16.3. RECORD TANK PRESSURE READINGS IN THE CMMS METER TANK PSI
- 16.4. (IF APPLICABLE) TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS
- 16.5. ENSURE ASSET IS LABELED CORRECTLY AND HAS A GREEN TAG . SIGN, INDICATE SERVICE PERFORMED, AND DATE GREEN TAG AT COMPLETION OF PM/PGM/PTI.

**17. PUMP HOUSE (WATER PUMPS)
WEEKLY**

- 17.1. CHECK GENERAL OPERATION.
- 17.2. CHECK SEALS OR PACKING & REPLACE IF NECESSARY.
- 17.3. (IF APPLICABLE) LUBE BEARINGS.
- 17.4. CHECK ALL ALARMS.
- 17.5. (IF APPLICABLE) CHECK WATER LEVEL INDICATORS.
- 17.6. RECORD WATER LEVEL IN CMMS METER WATERSTOR
- 17.7. (IF APPLICABLE) TAKE PHOTO OF METERS AND UPLOAD IMAGE IN CMMS
- 17.8. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**18. ROLL UP/ROLLING DOORS
SEMI-ANNUAL**

- 18.1. INSPECT SUPPORTS FOR SOUNDNESS & STABILITY - REPORT CONDITIONS FOUND.
- 18.2. INSPECT, CLEAN, LUBE CHAIN; CHECK FOR MISSING/BROKEN ROLLERS & DIRT BUILD-UP.
- 18.3. CHECK SPROCKET FOR DAMAGED/MISSING TEETH & FOR PROPER ALIGNMENT
- 18.4. CHECK GUIDES & DOOR CURTAIN FOR DAMAGE, DIRT BUILD-UP OR OTHER DEFECTS.
- 18.5. OPERATE DOOR AND CHECK FOR PROPER OPERATION, CHECK LIMITS, BRAKE AND SWITCH.
- 18.6. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**19. ROLLING TELESCOPE DOOR JOB PLAN
ANNUAL**

- 19.1. INSPECT OPERATION & CONTROLS
- 19.2. INSPECT BATTERY
- 19.3. INSPECT CHARGING STATION

- 19.4. INSPECT & LUBRICATE TRACK ROLLERS
- 19.5. INSPECT DRIVE TIME AND AIR PRESSURE
- 19.6. INSPECT CABLE SHEAVES
- 19.7. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**20. SEISMIC VALVE TEST
QUARTERLY**

- 20.1. NOTIFY EMS CONSOLE OF INTENT TO TEST VALVES.
- 20.2. ACTUATE VALVES BY MANUAL TRIPPING E-QUAKE SWITCH.
- 20.3. EACH VALVE SHOULD BE ACTUATED TWICE.
- 20.4. CHECK WITH EMS CONSOLE TO SEE IF INDICATOR LIGHTS FUNCTION
- 20.5. NOTIFY EMS CONSOLE WHEN TESTS ARE COMPLETED.
- 20.6. CHECK SEISMIC CONTROLS AND BATTERIES.

**21. SUMP PUMPS - ONE CHECK TO BE MADE IMMEDIATELY PRIOR TO START OF
QUARTERLY
RAINY SEASON (OCTOBER)**

- 21.1. CHECK CONTROLS BY ADDING WATER TO PUMP. (IF ACCESSIBLE)
- 21.2. CLEAN SUMP (IF ACCESSIBLE)
- 21.3. CHECK PUMP FOR NORMAL OPERATION.
- 21.4. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**22. UNDERGROUND STORAGE TANK (BLDG. 230)
ANNUAL**

- 22.1. PERFORM MONITORING CERTIFICATION PER TITLE 23, DIVISION 3, CHAPTER 16, ARTICLE 3, SECTION 2637(A).
- 22.2. PERFORM MONITORING CERTIFICATION PER TITLE 23, DIVISION 3, CHAPTER 16, ARTICLE 3, SECTION 2637(B).
- 22.3. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**23. UNDERGROUND STORAGE TANK (BLDG. 230) - EVERY 30 DAYS
MONTHLY**

- 23.1. A MONTHLY VISUAL INSPECTION OF THE UNDERGROUND STORAGE TANK LOCATED AT B230 MUST BE PERFORMED BY A CERTIFIED UST OPERATOR PER THE ATTACHED VISUAL INSPECTION FORM.
- 23.2. ALL SECTIONS (1 - 13) MUST BE COMPLETED INCLUDING THE FORM SIGNED BY AN ICC CERTIFIED OPERATOR.

23.3. A COPY OF THE COMPLETED AND SIGNED FORM MUST BE UPLOADED INTO THE MONTHLY PM WORK ORDER.

23.4. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

23.5. ENSURE ALL FUEL RESIDUE AND MAINTENANCE MATERIALS HAVE BEEN PROPERLY CLEANED UP AND REMOVED.

**24. UPDATE COOLING TOWER LOG
MONTHLY**

24.1. UPDATE COOLING TOWER LOG.

**25. VACUUM PUMPS
MONTHLY**

25.1. CHECK NORMAL OPERATION.

25.2. CHECK OIL FOR CONTAMINATION.

25.3. FLUSH SYSTEM AND CHANGE OIL AS NEEDED.

25.4. IF APPLICABLE: CHECK BELT.

25.5. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**26. WATER METER READINGS (WATER MAINS, IRRIGATION, COOLING TOWERS)
MONTHLY**

26.1. CHECK FOR PROPER OPERATION OF METER AND CALIBRATE IF NECESSARY.

26.2. RECORD READINGS IN THE CMMS

**27. WATER PUMPS (CHILLED, HOT, CONDENSATE, CIRCULATING)
QUARTERLY**

27.1. CHECK FOR NORMAL OPERATION.

27.2. (IF APPLICABLE) LUBE PER MANUFACTURER'S SPECIFICATIONS.

27.3. CHECK SEALS FOR LEAKAGE.

27.4. IF APPLICABLE, CHECK COUPLING AND ALIGNMENT.

27.5. CHECK BEARINGS ON MOTOR FOR NOISY OPERATION.

27.6. (IF APLPICABLE) REMOVE AND CLEAN STRAINER

27.7. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

28. WATER PUMPS (CHILLED, HOT, CONDENSATE, CIRCULATING), (MAINTENANCE FREE) SEMI-ANNUAL

28.1. CHECK FOR NORMAL OPERATION.

28.2. CHECK SEALS FOR LEAKAGE

28.3. REMOVE AND CLEAN WYE STRAINER

28.4. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**29. WATER SOFTENER MAINTENANCE
WEEKLY**

29.1. CHECK SALT LEVEL IN BRINE TANK.

29.2. TEST HARDNESS OF WATER.

29.3. CHECK FOR "MUSHING" OF SALT IN BRINE TANK.

29.4. CHECK FOR LEAKS.

29.5. CHECK FOR PROPER OPERATION OF BACKFLUSH PROCESS.

29.6. IF APPLICABLE, CHECK D.I. LAMP FOR ILLUMINATION

29.7. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

**30. WON FIRE DOORS (BLDG. 301, 303)
SEMI-ANNUAL**

30.1. COORDINATE WITH FIRE DEPT.

30.2. CHECK FOR BOTTOM SWEEP BINDINGS/PANELS TOUCHING FLOOR.

30.3. CHECK FOR TRACK SEPARATION FROM HEADER.

30.4. CHECK FOR TRACK OBSTRUCTIONS.

30.5. CHECK FOR GAPS IN TRACK JOINTS.

30.6. CHECK FOR MISALIGNED TRACK JOINTS.

30.7. CHECK FOR BROKEN ROLLERS OR ROLLERS OUT OF TRACK.

30.8. CHECK FOR BENT ROLLER PINS.

30.9. CHECK FOR BROKEN LEAD POST TROLLEY.

30.10. CHECK FOR BROKEN LEAD POST LOCKS AND LATCHES.

30.11. CHECK FOR SPLIT OR DRAGGING HINGES.

30.12. CHECK FOR DRAGGING FIBERGLASS OR LINER.

30.13. CHECK FOR LUBRICATION OF TRACK.

30.14. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

Appendix A.1.9 **Paint PM**

PAINT PM	
	FREQUENCY
1. PAINT USAGE REPORT	MONTHLY
1.1. CALCULATE V.O.C. CONTENT OF PAINT USAGE AS PER AQMD/EAO REGULATIONS.	
1.2. RECORD IN THE CMMS	
2. PAINTING	ANNUAL
2.1 OFFICES (235,000SQ.FT. WALL SPACE AND CEILING)	
3. PAINTING	ANNUAL
3.1 HALLWAYS AND COMMON AREAS (100,000SQ.FT. WALL SPACE)	
4. PAINTING	
4.1 EXTERIOR OF BUILDINGS (450,000 SQ.FT.)	ANNUAL
5. PAINTING	
5.1 CAFETERIAS (5,000SQ.FT.)	ANNUAL
6. PAINTING	
6.1 MISC AREAS (5,000 SQ.FT.)	ANNUAL
7. PAINTING	
7.1 RESTROOMS (5,000SQ.FT.)	ANNUAL
8. PAINTING	ANNUAL
8.1 VISITORS CONTROL AREAS (5,000 SQ.FT.)	

Appendix A.1.10 Plumbing PM

1. BACKFLOW TESTING (ALL SIZES)

- 1.1. PERFORM L.A. COUNTY MANDATED TESTS AND RECORD RESULTS.
- 1.2. ANY DEVICE LEAKING MUST BE REPAIRED AND TESTED WITHIN 10 DAYS OF REPORTED DATE
- 1.3. ANY REPLACED OR NEW BACKFLOW DEVICE MUST BE TESTED AND REGISTERED WITH LOS ANGELES COUNTY DEPARTMENT OF PUBLIC HEALTH WITHIN 30 DAYS OF
- 1.4. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED
- 1.5. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.

2. BLOW-DOWN LAB AIR SYSTEM

- 2.1. BLOW CONDENSATION (WATER) FROM AIR SYSTEM PIPING.
- 2.2. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED
- 2.3. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.

3. BUILDING 270, SEWAGE METERING STATION

- 3.1. REPLACE CHARCOAL VENT FILTER
- 3.2. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED
- 3.3. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.

4. DE-IONIZATION WATER FILTER

- 4.1. CHECK AND/OR REPLACE FILTER

5. DILUTION CHAMBERS (BLDG. 170)

- 5.1. INSPECT FOR SLUDGE & OVERFLOW CONDITION.
- 5.2. NOTE: IF SLUDGE APPEARS TO BE EXCESSIVE, NOTIFY THE PLUMBING GROUP LEADER IMMEDIATELY.
- 5.3. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED
- 5.4. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.

6. DRAIN/SEWER CLEANING - BLDG. 168 OR 169/TRAILER AREA

6.1. OPEN AND CLEAN DRAIN/SEWER WITH SEWER MACHINE.

6.2. RUN WATER DOWN DRAIN/SEWER WITH APPROPRIATELY SIZED HOSE.

7. GAS METER INSPECTION

7.1. CHECK ALL JOINTS & FITTINGS FOR LEAKS AND CORROSION - REPAIR AS NECESSARY.

7.2. IF INSTALLED, CHECK SEISMIC SHUT-OFF FOR PROPER OPERATION.

7.3. CHECK GAS PRESSURE BY PSI OR INCHES OF WATER COLUMN FOR OPERATION & ADJUSTMENT.

7.4. ENSURE ALL MANUAL VALVES ARE SAFE & IN PROPER WORKING ORDER.

8. GAS PRESSURE REDUCING STATIONS (7)

8.1. INSPECTION, TESTING, AND REPAIR

8.2. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

8.3. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.

9. PLUG VALVES

9.1. LUBE VALVE AND ACTUATE.

10. PUMP CLARIFIER (GREASE TRAP) IN BLDGS. 167 AND 303

10.1. PUMP OUT AND DISPOSE GREASE/SLUDGE CLARIFIER PER JPL/EAO AND STATE REGULATIONS.

10.2. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS CHECKED

10.3. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE REMOVED PROPERLY.

11. SAFETY EYEWASH/SHOWER ANNUAL MAINTENANCE

11.1. VALIDATE INSTALLATION IS PER SPEC, ACCESSIBLE, HAS CLEAR PATH, GOOD

11.2. INSULATION WHERE REQUIRED, GOOD LIGHTING AND CLEAR SIGNAGE. THE SYSTEM SHOULD PRODUCE THE REQUIRED SPARY PATTERN FOR A MIN. PERIOD OF 15 MINUTES.

11.3. SHOWER PATTERN SHOULD BE POSITIONED TO DISPERSE SUCH THAT THE TOP OF THE FLUSHING FLUID COLUMN IS AT LEAST 82 INCHES AND NOT MORE THAN 96 INCHES FROM THE SURFACE ON WHICH THE USER STANDS.

11.4. THE CENTER OF THE SPRAY SHALL BE ATLEAST 16 INCHES FROM A

11.5. CHECK ALL MOUNTING FOR LOOSE OR MISSING HARDWARE

11.6. CHECK OPERATION OF VALVES, AND PLUMBING FOR LEAKS.

11.7. OPEN VALVE TO FULL POSITION, CHECK OPERATION OF SPRAY VALVE

WITHOUT USE OF OPERATORS HANDS

- 11.8. WITH VALVE IN FULLY OPEN POSITION, MEASURE THE DIAMETER OF THE SPRAY PATTERN. IT SHOULD BE A MIN OF 20 INCHES AT 60 INCHES ABOVE THE STANDING SURFACE.
- 11.9. EYEWASH STATIONS SHALL PROVIDE A CONTROLLED FLOW OF FLUSHING TO BOTH EYES SIMULTANEOUSLY AT VELOCITY LOW ENOUGH TO BE NON- INJURIOUS TO THE USER
- 11.10. INSPECT NOZZLES AND FLUSHING FLUIDS, TO BE PROTECTED FROM AIRBORNE CONTAMINANTS, ANY COVERS THAT NEED TO BE REMOVED SHOULD NOT REQUIRE A SEPARATE MOTION WHEN ACTIVATING
- 11.11. VALIDATE THAT THE SYSTEM CAN BE USED HANDS FREE ONCE ACTIVATED
- 11.12. EYEWASHES MUST DELIVER FLUSHING FLUID NOT LESS THAN .4 GPM FOR 15 MIN (IN COMPLIANCE WITH COMPLY WITH ANSI Z358.1). BRADLEY PORTABLE
- 11.13. EYEWASH PRESSURE IS SET NOT GREATER THAN 90 PSI AND NOT LESS THAN 30 PSI.
- 11.14. VALIDATE THAT SHUT-OFF VALVES CANNOT BE ACCIDENTLY CLOSED OR SHUT-OFF W/O AUTHORIZATION
- 11.15. DELIVER TEPID (60-100 DEG. F) FLUSHING FLUID
- 11.16. DATE AND SIGN INPECTION TAG.

12. SAFETY EYEWASH/SHOWER MAINTENANCE

- 12.1. ALL TASKS TO BE PERFORMED WEEKLY
- 12.2. ASSEMBLED AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS, INCLUDING FLUSHING FLUID DELIVERY REQUIREMENTS.
- 12.3. DISCONNECT ANY ALARMS BEFORE TESTING.
- 12.4. IF UNIT IS A BRADLEY PORTABLE EYEWASH IS THE PRESSURE BETWEEN 30 PSI TO 90 PSI.
- 12.5. CHECK IF UNIT LEAKING FLUID AT ANY JOINTS OR CONNECTIONS.
- 12.6. ENSURE DEVICE IS IN AN ACCESSIBLE LOCATION THAT REQUIRES NO MORE THAN 10 SEC. TO REACH. THE SHOWER SHALL BE LOCATED ON THE SAME LEVEL AS THE HAZARD AND THE PATH OF TRAVEL SHALL BE FREE OF OBSTRUCTIONS THAT MAY INHIBIT
- 12.7. CHECK ALL MOUNTING FOR LOOSE OR MISSING HARDWARE.
- 12.8. IF UNIT IS PORTABLE, VISUALLY CHECK UNIT TO DETERMINE IF FLUSHING FLUID NEEDS TO BE CHANGED OR SUPPLEMENTED. AND BE LOCATED IN AN AREA IDENTIFIED WITH A HIGHLY VISIBLE SIGN POSITIONED SO THAT SIGN SHALL BE VISIBLE WITHIN THE AREA SERVED BY THE EMERGENCY SHOWER.
- 12.9. THE AREA AROUND THE EMERGENCY SHOWER SHALL BE WELL-LIT.
- 12.10. CHECK OPERATION OF SPRAY VALVE, HARDWARE VALVES, AND PLUMBING. CHECK ANY DAMAGE TO THE SYSTEM, FITTINGS, PIPING AND NOZZLES.

- 12.11. REPLACE EXTERNAL COMPONENTS AS NECESSARY.
- 12.12. IF UNIT IS PORTABLE, DRAIN, FLUSH, AND REFILL WITH CLEAN POTABLE
- 12.13. WATER AND STERILE ANTIMICROBIAL PRESERVATIVE EVERY 90 DAYS OR
- 12.14. IF UNIT IS PORTABLE AND WATER HAS BEEN DISCHARGED FOR ANY
REASON, PERFORM TASK 33.
- 12.15. IF UNIT HAS PRESSURE GAGE, CHECK PRESSURE GAUGE FOR PROPER
- 12.16. PRESSURE. PRESSURE GAUGE INDICATOR SHOULD BE WITHIN THE
GREEN BAR
- 12.17. IF UNIT IS PORTABLE, CHECK WEIGHT OF UNIT TO DETERMINE FLUID
LEVEL. (13 GAL. UNIT WEIGHT EMPTY 33LBS. WEIGHT FULL 108LBS.)
- 12.18. BE POSITIONED SO THAT THE SHOWER PATTERN IS DISPERSED AT THE TOP
OF THE FLUSHING FLUID COLUMN > 82 INCHES AND < 96 INCHES FROM THE
SURFACE ON
- 12.19. WHICH THE USER STANDS. THE CENTER OF THE SPRAY SHALL BE AT LEAST
16 INCHES
- 12.20. CHECK DRAIN, REMOVE DEBRIS.
- 12.21. BE CONNECTED TO A SUPPLY OF FLUSHING FLUID PER MANUFACTURER'S
REQUIREMENT
- 12.22. INSTALLATION INSTRUCTIONS TO PRODUCE THE REQUIRED SPRAY PATTERN
OF A
- 12.23. MINIMUM PERIOD OF 15 MINUTES
- 12.24. UNIT WILL BE ACTIVATED WEEKLY TO FOR A PERIOD LONG ENOUGH TO
- 12.25. VERIFY OPERATION AND INSURE THAT FLUSHING FLUID IS AVAILABLE
- 12.26. RE-ACTIVATE ALARMS (IF APPLICABLE).
- 12.27. WHERE THE POSSIBILITY OF FREEZING EXISTS, THE SHOWER SHALL BE
PROTECTED
- 12.28. FROM FREEZING. IF THE SHUT-OFF VALVES ARE INSTALLED IN THE SHOWER
LINE FOR
- 12.29. MAINTENANCE PURPOSES, PROVISIONS SHALL BE MADE TO PREVENT
UNAUTHORIZED
- 12.30. DATE AND SIGN INPECTION TAG.
- 12.31. DELIVER TEPID (60 -100 DEG. F) FLUSHING FLUID. IN CIRCUMSTANCES
WHERE
- 12.32. CHEMICAL REACTION IS ACCELERATED BY FLUSHING FLUID TEMPERATURE,
A FACILITIES
 - 12.32.1. SAFETY/HEALTH ADVISOR SHOULD BE CONSULTED OF THE OPTIMUM
TEMPERATURE
- 12.33. WHEN THE PLUMBED EMERGENCY SHOWER IS INSTALLED, ITS
PERFORMANCE SHALL
- 12.34. BE VERIFIED IN ACCORDANCE WITH THE FOLLOWING STEPS 80-180:
- 12.35. WITH THE UNIT CORRECTLY CONNECTED TO THE FLUSHING FLUID
SOURCE AND THE

- 12.36. VALVE(S) CLOSED, VISUALLY CHECK THE PIPING CONNECTIONS FOR LEAKS.
- 12.37. OPEN THE VALVE TO THE FULLY OPEN POSITION. THE VALVE SHALL REMAIN OPEN
- 12.38. WITHOUT REQUIRING FURTHER USE OF THE OPERATOR'S HANDS.
- 12.39. WITH THE VALVE IN THE FULLY OPENED POSITION, MEASURE THE DIAMETER OF THE
- 12.40. SPRAY PATTERN. IT SHALL BE A MINIMUM OF 20 INCHES AT 60 INCHES ABOVE THE
- 12.41. STANDING SURFACE. THE FLUSHING FLUID SHALL BE SUBSTANTIALLY DISPERSED
- 12.42. THROUGHOUT THE PATTERN.
- 12.43. A MEANS SHALL BE PROVIDED TO ENSURE THAT A CONTROLLED FLOW OF FLUSHING FLUID IS PROVIDED TO BOTH EYES SIMULTANEOUSLY AT A VELOCITY LOW ENOUGH TO BE NON-INJURIOUS TO THE USER.
13. THE EYEWASH SHALL BE DESIGNED AND POSITIONED IN SUCH A WAY AS TO POSE NO HAZARD TO THE USER.
 - 13.1. NOZZLES AND FLUSHING FLUID UNITS SHALL BE PROTECTED FROM AIRBORNE
 - 13.2. CONTAMINANTS. WHATEVER MEANS IS USED TO AFFORD SUCH PROTECTION, ITS
 - 13.3. REMOVAL SHALL NOT REQUIRE A SEPARATE MOTION BY THE OPERATOR WHEN
 - 13.4. EYEWASHES SHALL BE DESIGNED, MANUFACTURED AND INSTALLED IN SUCH A
 - 13.5. MANNER THAT, ONCE ACTIVATED, THEY CAN BE USED WITHOUT REQUIRING THE USE OF
 - 13.6. THE OPERATOR'S HANDS.
 - 13.7. EYEWASHES SHALL BE CONSTRUCTED OF MATERIALS THAT SHALL NOT CORRODE IN THE
 - 13.8. PRESENCE OF THE FLUSHING FLUID.
 - 13.9. EYEWASHES SHALL BE CAPABLE OF DELIVERING FLUSHING FLUID TO THE EYES NOT LESS THAN 0.4 GPM FOR 15 MINUTES. IF SHUT OFF VALVES ARE INSTALLED IN THE SUPPLY LINE FOR MAINTENANCE PURPOSES, PROVISIONS SHALL BE MADE TO PREVENT UNAUTHORIZED SHUT-OFF.
 - 13.10. EYEWASHES SHALL BE DESIGNED TO PROVIDE ENOUGH ROOM TO ALLOW THE EYELIDS
 - 13.11. TO BE HELD OPEN WITH THE HANDS WHILE THE EYES ARE IN THE FLUSHING FLUID
 - 13.12. EYEWASHES SHALL PROVIDE FLUSHING FLUID TO BOTH EYES SIMULTANEOUSLY. A TEST GAUGE FOR MAKING DETERMINATION OF A SUITABLE EYEWASH PATTERN SHALL BE A
 - 13.13. MINIMUM OF 4 INCHES IN LENGTH WITH TWO SETS OF PARALLEL LINES EQUIDISTANT FROM THE CENTER.
 - 13.14. THE INTERIOR LINES SHALL BE 1.25" APART AND THE EXTERIOR LINES

SHALL BE 3.25" APART. PLACE THE GAUGE IN THE STREAM OF THE EYEWASH.

13.15. THE FLUSHING FLUID SHALL COVER THE AREAS BETWEEN THE INTERIOR AND EXTERIOR LINES OF THE GAUGE AT SOME POINT <8" ABOVE EYEWASH NOZZLE(S).

13.16. DATE AND SIGN INPECTION TAG.

14. SEWER CLEANING FOR BLDGS. 301, 303, AND 306

14.1. RUN SNAKE THROUGH ALL MAIN SEWER DRAINS.

14.2. FLUSH ALL MAIN SEWERS WITH WATER.

15. WATER FILTER REPLACEMENT (BLDG. 18, 67, 82, 83, 111, 144, 158, 179, 16. 197, 198, 249, 300)

16.1.1.1. REPLACE WATER FILTER(S). (CUNO FILTERS).

17. WATER HEATERS, ELECTRIC

17.1. OPEN DRAIN COCK AND FLUSH @5 GALLONS FROM BOTTOM OF WATER HEATER.

17.2. CHECK ELECTRICAL ELEMENTS AND CONNECTIONS, AS APPROPRIATE.

17.3. CHECK TO VALIDATE WATER HEATER IS INSTALLED PER CODE
SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX IS

17.4. CHECKED

17.5. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS ARE

17.6. REMOVED PROPERLY.

18. WATER HEATERS, GAS

18.1. OPEN DRAIN COCK AND FLUSH @5 GALLONS FROM BOTTOM OF WATER
18.2. HEATER.

18.3. CHECK PILOT FLAME QUALITY, AS APPROPRIATE.

18.4. CHECK AND OPERATE TEMPERATURE CONTROLS. SET BACK TO NORMAL

18.5. RANGE TO ENSURE WATER AT 122°F AT POINT OF USE.

18.6. CHECK FOR LEAKS.

18.7. CHECK FLUE FOR PROPER DRAFTING.

18.8. CHECK ELECTRICAL ELEMENTS AND CONNECTIONS, AS APPROPRIATE.

18.9. CHECK TO VALIDATE WATER HEATER IS INSTALLED PER CODE

18.10. SCAN ASSET LABEL BARCODE IF THE ASSET MUST BE SCANNED CHECK BOX
IS

18.11. CHECKED

18.12. CLEAN UP AREA AND ENSURE ALL MAINTENANCE MATERIALS AND DEBRIS
ARE REMOVED PROPERLY.

Appendix A.1.11 PT&I

PT&I	
1. VIBRATION ANALYSIS & REPORTING	EVERY 5 WEEKS
1.1. ANALYSIS, TASKING, REVIEWING, AND RECORDING.	
<i>ROUTES SHOWN IN APPENDIX</i>	
2. INFRARED TESTING AND ANALYSIS	SEMI-ANNUAL
2.1. PERFORM INFRARED TESTING AND ANALYSIS.	
<i>POINTS SHOWN IN APPENDIX</i>	
3. OIL TESTING AND ANALYSIS	ANNUAL
3.1. COLLECT OIL SAMPLE.	
3.2. PERFORM CHEMICAL ANALYSIS OF OIL.	
<i>POINTS SHOWN IN 0</i>	
4. MOTOR CIRCUIT ANALYSIS	BIENNIAL
4.1. MOTOR CIRCUIT TESTING.	
<i>POINTS SHOWN IN 0</i>	
5. ULTRASONIC TESTING	ANNUAL
5.1. PNEUMATIC AIR LINES	
~~5.2. COMPRESSED AIR LINES (PER JPL DRAWING NO: JPL PD 050- COMP. AIR 0 provided in a separate file: APX A01.11.5 Compressed Air Lines.TIF)~~	
5.3.	
5.4.	

Appendix A.1.11.1 Vibration Analysis & Reporting Routes

Route No. 1: BLDG 18

Machine Count: 7

No. of Points: 44

Machine 1--18 CHP 1
M3653 CHILLED WATER PUMP 1

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MBA-S=St;W=St

Machine 2--18 CHP 2
M3656 CHILLED WATER PUMP 2

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MBA-S=St;W=St

Machine 3--18 HWP 1
M0854 HOT WATER PUMP 1

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MBA-S=St;W=St

Route No. 2: BLDG 103

Machine Count: 6

No. of Points: 50

Machine 1--103 AHU 3
M4123 AIR HANDLER FAN 3

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MOA-S=St;W=St 6. FIV-S=St;W=St

Machine 2--103 CHP 2
M2900 CHILLED WATER PUMP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 3--103 CHP 1
M2897 CHILLED WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 4--103 HWP 1
M3028 HOT WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--103 AHU 1
M2468 AIR HANDLER FAN 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FIM-S=St;W=St
9. FOM-S=St;W=St 10. FOR-S=St;W=St

Machine 6--103 AHU 2
M2469 AIR HANDLER FAN 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St

Route No. 1: BLDG. 125

Machine Count: 12

No. of Points: 87

Machine 2--125 CHP 1
M0772 CHILLED WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 3--125 CHP 2
M0773 CHILLED WATER PUMP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 4--125 CHP 3
M3395 CHILLED WATER PUMP 3

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--125 HWP 8
M0872 HOT WATER PUMP 8

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 6--125 HWP 9
M0873 HOT WATER PUMP 9

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 7--125 CHP 4
M0843 CHILLED WATER PUMP 4

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 8--125 CHP 5
M0868 CHILLED WATER PUMP 5

- 1. MOA-S=St;W=St 2. ILT-S=St;W=St 3. CLT-S=St;W=St 4. ILB-S=St;W=St
5. CLB-S=St;W=St

Machine 9--125 LAC
M5075 LAB AIR COMPRESSOR

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. 1SP-S=St;W=St 7. 2SP-S=St;W=St 8. 3SP-S=St;W=St

Machine 10--125 AH B36
M7626 AIR HANDLER UNIT B36

1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 11--125 AHU 1
M9870 AIR HANDLER UNIT 1

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 12--125 AHU 2
M9923 AIR HANDLER UNIT 2

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Route No. 1: BLDG. 126

Machine Count: 7

No. of Points: 44

Machine 1--126 CHP 2
M1684 CHILLED WATER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 2--126 CHP 1
M1674 CHILLED WATER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 3--126 CBP 2
M3362 CHILLED BOOSTER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 4--126 SAF 1
M7677-SA SUPPLY AIR FAN 1

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 5--126 RAF 1
M7677-RA RETURN AIR FAN 1

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 6--126 AHU 2
M4693 AIR HANDLER UNIT 2

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Route No. 3: BLDG. 144

Machine Count: 7

No. of Points: 46

Machine 1--144 CHP 2
M5048 CHILLED WATER PUMP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MOA-S=St;W=St

Machine 2--144 HWP 1
M0203 HOT WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 3--144 CHP 1
M4856 CHILLED WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 4--144 AHU 1
M4642-04 AIR HANDLER UNIT 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIV-S=St;W=St 7. FOV-S=St;W=St

Machine 5--144 AHU 2
M4642-05 AIR HANDLER UNIT 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FOV-S=St;W=St

Machine 6--144 AHU 7
M3800 AIR HANDLER UNIT 7

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FMR-S=St;W=St
9. FOR-S=St;W=St

Route No. 4: BLDG. 150

Machine Count: 15

No. of Points: 117

Machine 3--150 HWP 2
M10050 HOT WATER PUMP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--150 CHP 1
M9976 CHILLED WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 6--150 CHP 2

M0490 CHILLED WATER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 7--150 CTF 1

M0260 COOLING TOWER FAN 1

1. MOH-S=St;W=St 2. MIH-S=St;W=St 3. GI1-S=St;W=St 4. GI2-S=St;W=St
5. B1H-S=St;W=St 6. B2H-S=St;W=St 7. O1H-S=St;W=St 8. O2H-S=St;W=St

Machine 8--150 SAF 2

M0468 SUPPLY AIR FAN 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOH-S=St;W=St
9. FOV-S=St;W=St

Machine 9--150 HWP 4

M10052 HOT WATER PUMP 4

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 10--150 HWP 3

M10051 HOT WATER PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 11--150 AH AC1

M4646 AIR HANDLER UNIT AC1

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOH-S=St;W=St
5. FOV-S=St;W=St 6. FOA-S=St;W=St

Machine 12--150 AHU 2

M7940 AIR HANDLER UNIT 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOH-S=St;W=St
9. FOV-S=St;W=St 10. FOA-S=St;W=St

Machine 13--150 AHU 1

M1629 AIR HANDLING UNIT 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FOR-S=St;W=St

Machine 14--150 SAF 1B

M1630 SUPPLY AIR FAN 1B

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOH-S=St;W=St
9. FOV-S=St;W=St 10. FOA-S=St;W=St

Machine 15--150 SAF 1A

M1628 SUPPLY AIR FAN 1A

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOH-S=St;W=St
9. FOV-S=St;W=St 10. FOA-S=St;W=St

Route No. 1: BLDG. 157

Machine Count: 7

No. of Points: 43

Machine 1--157 AHU 1
M6932 AIR HANDLER UNIT 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 2--157 AHU 2
M6960 AIR HANDLER UNIT 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 4--157 CHP 2
M6961 CHILLED WATER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--157 CHP 1
M6962 CHILLED WATER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 6--157 CWP 11
M2332 CONDENSER PUMP 11

1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MOA-S=St;W=St

Machine 7--157 CWP 12
M2333 CONDENSER PUMP 12

1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MOA-S=St;W=St

Route No. 2: BLDG. 158

Machine Count: 11

No. of Points: 59

Machine 4--158 CWP 4
MXXXXX CONDENSER WATER PUMP 4

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 6--158 CHP-2
M3225 CHILLED WATER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 7--158 CHP-3
M3233 CHILLED WATER PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 8--158 CHP-4
M3234 CHILLED WATER PUMP 4

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 9--158 HWP 1
M6749 HOT WATER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St

Machine 10--158 AHU 3
M1726 AIR HANDLER UNIT 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St

Machine 11--158 LAC
M1331 LAB AIR COMPRESSOR

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. ST1-S=St;W=St 7. ST2-S=St;W=St 8. ST3-S=St;W=St

Route No. 3: BLDG 159

Machine Count: 3

No. of Points: 30

Machine 1--159 DWP A
M0994 DOMESTIC WATER PUMP A

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 2--159 DWP B
M1608 DOMESTIC WATER PUMP B

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 3--159 DWP C
M1609 DOMESTIC WATER PUMP C

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Route No. 3: BLDG. 161

Machine Count: 14

No. of Points: 73

Machine 3--161 CHP 4
M2486 CHILLED WATER PUMP 4

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 4--161 CHP 3
M2487 CHILLED WATER PUMP 3

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 5--161 CHP 2
M2488 CHILLED WATER PUMP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 6--161 CHP 1
M2489 CHILLED WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 14--161 AHU S2
M2607 AIR HANDLER UNIT S2

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Route No. 5: BLDG. 166

Machine Count: 8

No. of Points: 69

Machine 1--166 ALP 23
M1806 ARC LAMP WTR PUMP P23

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 2--166 ALP 24
M1810 ARC LAMP WTR PUMP P24

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 3--166 ALP 25
M1811 ARC LAMP WTR PUMP P25

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 4--166 ALP 26
M1812 ARC LAMP WTR PUMP P26

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St

5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--166 OLP 1
M9668 OPEN LOOP TOWER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 6--166 OLP 2
M9676 OPEN LOOP TOWER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 7--166 OLP 3
M9733 OPEN LOOP TOWER PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 8--166 CTF
M9751 COOLING TOWER FAN

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. GI1-S=St;W=St 4. GI2-S=St;W=St
5. GO1-S=St;W=St 6. GO2-S=St;W=St

Route No. 3: BLDG. 168

Machine Count: 12

No. of Points: 86

Machine 1--168 AHU 4
M0735 AIR HANDLER UNIT 4

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 2--168 CWP 15
M0569 CONDENSER PUMP 15

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 3--168 CWP 16
M0570 CONDENSER PUMP 16

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--168 CHP 10
M0658 CHILLED WATER PUMP 10

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 6--168 CHP 11

M0659 CHILLED WATER PUMP 11

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St

5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 7--168 CHP 8

M0565 CHILLED WATER PUMP 8

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St

Machine 8--168 CHP 9

M0538 CHILLED WATER PUMP 9

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St

Machine 9--168 HWP 3

M2943 HOT WATER PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St

Machine 10--168 CHP 1

M1395 CHILLED WATER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 11--168 CHP 2

M1392 CHILLED WATER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 12--168 AHU 5

M0703 AIR HANDLER UNIT 5

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Route No. 4: BLDG. 169

Machine Count: 4

No. of Points: 32

Machine 1--169 CWP 4

M0577 CONDENSER PUMP 4

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St

5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 2--169 CHP 3

M0580 CHILLED WATER PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St

5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 3--169 AHU 1
M6510 AIR HANDLER UNIT 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIV-S=St;W=St 7. FOV-S=St;W=St

Machine 4--169 AHU 2
M6511 AIR HANDLER UNIT 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIV-S=St;W=St 7. FOV-S=St;W=St

Route No. 5: BLDG. 170

Machine Count: 9

No. of Points: 65

Machine 3--170 CHP
M2541 CHILLED WATER PUMP

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St

Machine 4--170 CHP 2
M4644-7 CHILLED PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--170 CWP 1
M3981 CONDENSER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 6--170 HWP 1
M3364 HOT WATER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 7--170 AHU 6
M5975 AIR HANDLER UNIT 6

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FMV-S=St;W=St 8. FOV-S=St;W=St

Machine 8--170 AHU 7
M0559 AIR HANDLER UNIT 7

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIV-S=St;W=St

Machine 9--170 CHWP
M2164 CHILLED WATER PUMP

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Route No. 6: BLDG. 171

Machine Count: 11

No. of Points: 61

Machine 1--171 CHP 2
M0216 CHILLED WATER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 2--171 CHP 1
M0223 CHILLED WATER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 3--171 CHP 3
M0241 CHILLED WATER PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 4--171 CWP 3
M0196 CONDENSER PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 5--171 CWP 2
M0211 CONDENSER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 6--171 AHU 2
M7802 AIR HANDLER UNIT 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 7--171 AHU 1
M0329 AIR HANDLER UNIT 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FOS-S=St;W=St 8. FOT-S=St;W=St
9. FOA-S=St;W=St

Machine 8--171 SAF 1
M7178 SUPPLY AIR FAN 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St

Machine 9--171 HWP 1
M0103 HOT WATER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St

Machine 10--171 HWP 2
M0100 HOT WATER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 11--171 HWP 3
M0115 HOT WATER PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Route No. 7: BLDG. 179

Machine Count: 34

No. of Points: 199

Machine 1--179 AHU 4
M2799 AIR HANDLER UNIT 4

1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 2--179 AHU 3
M2802 AIR HANDLER UNIT 3

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 3--179 HWP 8
M7666 HOT WATER PUMP 8

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 4--179 HWP 7
M7667 HOT WATER PUMP 7

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--179 CWP 3
M1260 CONDENSER PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 6--179 CWP 4
M1257 CONDENSER PUMP 4

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 8--179 SCP 1N
M2827 SEC. CHILLED PUMP 1N

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 9--179 SCP 2N
M2823 SEC. CHILLED PUMP 2N

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 10--179 PCP 1N
M2829 PRI. CHILLED PUMP 1N

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 11--179 CRP 2N
M2828 PRI. CHILLED PUMP 2N

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 12--179 AHU S5
M5655 AIR HANDLER UNIT S5

- 1. MOH-S=No;W=St 2. MOV-S=No;W=St 3. MOA-S=No;W=St 4. MIH-S=No;W=St
5. MIV-S=No;W=St 6. FIV-S=No;W=St 7. FMV-S=No;W=St 8. FOV-S=No;W=St

Machine 13--179 MUA
M2855 MAKE UP AIR HANDLER

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 14--179 SAF 1C
M2805 SUPPLY AIR FAN 1C

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 15--179 RAF 1C
M2805 RETURN AIR FAN 1C

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 16--179 SAF 1B
M2804 SUPPLY AIR FAN 1B

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 17--179 RAF 1B
M2804 RETURN AIR FAN 1B

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 18--179 SAF 1A
M2803 SUPPLY AIR FAN 1A

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 19--179 RAF 1A
M2803 RETURN AIR FAN 1A

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 20--179 AHU 2

M2961 AIR HANDLER-AIR LOCK 2

1. MOR-S=No;W=St 2. MIR-S=No;W=St 3. FIR-S=No;W=St 4. FOH-S=No;W=St

Machine 22--179 SCP 2S
M2830 SEC. CHILLED PUMP 2S

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 23--179 SCP 1S
M2831 SEC. CHILLED PUMP 1S

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 24--179 PCP 1S
M2833 PRI. CHILLED PUMP 1S

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 25--179 PCP 2S
M2832 PRI. CHILLED PUMP 2S

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 26--179 RAF 1
M2846 RETURN AIR JOY FAN 1

1. MOR-S=No;W=St 2. MOA-S=No;W=St 3. MIR-S=No;W=St

Machine 27--179 RAF 2
M2845 RETURN AIR JOY FAN 2

1. MOR-S=No;W=St 2. MOA-S=No;W=St 3. MIR-S=No;W=St

Machine 28--179 RAF 3
M2844 RETURN AIR JOY FAN 3

1. MOR-S=No;W=St 2. MOA-S=No;W=St 3. MIR-S=No;W=St

Machine 29--179 RAF 4
M2843 RETURN AIR JOY FAN 4

1. MOR-S=No;W=St 2. MOA-S=No;W=St 3. MIR-S=No;W=St

Machine 30--179 CWP 1
M1903 CONDENSER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 31--179 CWP 2
M1915 CONDENSER PUMP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
 5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 33--179 HWP 5
 M7665 HOT WATER PUMP 5

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St

Machine 34--179 HWP 6
 M7662 HOT WATER PUMP 6

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St

Route No. 5: BLDG. 180

Machine Count: 20

No. of Points: 170

Machine 13--180 CTF 1
 M2136 COOLING TOWER FAN 1

- 1. MOA-S=St;W=St 2. MOH-S=St;W=St 3. GI1-S=St;W=St 4. GI2-S=St;W=St

Machine 14--180 CTF 2
 M2133 COOLING TOWER FAN 2

- 1. MOH-S=St;W=St 2. GO1-S=St;W=St 3. GO2-S=St;W=St

Route No. 1: BLDG. 183

Machine Count: 16

No. of Points: 105

Machine 1--183 EXF 2
 M6894 EXHAUST FAN 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOH-S=St;W=St
 9. FOV-S=St;W=St 10. FOA-S=St;W=St

Machine 3--183 CHR 1
 M0292 CHILLER 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St

Machine 4--183 CWP 1
 M5056 CONDENSER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 5--183 CWP 2
 M5055 CONDENSER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 6--183 CHP 3
M6886 CHILLED PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 7--183 CHP 4
M6887 CHILLED PUMP 4

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 9--183 HWP 11
M0728 HOT WATER PUMP 11

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 10--183 HWP 12
M0727 HOT WATER PUMP 12

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 11--183 EXF 1
M6844 EXHAUST FAN 1

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 12--183 CRP 1
M2631 CHILLED RETURN PUMP 1

1. MIT-S=St;W=St 2. MCT-S=St;W=St 3. MOA-S=St;W=St 4. MIB-S=St;W=St
5. MCB-S=St;W=St

Machine 13--183 CRP 2
M2633 CHILLED RETURN PUMP 2

1. MIT-S=St;W=St 2. MCT-S=St;W=St 3. MOA-S=St;W=St 4. MIB-S=St;W=St
5. MCB-S=St;W=St

Route No. 1: BLDG. 228

Machine Count: 4

No. of Points: 21

Machine 1--228 CWP E
M1231 CONDENSER PUMP EAST

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St

Machine 2--228 CWP W

M1232 CONDENSER PUMP WEST

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
 5. MIA-S=St;W=St

Machine 3--228 CTF W
 M4806 COOLING TOWER FAN WEST

- 1. MOH-S=St;W=St 2. MIH-S=St;W=St 3. GI1-S=St;W=St 4. GI2-S=St;W=St
 5. GO1-S=St;W=St 6. GO2-S=St;W=St

Machine 4--228 CTF E
 M4623 COOLING TOWER FAN EAST

- 1. MIH-S=St;W=St 2. GI1-S=St;W=St 3. GI2-S=St;W=St 4. GO1-S=St;W=St
 5. GO2-S=St;W=St

Route No. 2: BLDG. 230

Machine Count: 30

No. of Points: 187

Machine 25--230 UPS 1
 M9995 UPS GENERATOR 1

- 1. TBR-S=St;W=St 2. TBP-S=St;W=St 3. BBR-S=St;W=St 4. BBP-S=St;W=St

Machine 26--230 UPS 2
 M9996 UPS GENERATOR 2

- 1. TBR-S=St;W=St 2. TBP-S=St;W=St 3. BBR-S=St;W=St 4. BBP-S=St;W=St

Machine 27--230 UPS 3
 M9997 UPS GENERATOR 3

- 1. TBR-S=St;W=St 2. TBP-S=St;W=St 3. BBR-S=St;W=St 4. BBP-S=St;W=St

Route No. 2: BLDG. 233

Machine Count: 17

No. of Points: 114

Machine 1--233 CHP 2
 M7752 CHILLED WATER PUMP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St

Machine 2--233 CHP 1
 M7753 CHILLED WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St

Machine 4--233 CWP N.
 M4838 CONDENSER PUMP NORTH

- 1. MIT-S=St;W=St 2. MIB-S=St;W=St 3. MCT-S=St;W=St 4. MCB-S=St;W=St
 5. MOA-S=St;W=St

Machine 5--233 CWP S.
M7768 CONDENSER PUMP SOUTH

- 1. MIT-S=St;W=St 2. MIB-S=St;W=St 3. MCT-S=St;W=St 4. MCB-S=St;W=St
5. MOA-S=St;W=St

Machine 6--233 HWP 1
M9773 HOT WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 7--233 HWP 2
M9772 HOT WATER PUMP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 9--233 AHU 1
M4819 AIR HANDLER UNIT 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FOH-S=St;W=St 7. FOV-S=St;W=St 8. FOA-S=St;W=St

Machine 10--233 AHU 2
M4820 AIR HANDLER UNIT 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOV-S=St;W=St

Machine 11--233 SAF 2
M7775 SUPPLY AIR FAN AC-2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIV-S=St;W=St 7. FMR-S=St;W=St 8. FOR-S=St;W=St

Machine 12--233 SAF 3
M7774 SUPPLY AIR FAN AC-3

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FMR-S=St;W=St 8. FOR-S=St;W=St

Machine 13--233 AHU 3
M7898 AIR HANDLER UNIT 3

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FMR-S=St;W=St 8. FOR-S=St;W=St

Machine 14--233 AHU 4
M7899 AIR HANDLER UNIT 4

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FMR-S=St;W=St 8. FOR-S=St;W=St

Machine 15--233 RAF 2
M7786 SOUTH RETURN FAN 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FOR-S=St;W=St

Machine 16--233 RAF 1
M7785 NORTH RETURN FAN 1

- 1. FOR-S=St;W=St 2. FIR-S=St;W=St 3. MOH-S=St;W=St 4. MOV-S=St;W=St
 5. MOA-S=St;W=St 6. MIH-S=St;W=St 7. MIV-S=St;W=St

Machine 17--233 TCU
 M2983 TEMP. CONTROL UNIT

- 1. MOA-S=St;W=St 2. MIV-S=St;W=St 3. FIH-S=St;W=St 4. FOH-S=St;W=St

Route No. 2: BLDG. 238

Machine Count: 17

No. of Points: 150

Machine 1--238 AHU 8
 M6661 9TH FLR AIR HANDLER 8

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
 5. MIA-S=St;W=St 6. FIR-S=St;W=St 7. FIM-S=St;W=St 8. FMR-S=St;W=St
 9. FOM-S=St;W=St 10. FOR-S=St;W=St

Machine 2--238 AHU 7
 M6646 AIR HANDLER UNIT 7

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FIM-S=St;W=St 8. FMR-S=St;W=St
 9. FOM-S=St;W=St 10. FOR-S=St;W=St

Machine 3--238 AHU 6
 M6644 AIR HANDLER UNIT 6

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FIM-S=St;W=St 8. FMR-S=St;W=St
 9. FOM-S=St;W=St 10. FOR-S=St;W=St

Machine 4--238 AHU 5
 M6642 AIR HANDLER UNIT 5

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FIM-S=St;W=St 8. FMR-S=St;W=St
 9. FOM-S=St;W=St 10. FOR-S=St;W=St

Machine 5--238 AHU 4
 M6640 AIR HANDLER UNIT 4

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FIM-S=St;W=St 8. FMR-S=St;W=St
 9. FOM-S=St;W=St 10. FOR-S=St;W=St

Machine 6--238 AHU 3
 M3664 AIR HANDLER UNIT 3

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FIM-S=St;W=St 8. FMR-S=St;W=St
 9. FOM-S=St;W=St 10. FOR-S=St;W=St

Machine 7--238 AHU 2
 M6636 AIR HANDLER UNIT 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
 5. MIA-S=St;W=St 6. FIR-S=St;W=St 7. FIM-S=St;W=St 8. FMR-S=St;W=St

9. FOM-S=St;W=St 10. FOR-S=St;W=St
Machine 8--238 AHU 1
M6561 AIR HANDLER UNIT #1

1. MOH-S=St;W=St 2. MIH-S=St;W=St 3. MIA-S=St;W=St 4. FIR-S=St;W=St
5. FIM-S=St;W=St 6. FMR-S=St;W=St 7. FOM-S=St;W=St 8. FOR-S=St;W=St

Machine 10--238 CWP
M6721 CONDENSER WATER PUMP

1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MIA-S=St;W=St

Machine 11--238 CHP 1
M1868 CHILLED WATER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 12--238 CHP 4
M6566 CHILLED WATER PUMP 4

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 13--238 CHP 2
M1866 CHILLED WATER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 14--238 CHP 3
M6565 CHILLED WATER PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 15--238 CHP 8
M1862 CHILLED WATER PUMP 8

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 17--238 HWP P6
M6633 HOT WATER PUMP P6

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Route No. 3: BLDG. 241
Machine Count: 4
No. of Points: 22

Machine 1--241 AHU 5
M0332 AIR HANDLER UNIT 5

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St

Machine 2--241 RAF 1
M0278 RETURN AIR FAN 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FOR-S=St;W=St

Machine 3--241 SAF 1
M0278 SUPPLY AIR FAN 1

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 4--241 AHU
M0280 AIR HANDLER FEEDS 171

- 1. FOR-S=St;W=St 2. FIR-S=St;W=St 3. MIR-S=St;W=St 4. MOR-S=St;W=St

Route No. 3: BLDG. 248

Machine Count: 5

No. of Points: 36

Machine 1--248 RCU 1
M3365 CLEAN ROOM FAN RCU 1

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 2--248 RCU 2
M3366 CLEAN ROOM FAN RCU 2

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 3--248 AHU 1
M6599 AIR HANDLER UNIT 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. F1V-S=St;W=St 7. F2V-S=St;W=St 8. F3V-S=St;W=St
9. F4V-S=St;W=St 10. F5V-S=St;W=St

Machine 4--248 CHP 2
M9929 CHILLED WATER PUMP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--248 CHP 1
M9937 CHILLED WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Route No. 4: BLDG. 251

Machine Count: 1

No. of Points: 10

Machine 1--251 AHU
M6671 AIR HANDLER UNIT

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOH-S=St;W=St
9. FOV-S=St;W=St 10. FOA-S=St;W=St

Route No. 3: BLDG. 264

Machine Count: 24

No. of Points: 118

Machine 1--264 AHU 9
S6341 AIR HANDLER UNIT 9

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 2--264 AHU 11
S6343 AIR HANDLER UNIT 11

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 3--264 CWP 3
S3457 8TH FLR CHILLED PUMP 3

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MOA-S=St;W=St

Machine 4--264 AHU 8A
S6045 AIR HANDLER UNIT 8A

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 5--264 AHU 8B
S6046 AIR HANDLER UNIT 8B

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 6--264 AHU 7A
S6043 AIR HANDLER UNIT 7A

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 7--264 AHU 7B
S6044 AIR HANDLER UNIT 7B

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 8--264 AHU 6
M0557 AIR HANDLER UNIT 6

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 9--264 AHU 5
M0567 AIR HANDLER UNIT 5

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 10--264 AHU 4
M0578 AIR HANDLER UNIT 4

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St

Machine 11--264 AHU 3C

S6034 AIR HANDLER UNIT 3C

 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St
 Machine 12--264 AHU 3B
 S6033 AIR HANDLER UNIT 3B

 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St
 Machine 13--264 AHU 3A
 S6032 AIR HANDLER UNIT 3A

 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St
 Machine 14--264 AHU 2
 S6031 AIR HANDLER UNIT 2

 1. MIR-S=St;W=St 2. MOR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St
 Machine 15--264 AHU 1
 S6030 AIR HANDLER UNIT 1

 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St
 Machine 16--264 CWP 1
 S3446 CONDENSER WATER PUMP 1

 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St
 Machine 17--264 CWP 2
 S3447 CONDENSER WATER PUMP 2

 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St
 Machine 18--264 CHP 1
 S3444 CHILLED WATER PUMP 1

 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St
 Machine 19--264 CHP 2
 S3445 CHILLED WATER PUMP 2

 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St

Machine 20--264 CTF 1
 S6232 COOLING TOWER FAN 1

 1. MOH-S=St;W=St 2. MIV-S=St;W=St 3. GI1-S=St;W=St 4. GI2-S=St;W=St
 5. GO1-S=St;W=St 6. GO2-S=St;W=St
 Machine 21--264 CTF 2
 S6233 COOLING TOWER FAN 2

1. GO1-S=St;W=St 2. GO2-S=St;W=St 3. GI1-S=St;W=St 4. GI2-S=St;W=St
 5. MIH-S=St;W=St 6. MOH-S=St;W=St
 Machine 22--264 CTF 3
 S6234 COOLING TOWER FAN 3

1. MOH-S=St;W=St 2. MIH-S=St;W=St 3. GI1-S=St;W=St 4. GI2-S=St;W=St
 5. GO1-S=St;W=St 6. GO2-S=St;W=St
 Machine 23--264 HWP 1
 S3450 HOT WATER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St
 Machine 24--264 UPS
 S9866 UPS GENERATOR

1. TBR-S=St;W=St 2. TBP-S=St;W=St 3. BBR-S=St;W=St 4. BBP-S=St;W=St

Route No. 5: BLDG. 268

Machine Count: 3

No. of Points: 26

Machine 2--268 PWP P1
 M5684 POTABLE WATER PUMP P1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St 10. POA-S=St;W=St

Route No. 4: BLDG 277

Machine Count: 13

No. of Points: 101

Machine 1--277 AHU 2
 M5371 AIR HANDLER UNIT 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FMR-S=St;W=St
 9. FOR-S=St;W=St

Machine 2--277 AHU 8
 M5372 AIR HANDLER UNIT 8

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FMH-S=St;W=St
 9. FOH-S=St;W=St

Machine 3--277 CRP 3A
 M5430 CHILLED RETURN PUMP 3A

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St

Machine 4--277 CRP 3B
 M5457 CHILLED RETURN PUMP 3B

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St

Machine 5--277 CSP 4A
M7693 CHILLED SUPPLY PUMP 4A

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 6--277 CSP 4B
M5496 CHILLED SUPPLY PUMP 4B

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St

Machine 7--277 AHU 6
M5347 AIR HANDLER UNIT 6

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FMH-S=St;W=St
9. FOH-S=St;W=St

Machine 8--277 AHU 7
M5356 AIR HANDLER UNIT 7

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FMV-S=St;W=St
9. FOV-S=St;W=St

Machine 9--277 AHU 9
M5241 AIR HANDLER UNIT 9

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FMR-S=St;W=St
9. FOR-S=St;W=St

Machine 10--277 AHU 1
M5220 AIR HANDLER UNIT 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FMR-S=St;W=St 7. FOR-S=St;W=St 8. FIH-S=St;W=St
9. FIV-S=St;W=St

Machine 11--277 CWP 1A
M0981 CONDENSER WATER PMP 1A

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 12--277 CWP 1B
M0980 CONDENSER WATER PMP 1B

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 13--277 CTF
M5509 COOLING TOWER FAN

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. GI1-S=St;W=St 7. GI2-S=St;W=St 8. GO1-S=St;W=St

9. GO2-S=St;W=St

Route No. 4: BLDG. 296

Machine Count: 9

No. of Points: 53

Machine 1--296 CWP 1
M0639 CONDENSER WATER PUMP 1

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MIA-S=St;W=St

Machine 2--296 CWP 2
M0672 CONDENSER WATER PUMP 2

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MIA-S=St;W=St

Machine 3--296 CWP 6
M0692 CONDENSER WATER PUMP 6

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MIA-S=St;W=St

Machine 4--296 CWP 5
M0695 CONDENSER WATER PUMP 5

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MIA-S=St;W=St

Machine 5--296 CWP 7
M0701 CONDENSER WATER PUMP 7

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MIA-S=St;W=St

Machine 6--296 CWP 3
M0707 CONDENSER WATER PUMP 3

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MIA-S=St;W=St

Machine 7--296 CWP 4
M0714 CONDENSER WATER PUMP 4

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
5. MOA-S=St;W=St

Machine 8--296 CTF E.
M1244 COOLING TOWER FAN EAST

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. GI1-S=St;W=St 7. GI2-S=St;W=St 8. GO1-S=St;W=St
9. GO2-S=St;W=St

Machine 9--296 CTF W.
M0715 COOLING TOWER FAN WEST

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. GI1-S=St;W=St 7. GI2-S=St;W=St 8. GO1-S=St;W=St

9. GO2-S=St;W=St

Route No. 6: BLDG. 298

Machine Count: 2

No. of Points: 8

Machine 1--298 AHU 3
M1066 AIR HANDLER UNIT 3

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 2--298 AHU 2
M1063 AIR HANDLER UNIT 2

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Route No. 5: BLDG 300 CP

Machine Count: 16

No. of Points: 150

Machine 1--300 CWP 1
M5934 WEST CONDENSER PUMP 1

1. ILT-S=St;W=St 2. CLT-S=St;W=St 3. ILB-S=St;W=St 4. CLB-S=St;W=St
5. MIA-S=St;W=St 6. PTI-S=St;W=St 7. PTC-S=St;W=St 8. PT*-S=St;W=St
9. PBI-S=St;W=St 10. PBC-S=St;W=St 11. PB*-S=St;W=St

Machine 2--300 CWP 2
M1656 MID CONDENSER PUMP 2

1. ILT-S=St;W=St 2. CLT-S=St;W=St 3. ILB-S=St;W=St 4. CLB-S=St;W=St
5. MIA-S=St;W=St 6. PTI-S=St;W=St 7. PTC-S=St;W=St 8. PT*-S=St;W=St
9. PBI-S=St;W=St 10. PBC-S=St;W=St 11. PB*-S=St;W=St

Machine 3--300 CWP 3
M1162 EAST CONDENSER PUMP 3

1. ILT-S=St;W=St 2. CLT-S=St;W=St 3. ILB-S=St;W=St 4. CLB-S=St;W=St
5. MIA-S=St;W=St 6. PTI-S=St;W=St 7. PTC-S=St;W=St 8. PT*-S=St;W=St
9. PBI-S=St;W=St 10. PBC-S=St;W=St 11. PB*-S=St;W=St

Machine 4--300 CT 1A
M2861 COOLING TOWER FAN 1A

1. MOC-S=St;W=St 2. MOI-S=St;W=St 3. MOA-S=St;W=St 4. MIC-S=St;W=St
5. MII-S=St;W=St 6. BFB-S=St;W=St 7. TFB-S=St;W=St

Machine 5--300 CT 1B
M2861 COOLING TOWER FAN 1B

1. MOC-S=St;W=St 2. MOI-S=St;W=St 3. MOA-S=St;W=St 4. MIC-S=St;W=St
5. MII-S=St;W=St 6. BFB-S=St;W=St 7. TFB-S=St;W=St

Machine 6--300 CT 2A
M2862 COOLING TOWER FAN 2A

1. MOC-S=St;W=St 2. MOI-S=St;W=St 3. MOA-S=St;W=St 4. MIC-S=St;W=St
5. MII-S=St;W=St 6. BFB-S=St;W=St 7. TFB-S=St;W=St

Machine 7--300 CT 2B

M2862 COOLING TOWER FAN 2B

1. MOC-S=St;W=St 2. MOI-S=St;W=St 3. MOA-S=St;W=St 4. MIC-S=St;W=St
5. MII-S=St;W=St 6. BFB-S=St;W=St 7. TFB-S=St;W=St

Machine 9--300 HWP 6

M0092 HOT WATER PUMP 6

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 10--300 HWP 5

M0090 HOT WATER PUMP 5

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 11--300 CSP 1

M0022 CHILLED SUPPLY PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 12--300 CSP 2

M0020 CHILLED SUPPLY PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 13--300 CSP 3

M0019 CHILLED SUPPLY PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 14--300 CRP 1

M0036 CHILLED RETURN PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PI*-S=St;W=St 7. PIH-S=St;W=St 8. PIV-S=St;W=St
9. PO*-S=St;W=St 10. POH-S=St;W=St 11. POV-S=St;W=St 12. POA-S=St;W=St

Machine 15--300 CRP 2

M0037 CHILLED RETURN PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PI*-S=St;W=St 7. PIH-S=St;W=St 8. PIV-S=St;W=St
9. PO*-S=St;W=St 10. POH-S=St;W=St 11. POV-S=St;W=St 12. POA-S=St;W=St

Machine 16--300 CRP 3

M0046 CHILLED RETURN PUMP 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PI*-S=St;W=St 7. PIH-S=St;W=St 8. PIV-S=St;W=St
9. PO*-S=St;W=St 10. POH-S=St;W=St 11. POV-S=St;W=St 12. POA-S=St;W=St

Route No. 7: 300 AHU-EAST

Machine Count: 11

No. of Points: 75

Machine 1--300 AHU 2
M1050 AIR HANDLER UNIT 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOR-S=St;W=St

Machine 2--300 RF 2
M1056 AXIAL RETURN FAN 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FOR-S=St;W=St

Machine 3--300 AHU 4
M1078 AIR HANDLER UNIT 4

- 1. FOR-S=St;W=St 2. MOH-S=St;W=St 3. MOV-S=St;W=St 4. MOA-S=St;W=St
5. MIH-S=St;W=St 6. MIV-S=St;W=St 7. FIH-S=St;W=St

Machine 6--300 RF 4
M1234 AXIAL RETURN FAN 4

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FOR-S=St;W=St

Machine 7--300 AHU 6
M1119 AIR HANDLER UNIT 6

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MOA-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOR-S=St;W=St

Machine 8--300 RF 6
M1208 AXIAL RETURN FAN 6

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FOR-S=St;W=St

Route No. 6: 300 AHU-WEST

Machine Count: 9

No. of Points: 66

Machine 3--300 AHU 1
M1046 AIR HANDLER UNIT 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MOA-S=St;W=St 6. FOR-S=St;W=St 7. FIH-S=St;W=St

Machine 4--300 RF 5
M0683 AXIAL RETURN FAN 5

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FOR-S=St;W=St

Machine 5--300 RF 1

M0643 AXIAL RETURN FAN 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FOR-S=St;W=St

Machine 6--300 AHU 5

M0651 AIR HANDLER UNIT 5

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MOA-S=St;W=St 6. FIH-S=St;W=St 7. FOR-S=St;W=St

Machine 7--300 HAF 5

M0816 HEATING AIR FAN 5

1. FOH-S=St;W=St 2. FOV-S=St;W=St 3. FOA-S=St;W=St 4. MOH-S=St;W=St
5. MOV-S=St;W=St 6. MIH-S=St;W=St 7. MIV-S=St;W=St 8. MIA-S=St;W=St
9. FIV-S=St;W=St

Machine 8--300 HAF 1

M0822 HEATING AIR FAN 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FOR-S=St;W=St

Machine 9--300 HAF 3

M0940 HEATING AIR FAN 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FOR-S=St;W=St 7. FIH-S=St;W=St 8. FIV-S=St;W=St

Route No. 5: BLDG. 301

Machine Count: 10

No. of Points: 90

Machine 1--301 CHP 1

M5069 CHILLED WATER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 2--301 CHP 2

M0374 CHILLED WATER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 3--301 CWP 1

M7155 CONDENSER PUMP 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 4--301 CWP 2

M1982 CONDENSER PUMP 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 7--301 RAF 1E
M3740 RETURN AIR FAN 1E

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FOH-S=St;W=St 8. FOV-S=St;W=St
9. FOA-S=St;W=St

Machine 8--301 SAF 1E
M3998 SUPPLY AIR FAN 1E

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FOH-S=St;W=St 8. FOV-S=St;W=St
9. FOA-S=St;W=St

Machine 9--301 RAF 2W
M1442 RETURN AIR FAN 2W

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FOH-S=St;W=St 8. FOV-S=St;W=St
9. FOA-S=St;W=St

Machine 10--301 SAF 2W
M1598 SUPPLY AIR FAN 2W

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FOH-S=St;W=St 8. FOV-S=St;W=St
9. FOA-S=St;W=St

Route No. 1: BLDG. 302

Machine Count: 17

No. of Points: 107

Machine 1--302 CHP 1
M2574 CHILLED WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 2--302 CHP 2
M2575 CHILLED WATER PUMP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 3--302 HWP 1
M2576 HOT WATER PUMP 1

- 1. ILT-S=St;W=St 2. CLT-S=St;W=St 3. MOA-S=St;W=St 4. ILB-S=St;W=St
5. CLB-S=St;W=St

Machine 4--302 HWP 2
M2577 HOT WATER PUMP 2

- 1. ILT-S=St;W=St 2. CLT-S=St;W=St 3. MOA-S=St;W=St 4. ILB-S=St;W=St
5. CLB-S=St;W=St

Machine 5--302 AHU 2

M0364 AIR HANDLER UNIT 2

1. FBH-S=St;W=St 2. FBV-S=St;W=St 3. MIR-S=St;W=St 4. MOR-S=St;W=St
5. MOA-S=St;W=St

Machine 6--302 EXF 1A

M0358 INORGANIC EXH FAN 1A

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 7--302 EXF 1B

M0357 INORGANIC EXH FAN 1B

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 8--302 AHU 3

M0366 AIR HANDLER UNIT 3

1. FBH-S=St;W=St 2. FBV-S=St;W=St

Machine 9--302 AHU 4

M0360 AIR HANDLER UNIT 4

1. FBH-S=St;W=St 2. FBV-S=St;W=St

Machine 10--302 AHU 1

M0361 AIR HANDLER UNIT 1

1. MOA-S=St;W=St 2. MOR-S=St;W=St 3. MIR-S=St;W=St 4. LBB-S=St;W=St

Machine 11--302 EXF 3

M0246 EXHAUST FAN 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St

5. MIA-S=St;W=St 6. FOH-S=St;W=St 7. FOV-S=St;W=St 8. FOA-S=St;W=St

9. FIH-S=St;W=St 10. FIV-S=St;W=St

Machine 12--302 EXF 2A

M0245 EXHAUST FAN 2A

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St

5. MIA-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOH-S=St;W=St

9. FOV-S=St;W=St 10. FOA-S=St;W=St

Machine 13--302 EXF 2B

M0244 EXHAUST FAN 2B

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St

5. MIA-S=St;W=St 6. FOH-S=St;W=St 7. FOV-S=St;W=St 8. FOA-S=St;W=St

9. FIH-S=St;W=St 10. FIV-S=St;W=St

Machine 14--302 ISP 1

M0243 INORGANIC SCRUB PUMP 1

1. ILT-S=St;W=St 2. CLT-S=St;W=St 3. ILB-S=St;W=St 4. CLB-S=St;W=St

5. MOA-S=St;W=St

Machine 15--302 ISP 2

M2322 INORGANIC SCRUB PUMP 2

1. ILT-S=St;W=St 2. CLT-S=St;W=St 3. ILB-S=St;W=St 4. CLB-S=St;W=St

5. MOA-S=St;W=St

Machine 16--302 CHP 16
M2205 CHILLED WATER PUMP 16

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 17--302 CHP 12
M2204 CHILLED WATER PUMP 12

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Route No. 2: BLDG. 303

Machine Count: 17

No. of Points: 129

Machine 1--303 HWP 1
M7647 HOT WATER PUMP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 2--303 HWP 8
M0492 HOT WATER PUMP 8

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 3--303 HWP 7
M0494 HOT WATER PUMP 7

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--303 CTF 1
M3390 COOLING TOWER FAN 1

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. GI1-S=St;W=St 4. GI2-S=St;W=St
5. GO1-S=St;W=St 6. GO2-S=St;W=St

Machine 6--303 CTF 2
M3391 COOLING TOWER FAN 2

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. GI1-S=St;W=St 4. GI2-S=St;W=St
5. GO1-S=St;W=St 6. GO2-S=St;W=St

Machine 7--303 CSP 3
M0023 CHILLED SUPPLY PUMP 3

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 8--303 CSP 4
M0024 CHILLED SUPPLY PUMP 4

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 9--303 CSP 3A
M100178 CHILLED SUPPLY 3A

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 10--303 CWP 5
M0028 CONDENSER WATER PMP 5

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 11--303 CWP 6
M0029 CONDENSER WATER PMP 6

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 12--303 EXF 7
M0041 EXHAUST FAN 7

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOH-S=St;W=St
9. FOV-S=St;W=St 10. FOA-S=St;W=St

Machine 13--303 SAF 3
M0439 SUPPLY AIR FAN 3

- 1. FBH-S=St;W=St 2. FBV-S=St;W=St 3. MOV-S=St;W=St 4. MOA-S=St;W=St

Machine 14--303 SAF 2
M0421 SUPPLY AIR FAN 2

- 1. FBH-S=St;W=St 2. FBV-S=St;W=St 3. MOV-S=St;W=St 4. MOA-S=St;W=St

Machine 15--303 SAF 1
M0422 SUPPLY AIR FAN 1

- 1. FBH-S=St;W=St 2. FBV-S=St;W=St 3. MOH-S=St;W=St 4. MOA-S=St;W=St

Machine 16--303 EXF 1
M0626 AXIAL EXHAUST FAN 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FOH-S=St;W=St 8. FOA-S=St;W=St

Machine 17--303 EXF 2
M0627 AXIAL EXHAUST FAN 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. FIR-S=St;W=St 7. FOH-S=St;W=St 8. FOA-S=St;W=St

Route No. 3: BLDG. 306

Machine Count: 24

No. of Points: 188

Machine 1--306 CHP 14
M2558 CHILLED WATER PUMP 14

-
1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 2--306 CHP 13
M7086 CHILLED WATER PUMP 13

-
1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 3--306 CHP 3
M1003 CHILLED WATER PUMP 3

-
1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 4--306 CHP 2
M1769 CHILLED WATER PUMP 2

-
1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 5--306 CHP 1
M1430 CHILLED WATER PUMP 1

-
1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 6--306 CHP 11
M1432 CHILLED WATER PUMP 11

-
1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 7--306 CHP 12
M1433 CHILLED WATER PUMP 12

-
1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
9. POV-S=St;W=St

Machine 8--306 CHP 16
M1033 CHILLED WATER PUMP 16

-
1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 9--306 CHP 15

M0995 CHILLED WATER PUMP 15

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 10--306 CWP 21

M1434 CONDENSER PUMP 21

1. ILT-S=St;W=St 2. CLT-S=St;W=St 3. MOA-S=St;W=St 4. ILB-S=St;W=St

5. CLB-S=St;W=St 6. PBT-S=St;W=St 7. PT*-S=St;W=St 8. PBB-S=St;W=St

9. PB*-S=St;W=St

Machine 11--306 CWP 22

M1770 CONDENSER PUMP 22

1. ILT-S=St;W=St 2. CLT-S=St;W=St 3. MOA-S=St;W=St 4. ILB-S=St;W=St

5. CLB-S=St;W=St 6. PBT-S=St;W=St 7. PT*-S=St;W=St 8. PBB-S=St;W=St

9. PB*-S=St;W=St

Machine 12--306 CWP 23

M0977 CONDENSER PUMP 23

1. ILT-S=St;W=St 2. CLT-S=St;W=St 3. MOA-S=St;W=St 4. ILB-S=St;W=St

5. CLB-S=St;W=St

Machine 13--306 HWP 34

M2242 HOT WATER PUMP 34

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 14--306 HWP 33

M7076 HOT WATER PUMP 33

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St

5. MIA-S=St;W=No 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 15--306 HWP 32

M1772 HOT WATER PUMP 32

1. MOH-S=St;W=No 2. MOV-S=St;W=No 3. MOA-S=St;W=No 4. MIH-S=St;W=No

5. MIV-S=St;W=No 6. PIH-S=St;W=No 7. PIV-S=St;W=No 8. POH-S=St;W=No

9. POV-S=St;W=No

Machine 16--306 HWP 31

M1439 HOT WATER PUMP 31

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St

5. MIV-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 20--306 SAF 3

M1440 SUPPLY AIR FAN 3

 1. FBH-S=St;W=St 2. FBV-S=St;W=St 3. MOH-S=St;W=St 4. MOA-S=St;W=St
 Machine 21--306 SAF 2
 M1441 SUPPLY AIR FAN 2

 1. FBH-S=St;W=St 2. FBV-S=St;W=St 3. MOH-S=St;W=St 4. MOA-S=St;W=St
 Machine 22--306 SAF 4
 M1445 SUPPLY AIR FAN 4

 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. FIH-S=St;W=St 7. FIV-S=St;W=St 8. FOH-S=St;W=St
 Machine 23--306 SAF 1
 M1443 SUPPLY AIR FAN 1

 1. FBH-S=St;W=St 2. FBV-S=St;W=St 3. MOH-S=St;W=St 4. MOA-S=St;W=St
 Machine 24--306 EXF 1
 M1444 EXHAUST FAN 1

 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MOA-S=St;W=St 4. MIH-S=St;W=St
 5. MIV-S=St;W=St 6. FIR-S=St;W=St

Route No. 4: BLDG. 308

Machine Count: 2

No. of Points: 22

Machine 1--308 SLP P1
 M1411 SEWAGE LIFT PUMP P1

 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
 5. MIA-S=St;W=St 6. PTI-S=St;W=St 7. PBI-S=St;W=St 8. PTC-S=St;W=St
 9. PT*-S=St;W=St 10. PBC-S=St;W=St 11. PB*-S=St;W=St

Machine 2--308 SLP P2
 M1412 SEWAGE LIFT PUMP P2

 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
 5. MIA-S=St;W=St 6. PTI-S=St;W=St 7. PBI-S=St;W=St 8. PTC-S=St;W=St
 9. PT*-S=St;W=St 10. PBC-S=St;W=St 11. PB*-S=St;W=St

Route No. 7: BLDG. 310

Machine Count: 6

No. of Points: 44

Machine 1--310 CWP P4
 M7527 CONDENSER PUMP P4

 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
 5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St

Machine 2--310 CHP P1
 M7525 CHILLED PUMP P1

 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
 5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 3--310 CHP P2
M7526 CHILLED PUMP P2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Machine 4--310 SAF 1
M7500 SUPPLY AIR FAN 1

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 5--310 RAF 1
M5085 RETURN AIR FAN 1

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 6--310 HWP P3
M7528 HOT WATER PUMP P3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St

9. POV-S=St;W=St

Route No. 5: BLDG. 315

Machine Count: 16

No. of Points: 116

Machine 1--315 CTF 1
M3415 COOLING TOWER FAN 1

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. GI1-S=St;W=St 7. GI2-S=St;W=St 8. GO1-S=St;W=St

9. GO2-S=St;W=St

Machine 2--315 CTF 2
M3416 COOLING TOWER FAN 2

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. GI1-S=St;W=St 7. GI2-S=St;W=St 8. GO1-S=St;W=St

9. GO2-S=St;W=St

Machine 3--315 CTF 3
M3417 COOLING TOWER FAN 3

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. GI1-S=St;W=St 7. GI2-S=St;W=St 8. GO1-S=St;W=St

9. GO2-S=St;W=St

Machine 4--315 CTF 4
M3418 COOLING TOWER FAN 4

1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
5. MIA-S=St;W=St 6. GI1-S=St;W=St 7. GI2-S=St;W=St 8. GO1-S=St;W=St

9. GO2-S=St;W=St

Machine 5--315 CLP 1
M3419 CLOSED LOOP CWP 1

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
 5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 6--315 CLP 2
 M3420 CLOSED LOOP CWP 2

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
 5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 7--315 CLP 3
 M3421 CLOSED LOOP CWP 3

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
 5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 8--315 CLP 4
 M3422 CLOSED LOOP CWP 4

- 1. MOH-S=St;W=St 2. MOV-S=St;W=St 3. MIH-S=St;W=St 4. MIV-S=St;W=St
 5. MIA-S=St;W=St 6. PIH-S=St;W=St 7. PIV-S=St;W=St 8. POH-S=St;W=St
 9. POV-S=St;W=St 10. POA-S=St;W=St

Machine 9--315 CTP 8
 M2306 COOLING TOWER PUMP 8

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
 5. MIA-S=St;W=St

Machine 11--315 CTP 7
 M2303 COOLING TOWER PUMP 7

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
 5. MIA-S=St;W=St

Machine 13--315 CTP 6
 M2301 COOLING TOWER PUMP 6

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
 5. MIA-S=St;W=St

Machine 15--315 CTP 5
 M2297 COOLING TOWER PUMP 5

- 1. ILT-S=St;W=St 2. ILB-S=St;W=St 3. CLT-S=St;W=St 4. CLB-S=St;W=St
 5. MIA-S=St;W=St

Route No. 8: BLDG. 317

Machine Count: 6

No. of Points: 24

Machine 1--317 SAF 1
 M100183-S SUPPLY AIR FAN 1

- 1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 2--317 RAF 1
M100183-R RETURN AIR FAN 1

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 3--317 SAF 2
M100184-S SUPPLY AIR FAN 2

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 4--317 RAF 2
M100184-R RETURN AIR FAN 2

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 5--317 SAF 3
M100185-S SUPPLY AIR FAN 3

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 6--317 RAF 3
M100185-R RETURN AIR FAN 3

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Route No. 6: BLDG. 318

Machine Count: 3

No. of Points: 12

M7068 AIR HANDLER UNIT 2

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Machine 3--318 AHU 3
M7062 AIR HANDLER UNIT 3

1. MOR-S=St;W=St 2. MIR-S=St;W=St 3. FIR-S=St;W=St 4. FOR-S=St;W=St

Appendix A.1.11.12 Vibration Analysis & Reporting Routes

Vibration Route Machine Count and Points by Building Summary –
(sample only)

BUILDING	MACHINE COUNT	POINT COUNT
18	7	44
79	1	9
103	6	50
125	12	87
126	7	44
138	5	37
144	7	46
150	15	117
156	2	20
157	7	43

158	11	59
159	3	30
161	14	73
166	8	69
167	2	13
168	12	86
169	4	32
170	9	65
171	11	61
179	34	199
180	20	170
183	16	185
198	3	28
200	2	10
228	4	21
230	30	187
233	17	144
238	17	150
241	4	22
248	5	36
251	1	10
264	24	118
268	3	26
277	13	101
296	9	53
298	2	8
301	10	90
302	17	107
303	17	129
306	24	188
308	2	22
310	6	44
315	16	116
317	6	24
318	3	12
300CP	16	150
300E	11	75
300W	9	66
TOTALS	484	2078
	48	

Appendix A.1.11.2 Infrared Testing and Analysis (WIP to be validated)

BUILDING	LOCATION	EQUIPMENT
18	Outside West	1 A/C unit
18	2nd Floor - Room 206C	1 Circuit breaker
18	2nd Floor - North	3 Circuit breaker boxes
18	2nd Floor - North	1 Circuit breaker panel
18	Basement - Boiler Room	1 Circuit breaker panel
18	Top of West Stairway	1 Circuit breaker panel
18	1st Floor	5 Circuit breaker panels
18	1st Floor	2 Circuit breaker panels
18	2nd Floor	2 Circuit breaker panels
18	Basement - Hallway	2 Circuit breaker panels
18	Basement - Hallway Cabinets	5 Circuit breaker panels
18	Basement - Hallway Cabinets	1 Contactor
18	Top of West Stairway	1 Contactor
18	2nd Floor - North	1 Control transformer
18	Basement - Boiler Room	1 Controller
18	Basement - Hallway	1 Controller
18	2nd Floor	1 Controller
18	1st Floor	3 Controllers
18	2nd Floor - North	3 Controllers
18	Outside West	3 Controllers
18	2nd Floor - North	1 Disconnect
18	Basement - Boiler Room	1 Disconnect
18	Basement - Hallway Cabinets	1 Disconnect
18	Outside East	1 Disconnect
18	Outside West	1 Disconnect
18	Outside West	2 Disconnects
18	Roof	3 Disconnects
18	Top of West Stairway	1 Distribution panel
18	Outside West	2 Distribution panels
18	Basement - Boiler Room	1 Motor
18	Outside West	1 Motor
18	1st Floor	1 Transformer
18	Outside West	1 Water heater
18	Basement - Boiler Room	2 Water heaters
67	Outside - North (Room 127)	1 Boiler
67	1st Floor - Room 107	1 Circuit breaker panel
67	Basement	1 Circuit breaker panel
67	Outside - North (Room 128)	1 Circuit breaker panel
67	1st Floor - Hallway	4 Circuit breaker panels
67	2nd Floor - Hallway	6 Circuit breaker panels

BUILDING	LOCATION	EQUIPMENT
67	Outside - North	3 Circuit breaker panels
67	East Roof	1 Disconnect
67	Outside - East End	1 Disconnect
67	Outside - North	1 Disconnect
67	Outside - South	1 Disconnect
67	West Roof	1 Disconnect
67	1st Floor - Hallway	5 Disconnects
67	Outside - North (Boiler Room 127)	1 Motor
67	Outside - North (Room 128)	1 Relay box
67	Basement	2 Water heaters
79	2nd Floor - South End Hallway Closet	1 Circuit breaker panel
79	1st Floor	3 Circuit breaker panels
79	2nd Floor - Electrical Room	2 Circuit breaker panels
79	2nd Floor - Electrical Room	3 Control transformers
79	2nd Floor - Electrical Room	4 Controllers
79	1st Floor	1 Disconnect
79	2nd Floor - Electrical Room	3 Disconnects
79	Basement	2 Disconnects
79	1st Floor	1 Distribution
82	1st Floor Machine Room	1 A/C unit
82	1st Floor Room 110	2 Circuit breakers
82	1st Floor Machine Room	3 Disconnect
82	Outside	3 Disconnects
82	1st Floor Machine Room	1 Distribution panel
82	1st Floor Room 110	1 Transformer
83	Machine Room	1 Boiler
83	Machine Room	1 Circuit breaker panel
83	1st Floor Hallways	7 Circuit breaker panels
83	2nd Floor Hallways	2 Circuit breaker panels
83	Machine Room	2 Controllers
83	Machine Room	7 Disconnects
83	Outside (backside)	2 Disconnects
83	Machine Room	1 Transformer
122	Basement Machine Room	1 Boiler
122	1st Floor Hallway	2 Circuit breaker panel
122	Basement Machine Room	2 Circuit breaker panel
122	Basement Machine Room	2 Compressors
122	Basement Machine Room	11 Controllers
122	Basement Machine Room	12 Disconnects
122	Basement Machine Room	2 Distribution panel

BUILDING	LOCATION	EQUIPMENT
	122 Basement Machine Room	3 Transformers
	122 Basement Machine Room	1 Water heater
	125 Sub-basement Machine Room	1 Air compressor
	125 Sub-basement Machine Room	2 Boilers
	125 Electrical Room (below Bank 65)	1 Buss bar
	125 Sub-basement Machine Room	1 Chiller starter
	125 Sub-basement Machine Room	2 Chillers
	125 Sub-basement Machine Room	1 Circuit breaker box
	125 2nd Floor Air Handler Room Southeast	1 Circuit breaker panel
	125 Electrical Room (below Bank 65)	1 Circuit breaker panel
	125 1st Floor Hallway	12 Circuit breaker panels
	125 2nd Floor Hallway	5 Circuit breaker panels
	125 2nd Floor Room 232	6 Circuit breaker panels
	125 Basement Hallway	3 Circuit breaker panels
	125 2nd Floor Room 232	1 Controller
	125 Basement Room B-33	2 Controllers
	125 Sub-basement Machine Room	5 Controllers
	125 2nd Floor Room 232	4 Disconnects
	125 Basement Room B-33	5 Disconnects
	125 Outside	8 Disconnects
	125 Roof	7 Disconnects
	125 Sub-basement Machine Room	7 Disconnects
	125 Basement Room B-33	2 Distribution panels
	125 Electrical Room (below Bank 65)	2 Distribution panels
	125 Sub-basement Machine Room	1 MCC
	125 Roof	1 Motor
	125 Sub-basement Machine Room	5 Motors
	125 2nd Floor Air Handler Room Southeast	1 Transformer
	125 Basement Room B-33	1 Transformer
	125 Electrical Room (below Bank 65)	1 Transformer
	125 Outside	1 Transformer
	125 Sub-basement Machine Room	1 Transformer
	125 Sub-basement Machine Room	1 VSD
	125 Sub-basement Machine Room	1 Water heater
	138 1st Floor Machine Room	1 A/C unit
	138 Outside, East	1 A/C unit
	138 1st Floor Electrical Room	1 Boiler

BUILDING	LOCATION	EQUIPMENT
138	1st Floor Hallway	7 Circuit breaker panels
138	2nd Floor Hallway	3 Circuit breaker panels
138	3rd Floor Hallway	2 Circuit breaker panels
138	1st Floor Electrical Room	1 Controller
138	1st Floor Machine Room	1 Controller
138	Outside, East	1 Controller
138	1st Floor Machine Room	3 Disconnects
138	Outside, East	5 Disconnects
138	Outside, West	2 Disconnects
138	1st Floor Electrical Room	1 MCC panel
138	Outside, East	1 Motor
138	1st Floor Electrical Room	2 Motors
138	1st Floor Machine Room	3 Motors
138	1st Floor Machine Room	1 Transformer
138	Outside, West	1 Transformer
138	1st Floor Electrical Room	6 Transformers
138	1st Floor Electrical Room	1 Water heater
140	140 - Outside	2 Circuit breaker panels
141	141 - Outside	2 Circuit breaker panels
144	Outside, North	1 Air handler unit
144	Outside, North	1 Boiler
144	Chiller Room	1 Chiller
144	Chiller Room	1 Chiller starter disconnect
144	Chiller Room	2 Circuit breaker box
144	1st Floor	10 Circuit breaker panel
144	2nd Floor - Room 212	1 Circuit breaker panel
144	2nd Floor Hallways	3 Circuit breaker panel
144	2nd Floor, Bank 37	1 Circuit breaker panel
144	Chiller Room	1 Circuit breaker panel
144	Air Handler Room	2 Controller
144	Chiller Room	12 Controller
144	Air Handler Room	2 Disconnect
144	Chiller Room	1 Disconnect
144	Outside, North	3 Disconnect
144	Outside, West	2 Disconnect
144	1st Floor	38 Disconnect/controllers
144	2nd Floor, Bank 37	1 Distribution panel
144	Air Handler Room	1 MCC panel
144	Air Handler Room	2 Motor
144	Chiller Room	3 Motor
144	Outside, North	1 Motor

BUILDING	LOCATION	EQUIPMENT
144	2nd Floor, Bank 37	2 Transformer
144	Air Handler Room	1 Water heater
144	Outside, North	1 Water heater
148	1st Floor	4 Circuit breaker panels
148	1st Floor	2 Circuit breaker panels
148	2nd Floor	2 Circuit breaker panels
148	1st Floor	2 Controllers
148	1st Floor	1 Disconnect
148	Outside East	3 Disconnects
148	Outside West	2 Disconnects
148	Outside East	1 Main disconnect
148	Outside West	2 Motors
148	Outside East	1 Transformer
150	2nd Floor - Air Handler Room	3 Motor
150	Basement	4 Disconnect
150	Roof	1 Boiler
150	Outside Chiller Plant	1 Chiller
150	3rd Floor, South	1 Circuit breaker
150	1st Floor Room 103	5 Circuit breaker box
150	1st Floor	9 Circuit breaker panel
150	1st Floor Room 103	6 Circuit breaker panel
150	1st Floor	2 Controller
150	1st Floor Room 103	2 Controller
150	Outside Chiller Plant	3 Controller
150	Roof	1 Controller
150	1st Floor	5 Disconnect
150	Outside Chiller Plant	6 Disconnect
150	Roof	8 Disconnect
150	1st Floor	2 MCC
150	Outside Chiller Plant	6 Motor
150	Roof	4 Motor
150	1st Floor	5 Transformer
150	1st Floor Room 103	1 Transformer
156	1st Floor - Room 140	1 Circuit breaker panel
156	Basement	1 Circuit breaker panel
156	1st Floor	3 Circuit breaker panels
156	2nd Floor	6 Circuit breaker panels
156	Outside, S.W.	1 Disconnect
156	Basement	2 Distribution panel
156	Basement	2 Motors
156	Basement	1 Transformer

BUILDING	LOCATION	EQUIPMENT
156	Basement	2 VSD
157	Roof - Boiler Room	1 Boiler
157	Roof - Chiller Room	1 Chiller
157	Roof - Chiller Room	1 Chiller starter
157	1st Floor Electrical Room	6 Circuit breaker panel
157	Roof - Boiler Room	1 Circuit breaker panel
157	Roof - Chiller Room	3 Disconnect
157	Roof - Outside	1 Disconnect
157	1st Floor Air Handler Room	1 Distribution panel
157	1st Floor Air Handler Room	1 MCC panel
157	1st Floor Electrical Room	1 MCC panel
157	Roof - Chiller Room	1 MCC panel
157	1st Floor Air Handler Room	1 Motor
157	Roof - Boiler Room	2 Motor
157	Roof - Chiller Room	6 Motors
157	1st Floor Electrical Room	1 Transformer
157	Roof - Boiler Room	2 Water heater
159	MAIN ROOM	1 Circuit breaker panel
159	MAIN ROOM	3 Disconnects
159	MAIN ROOM	1 MCC
159	MAIN ROOM	3 Motors
166	166	1 Control cabinet
166	166	1 Controller
166	166	4 Disconnects
166	166	6 Electrical cabinet doors
166	166	7 Motors
167	1st Floor East (boiler room)	1 Boiler
167	1st Floor, West (boiler room)	1 Boiler
167	1st Floor Café Area	8 Circuit breaker panels
167	2nd Floor Machine Room	2 Circuit breaker panels
167	1st Floor, West (boiler room)	1 Controller
167	2nd Floor Machine Room	4 Controllers
167	2nd Floor - Air Handler Room	1 Disconnect
167	1st Floor East (boiler room)	2 Disconnects
167	2nd Floor Machine Room	3 Disconnects
167	2nd Floor Machine Room	1 MCC panel
167	1st Floor, West (boiler room)	1 Motor
167	2nd Floor - Air Handler Room	1 Motor
167	2nd Floor Machine Room	2 Motors
167	2nd Floor Machine Room	1 Transformer
167	2nd Floor Machine Room	1 Water heater

BUILDING	LOCATION	EQUIPMENT
168	2nd Floor - Electrical Rooms	1 Buss feed switch
168	3rd Floor - Electrical Room 309	1 Buss feed switch
168	4th Floor - Electrical Room	2 Buss feed switch
168	5th Floor - Electrical Room 509	1 Buss feed switch
168	1st Floor - Machine Room	2 Chillers
168	2nd Floor - Electrical Rooms	3 Circuit breaker boxes
168	3rd Floor - Electrical Room 309	4 Circuit breaker boxes
168	5th Floor - Electrical Room 509	3 Circuit breaker boxes
168	1st Floor - Machine Room	1 Circuit breaker panels
168	2nd Floor - Electrical Rooms	2 Circuit breaker panels
168	3rd Floor - Electrical Room 309	2 Circuit breaker panels
168	4th Floor - Electrical Room	2 Circuit breaker panels
168	5th Floor - Electrical Room 509	2 Circuit breaker panels
168	4th Floor - Electrical Room	3 Circuit breaker boxes
168	2nd Floor - Electrical Rooms	1 Disconnect
168	1st Floor - Machine Room	9 Disconnects
168	3rd Floor - Electrical Room 309	1 Disconnects
168	Roof	5 Disconnects
168	1st Floor - Machine Room	2 Distribution panels
168	1st Floor	5 Hallway circuit panels
168	2nd Floor	5 Hallway circuit panels
168	3rd Floor	4 Hallway circuit panels
168	4th Floor	3 Hallway circuit panels
168	5th Floor - Electrical Room 509	4 Hallway circuit panels
168	1st Floor - Machine Room	2 MCC panel
168	1st Floor - Machine Room	1 Transformer
168	2nd Floor - Electrical Rooms	1 Transformer
168	3rd Floor - Electrical Room 309	1 Transformer
168	4th Floor - Electrical Room	2 Transformer
168	5th Floor - Electrical Room 509	1 Transformer
168	1st Floor - Machine Room	4 VSD
169	2nd Floor - Electrical Room 209	2 Buss feeder switches

BUILDING	LOCATION	EQUIPMENT
169	3rd Floor - Electrical Room 309	2 Buss feeder switches
169	4th Floor - Electrical Room 409	2 Buss feeder switches
169	5th Floor - Electrical Room	2 Buss feeder switches
169	1st Floor - Machine Room	2 Chillers
169	2nd Floor - Electrical Room 209	1 Circuit breaker box
169	3rd Floor - Electrical Room 309	1 Circuit breaker box
169	4th Floor - Electrical Room 409	1 Circuit breaker box
169	5th Floor - Electrical Room	1 Circuit breaker box
169	1st Floor - Machine Room	1 Circuit breaker panels
169	2nd Floor	9 Circuit breaker panels
169	2nd Floor - Electrical Room 209	2 Circuit breaker panels
169	3rd Floor - Electrical Room 309	2 Circuit breaker panels
169	5th Floor - Electrical Room	2 Circuit breaker panels
169	4th Floor - Electrical Room 409	2 Circuit panels
169	1st Floor - Machine Room	2 Control boxes
169	1st Floor - Machine Room	7 Disconnects
169	Roof	6 Disconnects
169	1st Floor - Machine Room	1 Distribution panels
169	Roof	5 Ex. Switches
169	3rd Floor	8 Hallway breaker panels
169	4th Floor	10 Hallway breaker panels
169	5th Floor	12 Hallway breaker panels
169	1st Floor - Machine Room	2 MCC panels
169	1st Floor - Machine Room	2 Transformer
169	2nd Floor - Electrical Room 209	1 Transformer
169	3rd Floor - Electrical Room 309	1 Transformer
169	4th Floor - Electrical Room 409	1 Transformer
169	5th Floor - Electrical Room	1 Transformer
169	1st Floor - Machine Room	2 VSD
169	1st Floor - Machine Room	2 Water heaters
170	Sheet Metal Stores	1 A/C unit disconnect
170	Sheet Metal Stores	1 A/C unit, outside
170	Boiler Room	1 Boiler

BUILDING	LOCATION	EQUIPMENT
170	Chiller Room	1 Chiller
170	Electrical Room	1 Chiller starter breaker
170	Machine Room	4 Circuit breaker panels
170	Room 131-B	1 Circuit breaker panels
170	Sheet Metal Shop - Bottom	3 Circuit breaker panels
170	Weld Shop - Bottom	2 Circuit breaker panels
170	Electrical Room	2 Circuit breakers
170	Electrical Room	1 Controller
170	Boiler Room	1 Disconnect
170	Electrical Room	1 Disconnect
170	Room 131-A	2 Disconnect
170	Room 131-B	2 Disconnect
170	Sheet Metal Shop - Bottom	2 Disconnect
170	Weld Shop - Bottom	2 Disconnect
170	Weld Shop - Top	3 Disconnect
170	Machine Room	3 Distribution panels
170	Electrical Room	1 Distribution panel
170	Room 131-B	1 Distribution panel
170	Sheet Metal Shop - Bottom	1 Distribution panel
170	Weld Shop - Bottom	1 Distribution panel
170	Electrical Room	1 MCC panel
170	Sheet Metal Shop - Top	1 MCC panel
170	Boiler Room	1 Motor
170	Sheet Metal Shop - Top	1 Motor
170	Sheet Metal Stores	1 Motor
170	Sheet Metal Stores	1 Motor disconnect
170	Chiller Room	6 Motors
170	Electrical Room	1 Transformer
170	Machine Room	1 Transformer
170	Boiler Room	1 Water Heater
170	Sheet Metal Shop - Top	1 Water Heater
171	2nd Floor Boiler Room Outside, East	2 Boilers
171	3rd Floor Machine Room	2 Bypass switches
171	Chiller Room	2 Chillers
171	2nd Floor Electrical Room Outside, East	1 Circuit breaker panel
171	2nd Floor Hallway	4 Circuit breaker panel
171	3rd Floor Hallway	3 Circuit breaker panel
171	3rd Floor Machine Room	1 Circuit breaker panel
171	Basement	7 Circuit breaker panel

BUILDING	LOCATION	EQUIPMENT
171	2nd Floor Boiler Room Outside, East	1 Controller
171	3rd Floor Machine Room	6 Controller
171	Chiller Room	4 Controller
171	2nd Floor Boiler Room Outside, East	2 Disconnect
171	2nd Floor Electrical Room Outside, East	1 Disconnect
171	Basement	1 Disconnect
171	Chiller Room	7 Disconnect
171	2nd Floor Electrical Room Outside, East	2 Distribution panel
171	3rd Floor Hallway	1 Distribution panel
171	3rd Floor Machine Room	1 Distribution panel
171	Basement	1 Distribution panel
171	Chiller Room	1 Distribution panel
171	2nd Floor Electrical Room Outside, East	1 Main breaker
171	2nd Floor Electrical Room Outside, East	1 MCC panel
171	2nd Floor Hallway	1 MCC panel
171	Chiller Room	1 MCC panel
171	2nd Floor Boiler Room Outside, East	2 Motor
171	2nd Floor Electrical Room Outside, East	1 Motor
171	3rd Floor Machine Room	2 Motor
171	3rd Floor Machine Room	1 Rotary switch
171	2nd Floor Electrical Room Outside, East	1 Transformer
171	3rd Floor Machine Room	1 Transformer
171	Basement	3 Transformer
171	3rd Floor Machine Room	2 VSD
171	2nd Floor Boiler Room Outside, East	1 Water Heater
179	1st Floor - Machine Room 101	2 Chiller (control breaker panels)
179	1st Floor - Machine Room South	2 Chillers
179	Roof	2 Circuit breaker boxes
179	1st Floor - Air Handler Room 111, North	6 Circuit breaker panel
179	1st Floor - Electrical Room 103, North	1 Circuit breaker panel

BUILDING	LOCATION	EQUIPMENT
179	1st Floor - Machine Room South	5 Circuit breaker panel
179	2nd Floor	14 Circuit breaker panel
179	1st Floor - Machine Room 101	4 Disconnects
179	1st Floor - Machine Room South	2 Disconnects
179	Boiler Room	4 Disconnects
179	Roof	13 Disconnects
179	1st Floor - Electrical Room 103, North	1 Distribution panel
179	1st Floor - Machine Room South	3 Distribution panel
179	1st Floor - Air Handler Room 111, North	1 MCC panel
179	1st Floor - Machine Room 101	1 MCC panel
179	1st Floor - Machine Room South	2 MCC panels
179	1st Floor - Air Handler Room 111, North	1 Motors
179	1st Floor - Machine Room 101	4 Motors
179	1st Floor - Machine Room South	3 Motors
179	Outside - Condenser Water Pumps	4 Motors
179	Roof	1 Motors
179	1st Floor - Machine Room South	2 Steam generators
179	Roof	2 Steam generators
179	Roof	3 Trane units
179	1st Floor - Air Handler Room 111, North	2 Transformer
179	1st Floor - Electrical Room 103, North	2 Transformer
179	1st Floor - Machine Room 101	1 Transformer
179	1st Floor - Machine Room South	2 Transformer
179	1st Floor - Room 122, SW corner	
180	Basement, South	1 A/C stand-by unit
180	Boiler Room	2 Boiler
180	1st Floor Electrical Room	2 Buss switch
180	2nd Floor Electrical Room	1 Buss switch
180	3rd Floor Electrical Room	2 Buss switch
180	4th Floor Electrical Room	1 Buss switch

BUILDING	LOCATION	EQUIPMENT
180	5th Floor Electrical Room	2 Buss switch
180	6th Floor Electrical Room	1 Buss switch
180	7th Floor Electrical Room	1 Buss switch
180	8th Floor Electrical Room	2 Buss switch
180	9th Floor Electrical Room	1 Buss switch
180	Basement, South	2 Chiller
180	4th Floor Electrical Room	1 Circuit breaker box
180	9th Floor Electrical Room	1 Circuit breaker box
180	1st Floor Electrical Room	4 Circuit breaker panel
180	2nd Floor Electrical Room	3 Circuit breaker panel
180	3rd Floor Electrical Room	4 Circuit breaker panel
180	4th Floor Electrical Room	3 Circuit breaker panel
180	5th Floor Electrical Room	4 Circuit breaker panel
180	6th Floor Electrical Room	3 Circuit breaker panel
180	7th Floor Electrical Room	3 Circuit breaker panel
180	8th Floor Electrical Room	5 Circuit breaker panel
180	9th Floor Electrical Room	3 Circuit breaker panel
180	Basement, North	2 Circuit breaker panel
180	Basement, South	1 Circuit breaker panel
180	Electrical Room, East	1 Circuit breaker panel
180	Basement, North	7 Disconnect
180	Basement, South	11 Disconnect
180	Boiler Room	2 Disconnect
180	Electrical Room, East	2 Disconnect
180	Electrical Room, West	2 Disconnect
180	Roof - Cooling Tower	2 Disconnect
180	Roof - Perimeter	3 Disconnect
180	Basement, South	2 Distribution
180	2nd Floor Electrical Room	1 Lighting Contactor
180	3rd Floor Electrical Room	1 Lighting Contactor
180	4th Floor Electrical Room	1 Lighting Contactor
180	5th Floor Electrical Room	1 Lighting Contactor
180	6th Floor Electrical Room	1 Lighting Contactor
180	7th Floor Electrical Room	1 Lighting Contactor
180	8th Floor Electrical Room	1 Lighting Contactor
180	Basement, South	2 MCC
180	Electrical Room, East	1 MCC
180	Electrical Room, West	1 MCC
180	Air Handler Rooms, East	2 Motor
180	Air Handler Rooms, West	2 Motor
180	Basement, North	3 Motor

BUILDING	LOCATION	EQUIPMENT
180	Basement, South	8 Motor
180	Boiler Room	3 Motor
180	Electrical Room, East	1 Motor
180	Electrical Room, West	1 Motor
180	3rd Floor Electrical Room	1 Transformer
180	5th Floor Electrical Room	1 Transformer
180	5th Floor Electrical Room	1 Transformer
180	8th Floor Electrical Room	2 Transformer
180	Basement, North	1 Transformer
180	Basement, South	3 Transformer
180	Electrical Room, East	1 Transformer
180	Basement, South	2 VSD
180	Electrical Room, East	1 VSD
180	Electrical Room, West	1 VSD
183	7th Floor - Machine Room	3 Boilers
183	8th Floor - Machine Room	5 Buss breaker switches
183	9th Floor - Machine Room	4 Buss breakers
183	2nd Floor - Machine Room	2 Buss duct breaker feeder
183	3rd Floor - Machine Room	6 Buss duct breaker feeder
183	4th Floor - Machine Room	3 Buss duct breaker feeder
183	6th Floor - Machine Room	5 Buss duct breaker feeder
183	7th Floor - Machine Room	4 Buss duct riser breakers
183	9th Floor - Machine Room	2 Chillers (control, starter, and main)
183	3rd Floor - Machine Room	6 Circuit breaker feeders
183	2nd Floor - Machine Room	6 Circuit breaker panels
183	4th Floor - Machine Room	5 Circuit breaker panels
183	5th Floor - Machine Room	4 Circuit breaker panels
183	6th Floor - Machine Room	5 Circuit breaker panels
183	7th Floor - Machine Room	6 Circuit breaker panels
183	8th Floor - Machine Room	5 Circuit breaker panels
183	9th Floor - Machine Room	6 Circuit breaker panels
183	9th Floor - Machine Room	12 Control starters
183	3rd Floor - Machine Room	1 Controller
183	4th Floor - Machine Room	1 Controller
183	2nd Floor - Machine Room	1 Disconnect
183	2nd Floor - Room 228	1 Disconnect
183	3rd Floor - Room 334	1 Disconnect
183	4th Floor - Room 435	1 Disconnect
183	5th Floor - Room 535	1 Disconnect
183	6th Floor - Room 635	1 Disconnect
183	7th Floor - Room 735	1 Disconnect

BUILDING	LOCATION	EQUIPMENT
183	8th Floor - Room 835	1 Disconnect
183	9th Floor - Room 935	1 Disconnect
183	3rd Floor - Machine Room	4 Disconnects
183	4th Floor - Machine Room	3 Disconnects
183	5th Floor - Machine Room	3 Disconnects
183	6th Floor - Machine Room	2 Disconnects
183	7th Floor - Machine Room	4 Disconnects
183	8th Floor - Machine Room	4 Disconnects
183	9th Floor - Machine Room	7 Disconnects
183	Air Handler Room	2 Disconnects
183	Roof	2 Disconnects
183	3rd Floor - Machine Room	1 Distribution breaker panel
183	8th Floor - Machine Room	1 Distribution breaker panel
183	Roof	5 Exhaust fan switches
183	5th Floor - Machine Room	2 Line control starters
183	8th Floor - Machine Room	5 Line control starters
183	2nd Floor - Machine Room	1 Line controller
183	6th Floor - Machine Room	7 Line controllers
183	7th Floor - Machine Room	6 Line controllers
183	2nd Floor - Machine Room	1 Mag starter
183	2nd Floor - Machine Room	1 MCC panel
183	3rd Floor - Machine Room	2 MCC panel
183	4th Floor - Machine Room	1 MCC panel
183	5th Floor - Machine Room	1 MCC panel
183	6th Floor - Machine Room	1 MCC panel
183	7th Floor - Machine Room	1 MCC panel
183	8th Floor - Machine Room	1 MCC panel
183	9th Floor - Machine Room	1 MCC panel
183	Air Handler Room	1 Motor
183	8th Floor - Machine Room	1 Transformer
183	8th Floor - Machine Room	4 VSD
183	9th Floor - Machine Room	1 VSD
185	Hallways	3 Circuit breaker panel
185	Machine Room	1 Controller
185	Machine Room	2 Disconnects
185	Machine Room	1 Motor
185	Machine Room	1 Relay box
186	Outside	2 A/C units
186	Outside	1 Boiler
186	Hallways	5 Circuit breaker panels
186	Machine Room Upstairs	3 Circuit breaker panels

BUILDING	LOCATION	EQUIPMENT
186	Machine Room South	1 Disconnect
186	Machine Room Upstairs	1 Disconnect
186	Outside	3 Disconnects
186	Machine Room Upstairs	1 MCC panel
186	Machine Room Upstairs	1 MCC panel
186	Machine Room South	1 Motor
186	Machine Room Upstairs	2 Transformers
186	Outside	1 Transformers
186	Machine Room Upstairs	1 Water heater
190	1st Cafeteria Area	4 Circuit breaker panels
190	Outside	2 A/C unit
190	1st Floor Machine Room	1 Boiler
190	1st Floor Hallway	4 Circuit breaker panels
190	2nd Floor	3 Circuit breaker panels
190	1st Floor Machine Room	2 Controller
190	1st Floor Machine Room	1 Disconnect
190	Outside	3 Disconnect
190	2nd Floor	1 Distribution panel
190	Outside	1 Distribution panel
190	1st Floor Machine Room	1 Motor
190	Outside	1 Power main panel
190	1st Floor Machine Room	2 Water heaters
198	Basement	1 Battery rack
198	Basement	4 Breaker panels
198	Basement	2 Breaker switch boards
198	3rd Floor - Air Handler Room, East	3 Disconnects
198	3rd Floor - Air Handler Room, West	3 Disconnects
198	1st Floor	17 Hallway breaker panels
198	2nd Floor	17 Hallway breaker panels
198	3rd Floor	8 Hallway breaker panels
198	3rd Floor - Air Handler Room, East	1 MCC panel
198	Basement	1 MCC panel
198	Basement	1 Transformer
198	Basement	3 VSD controller switch
198	3rd Floor - Air Handler Room, West	1 Water Heater
200	Boiler Room	1 Boiler
200	Outside	1 Chiller
200	1st Floor	10 Circuit breaker panels

BUILDING	LOCATION	EQUIPMENT
200	2nd Floor - Electrical Room	5 Circuit breaker panels
200	1st Floor	2 Disconnects
200	Outside	3 Disconnects
200	1st Floor	2 Distribution panels
200	Boiler Room	1 Mag starter
200	Outside	4 Mag starter
200	Outside	2 Motors
200	Outside	1 Transformer
200	1st Floor	2 Transformers
200	Boiler Room	1 Water heater
201	2nd Floor Machine Room	1 Boiler
201	1st Floor East	1 Circuit breaker panel
201	1st Floor West	3 Circuit breaker panel
201	2nd Floor Hallway	2 Circuit breaker panel
201	1st Floor West	2 Controller
201	1st Floor West	5 Disconnect
201	2nd Floor Machine Room	2 Disconnect
201	Outside	1 Disconnect
201	1st Floor West	1 Distribution panel
201	1st Floor West	1 Transformer
201	2nd Floor Machine Room	2 Transformer
201	Outside	1 Transformer
201	2nd Floor Machine Room	1 Water heater
202	1st Floor Equipment Room	4 Battery pack racks
202	1st Floor Equipment Room	1 Boiler
202	1st Floor Equipment Room	5 Circuit breaker panels
202	2nd Floor Hallway	3 Circuit breaker panels
202	1st Floor Equipment Room	3 Controller
202	1st Floor Equipment Room	2 Disconnect
202	1st Floor Equipment Room	4 Distribution panel
202	1st Floor Equipment Room	2 MCC panel
202	1st Floor Equipment Room	2 Transformers
202	1st Floor Equipment Room	1 VSD switch
224	224 - Outside	3 Controller
224	224 - Outside	3 Disconnects
224	224 - Outside	2 Transformer
231	231 - 1st Floor South	1 Circuit breaker panel
231	231 - 2nd Floor Lock and Keys	1 Circuit breaker panel
231	231 - 1st Floor Electrical Room	2 Circuit breaker panel
231	231 - 1st Floor Electrical Room	1 Circuit breaker panel

BUILDING	LOCATION	EQUIPMENT
231	231 - 1st Floor Electrical Room	1 Disconnects
231	231 - 1st Floor Paint Shop	2 Disconnects
231	231 - Outside	5 Disconnects
231	231 - 1st Floor Electrical Room	1 Distribution panel
231	231 - 1st Floor Electrical Room	1 MCC panel
231	231 - 1st Floor Electrical Room	2 Transformer
233	2nd Floor - Machine Room	1 Boiler
233	2nd Floor - Machine Room	2 Chillers
233	1st Floor - Electrical Room 107	4 Circuit breaker panels
233	1st Floor - Outside Equipment Room	1 Circuit breaker panels
233	1st Floor - Room 118	1 Circuit breaker panels
233	2nd Floor - Electrical Room	1 Circuit breaker panels
233	2nd Floor - Machine Room	2 Circuit breaker panels
233	3rd Floor	5 Circuit breaker panels
233	1st Floor - Room 118	1 Contactor panel
233	1st Floor - Outside Equipment Room	2 Disconnects
233	1st Floor - Room 118	3 Disconnects
233	2nd Floor - Machine Room	13 Disconnects
233	Roof	6 Disconnects
233	1st Floor - Room 118	2 Distribution panels
233	2nd Floor - Electrical Room	4 Distribution panels
233	2nd Floor - Machine Room	1 Distribution panels
233	2nd Floor	6 Hallway circuit breaker panels
233	1st Floor - Outside Equipment Room	1 MCC panels
233	2nd Floor - Electrical Room	3 MCC panels
233	2nd Floor - Machine Room	2 MCC panels
233		5 Overload switches
233	1st Floor - Outside Equipment Room	2 Steam boilers
233	2nd Floor - Machine Room	2 VSD
234	234 - Outside	1 A/C unit
234	234 - Outside	3 Disconnects
234	234 - Outside	1 Motor
238	Boiler Room	1 Boiler
238	Machine Room	2 Chillers

BUILDING	LOCATION	EQUIPMENT
238	2nd Floor Electrical Room	1 Circuit breaker box
238	3rd Floor Electrical Room	2 Circuit breaker box
238	4th Floor Electrical Room	1 Circuit breaker box
238	5th Floor Electrical Room	1 Circuit breaker box
238	6th Floor Electrical Room	4 Circuit breaker box
238	7th Floor Electrical Room	1 Circuit breaker box
238	Boiler Room	1 Circuit breaker panel
238	Top of Stairs	1 Circuit breaker panel
238	1st Floor - Hallway West	3 Circuit breaker panels
238	2nd Floor - Room 213	4 Circuit breaker panels
238	2nd Floor Electrical Room	4 Circuit breaker panels
238	2nd Floor Hallway	6 Circuit breaker panels
238	3rd Floor Electrical Room	3 Circuit breaker panels
238	3rd Floor Hallway	8 Circuit breaker panels
238	4th Floor Electrical Room	4 Circuit breaker panels
238	4th Floor Hallway	8 Circuit breaker panels
238	5th Floor Electrical Room	4 Circuit breaker panels
238	5th Floor Hallway	8 Circuit breaker panels
238	6th Floor Electrical Room	3 Circuit breaker panels
238	6th Floor Hallway	8 Circuit breaker panels
238	7th Floor Electrical Room	3 Circuit breaker panels
238	7th Floor Hallway	8 Circuit breaker panels
238	Penthouse - Hallway	4 Circuit breaker panels
238	2nd Floor - Room 213	1 Controller
238	2nd Floor Machine Room	1 Disconnect
238	3rd Floor Machine Room	1 Disconnect
238	4th Floor Machine Room	1 Disconnect
238	5th Floor Machine Room	1 Disconnect
238	6th Floor Machine Room	1 Disconnect
238	7th Floor Machine Room	1 Disconnect
238	Machine Room	3 Disconnect
238	Penthouse - Roof	1 Disconnect
238	Boiler Room	4 Disconnects
238	Roof	2 Disconnects
238	Roof - Air Handler Room	2 Disconnects
238	Machine Room	1 MCC panel
238	Penthouse - Electrical Room	1 MCC panel
238	2nd Floor Machine Room	1 Motor
238	3rd Floor Machine Room	1 Motor
238	4th Floor Machine Room	1 Motor
238	5th Floor Machine Room	1 Motor

BUILDING	LOCATION	EQUIPMENT
238	6th Floor Machine Room	1 Motor
238	7th Floor Machine Room	1 Motor
238	Roof - Air Handler Room	1 Motor
238	Boiler Room	3 Motors
238	Machine Room	6 Motors
238	Machine Room	2 Starters (chiller)
238	2nd Floor Electrical Room	2 Transformers
238	3rd Floor Electrical Room	2 Transformers
238	4th Floor Electrical Room	2 Transformers
238	5th Floor Electrical Room	2 Transformers
238	6th Floor Electrical Room	2 Transformers
238	7th Floor Electrical Room	2 Transformers
238	Machine Room	2 VSD
241	1st Floor Shipping and Receiving	2 Circuit breaker panel
241	2nd Floor Air Handler Room	1 Circuit breaker panel
241	2nd Floor Electrical Room	3 Circuit breaker panel
241	2nd Floor Hallway	3 Circuit breaker panel
241	2nd Floor Air Handler Room	1 Controller
241	1st Floor Shipping and Receiving	1 Disconnect
241	2nd Floor Electrical Room	1 Distribution panel
241	1st Floor Shipping and Receiving	1 Elevator equipment
241	2nd Floor Air Handler Room	2 MCC panel
241	2nd Floor Air Handler Room	2 Motor
241	2nd Floor Air Handler Room	1 Transformer
241	2nd Floor Electrical Room	1 Transformer
241	2nd Floor Air Handler Room	1 VSD
241	2nd Floor Air Handler Room	1 Water heater
248	Outside, East	3 A/C unit
248	1st Floor	2 Circuit breaker box
248	Basement	2 Circuit breaker box
248	1st Floor - Room 107	1 Circuit breaker panel
248	1st Floor	3 Circuit breaker panels
248	1st Floor	6 Controllers
248	Basement	7 Controllers
248	1st Floor	1 Disconnect
248	Basement	1 Disconnect
248	1st Floor - Room 107	2 Disconnects
248	4th Floor	3 Disconnects
248	Outside, East	3 Disconnects

BUILDING	LOCATION	EQUIPMENT
248	1st Floor	3 MCC panels
248	4th Floor	1 Transformer
248	Basement	1 Transformer
248	1st Floor	2 VSD
249	Roof	1 A/C unit
249	Machine Room	1 Boiler
249	Machine Room	3 Circuit breaker panels
249	Roof	1 Disconnect
249	Machine Room	1 Distribution panel
249	Machine Room	1 Motor
249	Machine Room	1 Transformer
277	2nd Floor Machine room	1 Boiler
277	Machine Room	1 Chiller
277	2nd Floor Outside Machine Room	1 Circuit breaker box
277	1st Floor - Room B3	1 Circuit breaker panel
277	1st Floor - Hallway	4 Circuit breaker panels
277	2nd Floor Hallway	2 Circuit breaker panels
277	2nd Floor Outside Machine Room	5 Circuit breaker panels
277	Machine Room	2 Circuit breaker starters
277	1st Floor - Room B6	1 Controller
277	1st Floor - Hallway	1 Disconnect
277	Outside West	2 Disconnects
277	Roof	9 Disconnects
277	Machine Room	2 Distribution panels
277	Outside South	1 Humidifier unit
277	2nd Floor Machine room	1 MCC panel
277	Machine Room	3 MCC panels
277	2nd Floor Machine room	4 Motors
277	Machine Room	11 Motors
277	Outside West	2 Motors
277	Machine Room	2 Transformers
277	1st Floor - Hallway	1 Water heater
277	2nd Floor Machine room	1 Water heater
280	280	1 Circuit breaker panel
280	280	1 Disconnect
288	288 - Outside	1 Circuit breaker panel
288	288 - Outside	6 Controllers
288	288 - Outside	15 Disconnects
288	288 - Outside	3 Transformers
291	1st Floor Hallway	1 Circuit breaker

BUILDING	LOCATION	EQUIPMENT
291	2nd Floor Electrical Room (Room 125)	1 Circuit breaker
291	2nd Floor Electrical Room (Room 125)	1 Circuit breaker box
291	2nd Floor Electrical Room (Room 125)	1 Disconnect
291	2nd Floor Electrical Room (Room 125)	1 Distribution panel
291	2nd Floor Electrical Room (Room 125)	1 Transformer
299	299 - Inside	3 Circuit breaker panels
299	299 - Outside	4 Disconnects
300	Chiller Plant	4 Boilers
300	1st Floor Mezzanine	2 Buss switches
300	2nd Floor Mezzanine	6 Buss switches
300	Mezzanine North	3 Buss switches
300	Mezzanine West	6 Buss switches
300	Chiller Plant	3 Chillers
300	2nd Floor Mezzanine	4 Circuit breaker boxes
300	Mezzanine North	2 Circuit breaker boxes
300	Mezzanine West	2 Circuit breaker boxes
300	1st Floor Hallway Room 110	1 Circuit breaker panel
300	1st Floor Hallway Room 118	1 Circuit breaker panel
300	1st Floor Hallway Room 131B	1 Circuit breaker panel
300	2nd Floor Room 227	1 Circuit breaker panel
300	2nd Floor Room 234	1 Circuit breaker panel
300	3rd Floor Room 314 Hallway	1 Circuit breaker panel
300	3rd Floor Room 319 Hallway	1 Circuit breaker panel
300	3rd Floor Room 324 Hallway	1 Circuit breaker panel
300	3rd Floor Room 329 Hallway	1 Circuit breaker panel
300	3rd Floor Room 321 Hallway	1 Circuit breaker panel
300	1st Floor Hallway Room 149	2 Circuit breaker panels
300	1st Floor Mezzanine	4 Circuit breaker panels
300	2nd Floor Mezzanine	4 Circuit breaker panels
300	Mezzanine North	2 Circuit breaker panels
300	Mezzanine West	2 Circuit breaker panels
300	Chiller Plant	14 Disconnects
300	Roof	2 Disconnects
300	Roof East Machine Room	13 Disconnects
300	Roof West Machine Room	14 Disconnects
300	Mezzanine West	1 MCC panel
300	Chiller Plant	6 MCC panel doors

BUILDING	LOCATION	EQUIPMENT
300	Chiller Plant	11 Motors
300	Roof West Machine Room	9 Motors
300	1st Floor Mezzanine	6 Transformers
300	2nd Floor Mezzanine	5 Transformers
300	Chiller Plant	1 Transformers
300	Mezzanine North	3 Transformers
300	Mezzanine West	4 Transformers
300	Mezzanine West	9 VSD
300	Roof West Machine Room	2 Water heaters
301	4th Floor Electrical Room, East	5 Circuit breaker panel
301	1st Floor Electrical Room, East	5 Circuit breaker panel
301	Garage Floor - SW Electrical Room	1 Battery pack
301	Garage Floor - Bank	5 Bay switches
301	Chiller Room	2 Chiller
301	Garage Floor - Bank	2 Circuit breaker
301	1st Floor Electrical Room, West	2 Circuit breaker box
301	1st Floor Electrical Room, West	3 Circuit breaker panel
301	2nd Floor Electrical Room, East	9 Circuit breaker panel
301	2nd Floor Electrical Room, West	5 Circuit breaker panel
301	2nd Floor Hallway	3 Circuit breaker panel
301	3rd Floor Electrical Room, East	5 Circuit breaker panel
301	3rd Floor Electrical Room, West	4 Circuit breaker panel
301	3rd Floor Hallway	1 Circuit breaker panel
301	4th Floor Electrical Room, West	5 Circuit breaker panel
301	4th Floor Hallways	2 Circuit breaker panel
301	Garage Floor - West Middle Room	2 Circuit breaker panel
301	Room 284A	1 Circuit breaker panel
301	Room 382	2 Circuit breaker panel
301	Room 486	1 Circuit breaker panel
301	Garage Floor - SW Electrical Room	1 Circuit panel
301	1st Floor Electrical Room, West	1 Controller

BUILDING	LOCATION	EQUIPMENT
301	Garage Floor - West Middle Room	1 Controller
301	Air Handler Room, East	2 Disconnect
301	Chiller Room	7 Disconnect
301	Garage Floor - Air Handler Room	2 Disconnect
301	Garage Floor - Exhaust Fan Room	1 Disconnect
301	Garage Floor - Bank	4 Distribution panel
301	Garage Floor - SW Electrical Room	1 Distribution panel
301	Garage Floor - West Middle Room	1 Distribution panel
301	Garage Floor - West Middle Room	1 Main breaker
301	Chiller Room	1 MCC
301	Garage Floor - Bank	1 MCC
301	Garage Floor - West Middle Room	1 MCC
301	Air Handler Room, East	2 Motor
301	Chiller Room	6 Motor
301	Garage Floor - Air Handler Room	2 Motor
301	Garage Floor - Exhaust Fan Room	1 Motor
301	Chiller Room	2 Starter
301	Garage Floor - Bank	3 Transformer
301	Garage Floor - West Middle Room	1 Transformer
301	Garage Floor - Bank	2 Transformer distribution panels
301	Garage Floor - Bank	2 VSD
301	Garage Floor - West Middle Room	2 VSD
302	2nd Floor	2 Circuit breaker panels
302	3rd Floor	4 Circuit breaker panels
302	2nd Floor Machine Room	1 MCC panel
302	3rd Floor	1 Transformer
302	2nd Floor Machine Room	3 Transformers
303	Machine Room	2 Chillers
303	Cafeteria Area - Hallway Cabinet	1 Circuit breaker box
303	2nd Floor Room 208D (outside)	1 Circuit breaker panel
303	3rd Floor Room 313	1 Circuit breaker panel

BUILDING	LOCATION	EQUIPMENT
303	3rd Floor Room 315	1 Circuit breaker panel
303	4th Floor Outside Room 408C	1 Circuit breaker panel
303	2nd Floor Room 215	1 Circuit breaker panel
303	2nd Floor Hallway Cabinet	3 Circuit breaker panels
303	3rd Floor Hallway Cabinet	3 Circuit breaker panels
303	4th Floor Hallway Cabinets	4 Circuit breaker panels
303	Cafeteria Area - Hallway	2 Circuit breaker panels
303	Cafeteria Area - Electrical Room	2 Circuit breaker panels
303	Cafeteria Area - Hallway Cabinet	1 Disconnect
303	Machine Room	2 Disconnect
303	Cafeteria Area - Elevator Room	2 Disconnects
303	Dishwasher Room	2 Disconnects
303	Machine Room Roof	5 Disconnects
303	Outside 2nd Floor North	6 Disconnects
303	Roof	8 Disconnects
303	4th Floor Hallway Cabinets	1 Distribution
303	2nd Floor Hallway Cabinet	1 Distribution panel
303	3rd Floor Hallway Cabinet	1 Distribution panel
303	Cafeteria Area - Electrical Room	3 Distribution panels
303	Machine Room	1 MCC panel
303	Machine Room Roof	1 MCC panel
303	Machine Room	6 Motors
303	Machine Room Roof	2 Motors
303	Outside 2nd Floor North	3 Motors
303	Cafeteria Area - Electrical Room	1 Transformer
303	Machine Room	2 VSD
306	Outside	2 Air handler units
306	Chiller Plant	2 Boiler
306	Chiller Plant	2 Chiller
306	1st Floor Electrical Room, North	3 Circuit breaker panel
306	1st Floor Electrical Room, South	2 Circuit breaker panel
306	2nd Floor Electrical Room, North	2 Circuit breaker panel
306	2nd Floor Electrical Room, South	1 Circuit breaker panel

BUILDING	LOCATION	EQUIPMENT
306	3rd Floor Electrical Room, North	2 Circuit breaker panel
306	3rd Floor Electrical Room, South	2 Circuit breaker panel
306	4th Floor Electrical	2 Circuit breaker panel
306	5th Floor Hallway	2 Circuit breaker panel
306	Chiller Plant	6 Disconnect
306	Outside	2 Disconnect
306	Roof	5 Disconnect
306	Roof Equipment Room	5 Disconnect
306	1st Floor Electrical Room, North	3 Distribution panel
306	1st Floor Electrical Room, North	1 Distribution panel
306	1st Floor Electrical Room, South	2 Distribution panel
306	2nd Floor Electrical Room, North	3 Distribution panel
306	2nd Floor Electrical Room, South	3 Distribution panel
306	3rd Floor Electrical Room, North	2 Distribution panel
306	3rd Floor Electrical Room, South	2 Distribution panel
306	4th Floor Electrical	2 Distribution panel
306	3rd Floor Electrical Room, North	1 Lighting controller
306	Chiller Plant	1 MCC
306	Chiller Plant	8 Motor
306	1st Floor Electrical Room, South	1 Transformer

Appendix A.1.11.3 Oil Testing and Analysis

OIL TYPE (AS SPECIFIED BY MANUFACTURER)	MACHINE ID	SAMPLING POINTS
GENERATORS		
	S2208 230 DIESEL GENERATOR X 230 GEN X	1
	S2209 230 DIESEL GENERATOR Y 230 GEN Y	1
	S2210 230 DIESEL GENERATOR Z 230 GEN Z	1
	G8225 159 DIESEL GENERATOR 159 GEN	1
	G3454 202 DIESEL GENERATOR 202 GEN	1
	G8159 277 DIESEL GENERATOR 277 GEN	1
	G8229 302 DIESEL GENERATOR 302 GEN	1
	G3454 DIESEL GENERATOR 202 GEN	1
CHILLERS		
	M3423 CHILLER 158 CHILLER	1
	M2408 CHILLER 190 CHILLER	1
	M2740 CHILLER 199 CHILLER	1
	M5062 CHILLER #1 200 CHILLER	1
	S5053 CHILLER 264 CHILLER	1

OIL TYPE (AS SPECIFIED BY MANUFACTURER)	MACHINE ID	SAMPLING POINTS
	S5054 CHILLER 264 CHILLER	1
	M2158 CHILLER 299 CHILLER	1
	M2571 CHILLER 302 CHILLER	1
	M1824 CHILLER 306 CHILLER	1
	M7505 CHILLER 310 CHILLER	1
COOLING TOWERS	S6233 COOLING TOWER 264	1
	S6234 COOLING TOWER 264	1
	S6232 COOLING TOWER 264	1

Appendix A.1.11.4 Motor Circuit Analysis (WIP sample only)

BUILDING	ASSET #	DESCRIPTION
18	M3656	PUMP, CHILL WATER
18	M3653	PUMP, CHILL WATER
103	M4123	AIR HANDLER UNIT
125	M0893	AIR HANDLER UNIT
125	M0872	PUMP, HOT WATER
125	M2984	AIR HANDLER UNIT

125	M2736	CHILLER, WATER, CENTRIFUGAL, MAG BEARING
125	M0873	PUMP, HOT WATER
126	M1674	PUMP, CHILL WATER
126	M1684	PUMP, CHILL WATER
138	M2659	AIR HANDLER UNIT
138	M1659	PUMP, CHILL WATER
138	M2658	AIR HANDLER UNIT
144	M3811	AIR HANDLER UNIT
144	M3800	AIR HANDLER UNIT
144	M0203	PUMP, HOT WATER, HEATING
144	M4856	PUMP, CHILL WATER
144	M5048	PUMP, CHILL WATER
149	M0131A	COOLING TOWER
150	M0490	PUMP, CHILL WATER, CHWP-2
150	M9976	PUMP, CHILL WATER, CHWP-1
150	M1628	AIR HANDLER UNIT
150	M0468	AIR HANDLER UNIT
150	M1630	AIR HANDLER UNIT
150	M9967	PUMP, CONDENSER WATER
150	M10050	PUMP #2, HOT WATER, Bldg. 150
150	M1629	AIR HANDLER UNIT
156	M2472	AIR HANDLER UNIT
156	M2473	AIR HANDLER UNIT
157	M1580	AIR HANDLER UNIT
157	M6961	PUMP, CHILL WATER
157	M6962	PUMP, CHILL WATER
157	M1591	AIR HANDLER UNIT
157	M1588	AIR HANDLER UNIT
157	M6960	AIR HANDLER UNIT
157	M6932	AIR HANDLER UNIT
158	M1331	COMPRESSOR, AIR

158	M1578	AIR HANDLER UNIT
158	M1579	AIR HANDLER UNIT
158	M1726	AIR HANDLER UNIT
158	M2336	PUMP, CONDENSER WATER
158	M2337	PUMP, CONDENSER WATER
158	M6749	PUMP, HOT WATER
159	M1608	WATER PUMP #2
159	M1609	WATER PUMP #3
159	M0994	WATER PUMP #1
161	M2486	PUMP, CHILL WATER, CHWP-4
161	M2477	PUMP, HOT WATER #2
161	M2405	PUMP, HOT WATER #5
161	M2476	PUMP, HOT WATER #1
161	M2764	PUMP, HOT WATER #6
161	M2479	PUMP, HOT WATER, HWP-4
161	M2478	PUMP, HOT WATER, HWP-3
166	M1806	PUMP, COOLANT, GLYCOL
166	M1810	PUMP, COOLANT, GLYCOL
166	M1812	PUMP, COOLANT, GLYCOL
166	M9668	PUMP, CONDENSER WATER (CWP-1)
166	M9733	PUMP, CONDENSER WATER (CWP-3)
166	M9676	PUMP, CONDENSER WATER (CWP-2)
167	M4858	FAN, MAKE-UP AIR
167	M2932	AIR HANDLER UNIT
167	M4857	AIR HANDLER UNIT
168	M1395	PUMP, CHILLED WATER
168	M0570	PUMP, CONDENSER WATER
168	M0658	PUMP, CHILL WATER
168	M0538	PUMP, CHILLED WATER, P-9
168	M0565	PUMP, CHILLED WATER, P-8
168	M0659	PUMP, CHILL WATER
168	M1392	PUMP, CHILL WATER

168	M0130	FAN, EXHAUST
168	M2943	PUMP, HOT WATER
168	M0569	PUMP, CONDENSER WATER
168	M0595	PUMP, CHILL WATER
169	M6517	PUMP, CHILL WATER (CHWP-169A)
169	M6515	PUMP, CHILL WATER (CHWP-169B)
169	M6511	AIR HANDLER UNIT, AHU-2
169	M6510	AIR HANDLER UNIT, AHU-1
169	M0580	PUMP, CHILL WATER
169	M0577	PUMP, CONDENSER WATER
170	M4644-01	AIR HANDLER UNIT
170	M3981	PUMP, CONDENSER WATER
170	M4644-7	PUMP, CHILL WATER
170	M4644-02	AIR HANDLER UNIT (AHU-2)
171	M2753	CHILLER, WATER, CENTRIFUGAL (CH-2)
171	M7178	AIR HANDLER UNIT
171	M0574	PUMP, SEPARATOR
171	M2752	CHILLER, WATER, CENTRIFUGAL (CH-1)
171	M0329	AIR HANDLER UNIT
171	M7802	AIR HANDLER UNIT
171	M0211	PUMP, CONDENSER WATER (CWP-1)
171	M0241	PUMP, CHILL WATER (CHWP-3)
171	M0223	PUMP, CHILL WATER (CHWP-1)
171	M0216	PUMP, CHILL WATER (CHWP-2)
171	M1970	FAN, EXHAUST
171	M1971	SUPPLY FAN 1
179	M1915	PUMP, CONDENSER WATER 2
179	M5655	AIR HANDLER UNIT
179	M1903	PUMP, CONDENSER WATER 1
179	M2846	AIR HANDLER UNIT

179	M1257	PUMP, CONDENSER WATER #4
179	M1260	PUMP, CONDENSER WATER #3
179	M7666	PUMP, HOT WATER (HHWP-8)
179	M7667	PUMP, HOT WATER (HHWP-7)
179	M2687	VACUUM, CENTRAL
179	M2843	AIR HANDLER UNIT
179	M2844	AIR HANDLER UNIT
179	M2845	AIR HANDLER UNIT
180	M3363	PUMP, CHILLED WATER (CHWP-3)
180	M6022	AIR HANDLER UNIT
180	M2136	COOLING TOWER (CT-1)
180	M2133	COOLING TOWER (CT-2)
180	M1504	PUMP, HOT WATER
180	M6010	PUMP, CHILLED WATER, (CHWP-2)
180	M6009	PUMP, CHILLED WATER, (CHWP-1)
180	M4960	PUMP, CONDENSER WATER, (CWP-3)
180	M4959	PUMP, CONDENSER WATER, (CWP-2)
180	M4958	PUMP, CONDENSER WATER, (CWP-1)
180	M2754	PUMP, CHILL WATER, FILTER
183	M1509	AIR HANDLER UNIT
183	M6886	PUMP, CHILLED WATER
183	M0910	PUMP, CHILL WATER
183	M6887	PUMP, CHILLED WATER
183	M0727	PUMP, HOT WATER CIRCULATING
183	M1493	AIR HANDLER UNIT
183	M1494	AIR HANDLER UNIT
183	M0283	PUMP, VACUUM
183	M1496	AIR HANDLER UNIT
183	M0720	SUPPLY FAN
183	M0721	FAN, SUPPLY
183	M1518	AIR HANDLER UNIT
183	M1480	AIR HANDLER UNIT

183	M1501	AIR HANDLER UNIT
183	M1499	AIR HANDLER UNIT
183	M1497	AIR HANDLER UNIT
183	M0728	PUMP, HOT WATER CIRCULATING
183	M1505	AIR HANDLER UNIT
183	M0906	PUMP, CHILL WATER
190	M2408	CHILLER, AIR, ROTARY
200	M1589	PUMP, HOT WATER, Bldg 200-BOILER ROOM, M1589
228	M1231	PUMP, CONDENSER WATER, CWP-1
228	M1232	PUMP, CONDENSER WATER, CWP-2
228	M4623	COOLING TOWER 1
230	S9877	PUMP, CHILLED WATER, SCHWP-3
230	S5411	AIR HANDLER UNIT
230	S5404	AIR HANDLER UNIT
230	S5406	AIR HANDLER UNIT
230	S6009	AIR HANDLER UNIT
230	S6317	RADIATOR, Z ENGINE
230	S5405	AIR HANDLER UNIT
230	S9878	PUMP, CHILLED WATER, SCHWP-2
230	S6203	COOLING TOWER, FAN 3, CTF-3
230	S6201	COOLING TOWER, FAN 1, CTF-1
230	S9879	PUMP, CHILLED WATER, SCHWP-1
233	M9773	PUMP, HOT WATER, HWP-1
233	M7786	AIR HANDLER UNIT
233	M4838	PUMP, CONDENSOR
233	M7768	PUMP, CONDENSOR
233	M7899	AIR HANDLER UNIT
233	M4819	AIR HANDLER UNIT
233	M4820	AIR HANDLER UNIT
233	M9772	PUMP, HOT WATER, HWP-2
233	M7898	AIR HANDLER UNIT

233	M7753	PUMP, CHILLED WATER
234	M9692	PUMP, WATER
238	M6721	PUMP, CONDENSER WATER
238	M1866	PUMP, CHILL WATER
238	M1868	PUMP, CHILL WATER
238	M6644	AIR HANDLER UNIT
238	M6638	AIR HANDLER UNIT
238	M6646	AIR HANDLER UNIT
238	M6566	PUMP, CHILLED WATER
238	M6565	PUMP, CHILLED WATER
238	M6632	PUMP, HOT WATER, P-5
238	M6633	PUMP, HOT WATER, P-6
238	M6661	AIR HANDLER UNIT
241	M0278	AIR HANDLER UNIT
241	M0332	AIR HANDLER UNIT
248	M9929	PUMP, CHILL WATER
248	M9937	PUMP, CENTRIFUGAL
251	M6671	AIR HANDLER UNIT
264	S3445	PUMP, CHILL WATER
264	S6033	AIR HANDLER UNIT
264	S6043	AIR HANDLER UNIT
264	S6046	AIR HANDLER UNIT
264	S3444	PUMP, CHILL WATER
264	S6232	COOLING TOWER
264	S6044	AIR HANDLER UNIT
264	S6045	AIR HANDLER UNIT
264	S3447	PUMP, CONDENSER WATER, (CWP-2)
264	S3450	PUMP, HOT WATER
268	M5686	COMPRESSOR, AIR
277	M3367	DEHUMIDIFIER, AIR HANDLER
277	M5356	AIR HANDLER UNIT
277	M5430	PUMP, CHILL WATER

277	M5371	AIR HANDLER UNIT
277	M5347	AIR HANDLER UNIT
277	M5372	AIR HANDLER UNIT
277	M5457	PUMP, CHILL WATER
277	M5220	AIR HANDLER UNIT
277	M2245	AIR HANDLER UNIT
277	M0981	PUMP, CONDENSER WATER
277	M5241	AIR HANDLER UNIT
277	M0980	PUMP, CONDENSER WATER
296	M0672	PUMP, CONDENSER WATER
296	M0715	DRIVE, GEAR, COOLING TOWER
296	M0714	PUMP, CONDENSATE
296	M1244	DRIVE, GEAR, COOLING TOWER
296	M0695	PUMP, CONDENSER WATER
296	M0701	PUMP, CONDENSER WATER
296	M0707	PUMP, CONDENSER WATER
296	M0639	PUMP, CONDENSER WATER
296	M0692	PUMP, CONDENSER WATER
298	M0619	PUMP, HOT WATER
298	M1069	PUMP, CHILL WATER
298	M0616	PUMP, CHILL WATER
298	M0717	PUMP, CHILLED WATER
298	M0575	PUMP, CHILL WATER
298	M0678	PUMP, CHILL WATER
298	M0571	PUMP, CHILL WATER
298	M0561	PUMP, CHILL WATER
298	M0545	PUMP, CHILL WATER
298	M0535	PUMP, WATER
298	M1066	AIR HANDLER UNIT
298	M0497	PUMP, CHILL WATER
298	M0622	PUMP, HOT WATER
298	M0810	COMPRESSOR, AIR

298	M0739	FAN, SUPPLY
298	M0798	COMPRESSOR, AIR
298	M1063	AIR HANDLER UNIT
300	M1056	AIR HANDLER UNIT
300	M5934	PUMP, CONDENSER WATER (CWP-1)
300	M1078	AIR HANDLER UNIT
300	M1656	PUMP, CONDENSER WATER (CWP-2)
300	M1234	AIR HANDLER UNIT
300	M1209	AIR HANDLER UNIT
300	M1208	AIR HANDLER UNIT
300	M1119	AIR HANDLER UNIT
300	M0020	PUMP, CHILL WATER
300	M1050	AIR HANDLER UNIT
300	M1046	AIR HANDLER UNIT
300	M0683	FAN, RETURN
300	M0651	AIR HANDLER UNIT
300	M0643	FAN, RETURN
300	M0010	AIR HANDLER UNIT
300	M0002	AIR HANDLER UNIT
300	M1153	AIR HANDLER UNIT
300	M0046	PUMP, CHILL WATER (CHWP-1)
300	M0019	PUMP, CHILL WATER
300	M7988	FAN, RETURN
300	M1162	PUMP, CONDENSER WATER, CWP-1
300	M0090	PUMP, HOT WATER
300	M0037	PUMP, CHILL WATER (CHWP-2)
300	M0036	PUMP, CHILL WATER
300	M0022	PUMP, CHILL WATER
300	M0092	PUMP, HOT WATER
301	M7155	PUMP, CONDENSER WATER
301	M1598	AIR HANDLER UNIT
301	M3998	AIR HANDLER UNIT

301	M9837	FAN, EXHAUST
301	M3740	AIR HANDLER UNIT
301	M5971	PUMP, HOT WATER
301	M1442	AIR HANDLER UNIT
301	M5261	FAN, EXHAUST
301	M5069	PUMP, CHILL WATER
301	M5380	PUMP, HOT WATER
302	M0364	AIR HANDLER UNIT
302	M1932	FAN, SUPPLY
302	M0246	FAN, EXHAUST
302	M0357	FAN, EXHAUST
302	M0358	FAN, EXHAUST
302	M0360	AIR HANDLER UNIT
302	M0361	AIR HANDLER UNIT
302	M0366	AIR HANDLER UNIT
303	M0626	FAN, EXHAUST
303	M0494	PUMP, HOT WATER
303	M7682	PUMP, SAND FILTER, CENTRIFUGAL, Bldg 303
303	M0439	AIR HANDLER UNIT
303	M0422	AIR HANDLER UNIT
303	M0421	AIR HANDLER UNIT
303	M0492	PUMP, HOT WATER
303	M2032	CHILLER, WATER, CENTRIFUGAL
303	M0029	PUMP, CONDENSER WATER
303	M0028	PUMP, CENTRIFUGAL
303	M0023	PUMP, CIRCULATING, #3
303	M0627	FAN, EXHAUST
303	M0024	PUMP, CIRCULATING, #4
306	M1443	AIR HANDLER UNIT
306	M1429	CHILLER, WATER, CENTRIFUGAL, CH-1
306	M1430	PUMP, CHILL WATER #1

306	M1445	AIR HANDLER UNIT
306	M1772	PUMP, HOT WATER (HWP-32)
306	M1770	PUMP, CONDENSER WATER
306	M1769	PUMP, CHILL WATER #2
306	M1766	CHILLER, WATER, CENTRIFUGAL, CH-2
306	M1439	PUMP, HOT WATER (HWP-31)
306	M1434	PUMP, CONDENSER WATER
306	M1433	PUMP, CHILL WATER #12
306	M1432	PUMP, CHILL WATER (CHWP-11)
308	M1412	PUMP, SEWAGE EJECTOR
308	M1411	PUMP, SEWAGE EJECTOR
315	M3415	COOLING TOWER, FAN-1
315	M2297	PUMP, CIRCULATING PUMP #5, CELL #1
315	M2305	WATER FILTRATION SYSTEM, CELL #4
315	M2306	PUMP, CIRCULATING PUMP #8, CELL #4
315	M2303	PUMP, CIRCULATING, PUMP #7, CELL #3
315	M2302	WATER FILTRATION SYSTEM, CELL # 3
315	M2301	PUMP, CIRCULATING PUMP #6, CELL #2
315	M2298	WATER FILTRATION SYSTEM, CELL #2
315	M2296	WATER FILTRATION SYSTEMCELL #1
315	M3422	PUMP, CONDENSER WATER, #4
315	M3421	PUMP, CONDENSER WATER, #3
315	M3420	PUMP, CONDENSER WATER, #2
315	M3418	COOLING TOWER, FAN-4
315	M3416	COOLING TOWER, FAN-2
315	M3419	PUMP, CONDENSER WATER, #1
315	M3417	COOLING TOWER, FAN-3

Appendix A.1.11.5 Compressed Air Lines

Compressed air lines at JPL are shown in a separate file: Attachment 6 Compressed Air Lines

Appendix A.1.11.6 Gas Lines

Gas lines at JPL are shown in a separate file: Attachment 8 Gas Lines

Appendix A.1.12 - NONE
Appendix A.1.13 Grounds Care PM

Work Requirements	Quantity	Frequency
Tree Care		
Complete tree trim to prune and shape to maintain natural growth pattern.	300 Trees	Once per year as approved annual work schedule and in accordance with guidelines as described below*
Fertilization. - Apply a complete type fertilizer within the trees drip line. Tree spike fertilizer is required; apply per instructions on package, as approved by JPL CTM or designate. Water in after application.	200 Trees	Once per year.
Water. – Manual irrigation will be required where automatic sprinklers are not available.		As needed.
Staking and Guying. - Stakes and guys are to be inspected twice per year, and adjusted or removed as required.	50 Trees	Twice per year, as needed.
Removal and Planting. – The removal of diseased/declining and/or malformed trees and the planting of new trees or the movement of old trees may be required. Assessment shall be conducted by a certified arborist. New tree plantings from 36” box size.		Up to 15 trees annually

Work Requirements

Quantity Frequency

*Development Guidelines for annual tree trimming schedule:

The following guidelines have been developed to deal with the decrease in the number of trees to be trimmed as well as establishing a defined workload for the contract year. With the reduction, there is a clear need to be selective in the types of trees to be trimmed annually.

- The annual 300 tree trimming requirement will be broken down into a monthly quota. Recommended range is to be set at a minimum of 20 and a maximum of 40 trees / mo.
- Tree trimming requirements are to be balanced in terms of workload (i.e. a reasonable mix of small, medium and large trees). All the laboratories trees will fall into one of the three categories (i.e. of the approximately 2500 trees on lab, small, medium, and large trees). This ratio should be applied as a rule of thumb when selecting the trees to be trimmed any given month.
- Each tree is to be categorized into the category of how it impacts the laboratory and its mission (i.e. impacts roof clearances, poses a security threat, poses a threat to pedestrians and/or roadways, poses a clearance issue, impacts lighting levels, etc.).
- If a tree is selected for trim it shall be trimmed in full whenever possible. The definition of a full trim according to the International Society of Arboriculture is the removal of no more than 25% of the canopy.
- A separate annual tree trimming plan is to be submitted to the CTM for approval during the month of September for the upcoming fiscal year.
- Any proposed deviation s from the approved annual plan are to be provided 15 days in advance of the month they are to be trimmed in writing by the CTM or his designee.
- All requested tree trims will be scheduled, performed and validated in writing to the CTM or designee by the end of the month they are performed.

Shrub Care		
Pruning. - Prune and shape to maintain natural growth pattern. Eliminate damaged or diseased wood. Maintain growth with space limitations. Minimize hedging.	6 Acres	Four times per year.
Fertilization. - Apply a complete type fertilizer within the shrub drip line. Use ½ pound of actual nitrogen per 1000 square foot shrub area. Water in after application. Use Best 16-6-8 or JPL-approved equivalent.	6 Acres	Once per year.

Work Requirements	Quantity	Frequency
Water. - Manual irrigation will be required where automatic sprinklers are not available. When the shrubs are fertilized or newly planted, hand-watering will be required.		As needed.
Planting. - The planting of new shrubs may be required. New shrub planting shall be in 15-gallon size.	25 New	As necessary, per JPL CTM or designate.
Weeding. – Shrub weeding shall be performed in a manner that removes weeds, including roots; line trimmers (weed whackers) shall not be used.	6 Acres	Monthly, JPL CTM or designate shall be the final authority on what a weed is in any particular area.

Ground Cover Care		
Edging and Trimming. - Maintain ground cover as needed to keep from spreading over walks, curbs, and up walls. Detailing shrubs in ground cover – Keep ground cover trimmed at least 6 inches from drip line of shrubs.	15,000 lineal feet	Ten times per year.
Fertilization. - Apply a complete type fertilizer. Use Best 16-6-8 or JPL-approved equivalent. Water in after application.	11.25 Acres	Twice per year (early Spring and mid Fall)
Water. - Manual irrigation will be required where automatic sprinklers are not available. When ground cover is fertilized or newly planted, hand-watering will be required.		As needed.
Planting. - The planting of ground cover will be required.	1 acre	As directed by CTM.

Work Requirements	Quantity	Frequency
Weeding. - Maintain ground cover areas free of weeds. Ground cover weeding shall be performed in a manner that removes weeds, including roots; line trimmers (weed whackers) shall not be used.	11.25 Acres	Monthly, JPL CTM or designate shall be the final authority on what a weed is in any particular area.
Flowers. - plant annual flowers in assorted colors throughout the Lab as directed by the CTM and remove them at the end of their season. (Approximately 5000 square feet each planting.)		As directed by JPL CTM ,
Turf Care		
Mowing. - Cool season turf such as Fescue shall be mowed at 2 inches in warm weather, and 1 ½ inches during cool weather. Warm season turf such as Bermuda Grass, shall be mowed to a height of ¾ of an inch. Remove grass clippings.	60,000 sq.ft.	April through November – Weekly. December through March – Bi-weekly.
Edging. - Edging along sidewalks and curbs shall be performed every other mowing. - Grasses will be prevented from spreading into ground cover areas. - Turf shall be kept away from the bases of trees to no less than a 6-inch radius to prevent mechanical damage from mowers. - Turf shall be trimmed around all sprinklers and other objects as necessary to allow proper functioning and to prevent damage. Plant life such as ground cover, shrubs, hedges shall be edged a minimum of 6 inches from curbs, walkways, and roadways.	10,000 lineal feet	After every other mowing.
Fertilization. - Lawns shall be fertilized with a commercial fertilizer for a total of 10 pounds of actual nitrogen per 1000 square feet per year. Applications shall be watered in. Use Best 16-6-8 or JPL-approved equivalent.	60,000 sq.ft.	Two times per year, early spring and mid-fall.
Aeration. - Aerate all turf sites with gas-engine-powered machine that removes plugs. Plugs may be left on aerated areas.	60,000 sq.ft.	Once per year.
Weeding. - Treat Oxalis and other broad leaf weed found in the turf. Application must be made by a State of California-certified Pesticide Applicator. Follow label directions.	8,000 square feet	Three times per year.

Work Requirements	Quantity	Frequency
Water. - Manual irrigation will be required where automatic sprinklers are not available. When turf is fertilized or newly laid, hand-watering will be required.		As needed.
Seeding. - Seeding of areas will be required. Keep areas moist until germination. Hand watering will be required.		As needed.

Debris Clean up and Hardscape Blowing		
Paved areas, Patios, Cafeterias, and Curbs: Shall be monitored and kept clear of all litter and debris. Clean up will be accomplished by sweeping, air blowing, or vacuuming. Special restrictions will apply to use of blowers near residential areas surrounding JPL premises.	20Acres	Daily
Trash bags. – Trash bags shall be checked and changed daily (40-45-gallon trash containers). The changed-out trash bags shall be transported to the nearest building dumpster. Compostable waste dispensers shall use compostable rated waste bags. Compostable waste shall be disposed of in a separate compostable waste container.	110	Daily (must be after 2:30 p.m.)
Landscaped areas. - Shall be monitored and kept clear of all litter and debris. All green waste shall be placed in the “Green Waste Only” roll off bin.	11.25 Acres	Daily.
Mall Area. - Shall be monitored and kept clear of all litter and debris. Hardscape blowing or vacuuming shall be done. Work to commence at 7 AM and be completed by 7:30 AM. Additional hardscape blowing may be required before special events or when debris is brought in by windy conditions.	1.5 Acres	Daily.

Work Requirements	Quantity	Frequency
Brush Control for Fire Hazard Mitigation		
Work shall consist of: - Trim trees, removing branches up to 15' above grade. - Eucalyptus, ash, pine, elm, and other trees not planted by JPL, with a trunk smaller than 10" diameter, 4' above grade shall be removed. Stump may remain for erosion control. All trees within 12' of the Perimeter Security Fence shall be removed. Small Oak trees shall remain if spaced more than 25' apart, but shall be trimmed. All trees and branches within 25' of any building shall be removed. - Cut and chip or remove all dead brush, leave stump or roots in ground for erosion control. - Cactus, yucca, agave, coyote bush, and other beneficial, low burn possibility plants (identified by JPL CTM or designate) are to remain untouched. - Oleander bushes shall be trimmed down to less than 2' above grade. - Cut highly flammable brush like sumac and chamise (adenostoma) to less than 12" above grade, chip or remove material, cut other vegetation down to ankle height. Other large brush acceptable to JPL CTM or Designate, may be trimmed up, off the ground to resemble a small tree, and spaced no closer than 25 feet from each other. - Brush, branches, and other green waste may be chipped and spread in the removal area to a depth not more than 6" deep. Alternative is to remove from JPL site and dispose of properly.	28.75 Acres	In May.
Tree, Shrub, and Turf Inspection		
Inspect trees, shrubs, and turf areas for insects, disease and weeds. Treat diseased and infested trees, shrubs, and turf areas to neutralize problems. Spray weeds and remove. Report all findings to JPL CTM or designate.	Lab area	Semi-Annual
Load Trash & Metal Bin		
Load Up Trash and Metal Bins.		Weekly
Irrigation Sprinklers		
Activate and Observe Sprinkler Systems. Repair Sprinkler Systems as Needed to Be Fully Operational		Quarterly
Landscape Maintenance		
Perform Landscape Maintenance on Ground Covers and Mow Lawns.		Weekly

Work Requirements	Quantity	Frequency
Read & Record Irrigation Water Meters		
Read & Record Irrigation Water Meters and Irrometers.		Monthly
Retaining Wall/Fence Inspection		
Remove Debris Build-Up and Loose Rocks from Behind Walls/Fences. Repair or Replace Retaining Walls/Fences That Are Unsafe.		Annual
Perimeter Fencing		
Clear Shrubs and Weeds Up To 10-Foot Clearance on Both Sides of The Perimeter Fence Up to A Height Of 8 Ft. From Top of Fence Line.		Annual, during May and June
Eliminate gaps greater than 4 inches underneath the fence. Compact new placed dirt. Loose fencing shall be tightened. Barbed wire at the top of the fence shall be tight and properly spaced.		As needed. JPL CTM or designate shall be the final authority on fence repair needs.
Waterways, Catch Basins, And Debris Basins		
Clear All Water Ways, Drain Flumes, Catch Basins, and Debris Basins.		October & April, and as needed During Rainy Season
Pressure wash exterior concrete surfaces (64,325 sq. ft.); and pick up all water and detergent. Locations and schedules to be approved by JPL		3 Times per year
Fertilization		
Fertilization of Trees, Shrubs, Lawns, & Ground Cover.		Semi-Annual

Work Requirements	Quantity	Frequency
Outdoor Sweeping and Weed Control		
Sweep Streets, Parking Lots, Stairs & Walkways. Inspect and Perform Weed Abatement for All Paved Areas		Twice Monthly
Indoor Plants		
Water Once A Week and Fertilize. (See 0, Indoor Plant Inventory)		Weekly
Hard Surface and Trip Hazard Repair		
Subcontractor shall repair and/or replace concrete and asphalt pedestrian surfaces and roads to eliminate trip hazards and vehicle damage. Subcontractor shall remove roots that are causing heaving in asphalt or concrete, paved walkways, roads, and pedestrian hazards. Asphalt repairs shall be done with an approved hot mix.	6,000 sq.ft.	Semiannually
Calsense ET Gage		Monthly
1. Verify ET Gage sends daily measurements to the irrigation controller.		
2. Verify area not obstructed from wind or sunlight.		
3. Verify water from irrigation system does not hit the top surface of the ET Gage		
4. Fill with distilled water.		
Calsense ET Gage		Semiannually (January and July)
1. Clean the top surface and water reservoir.		

Appendix A.1.14 Gym Equipment PM

GYM EQUIPMENT PM	
1. INSPECTION AND REPAIR OF GYM EQUIPMENT/FURNITURE	BI-MONTHLY
1.1 INSPECT AND TEST ALL EQUIPMENT/FURNITURE.	
1.2 SAFETY INSPECTION AND TESTING TO INCLUDE: Bearings, belts, bushings, cables, cams, decks, chains, electronics, flywheels, hardware, motors, power cords, pulleys, rollers, upholstery, hand grips and function of the equipment. Cords from equipment to be rolled up with cable ties installed to prevent damage and tripping hazards.	
1.3 CALIBRATION, LUBRICATION, ALIGNMENT, ADJUSTMENT AND REPAIR AS SUGGESTED BY THE MANUFACTURER.	
1.4 REPLACE ALL WORN/BROKEN PARTS WITH NEW MANUFACTURER PARTS.	

Appendix A.1.16 Indoor Plants Inventory

INDOOR PLANTS INVENTORY		
Building	Floor/Room	Quantity
114	1	3
180	2	10
180	3	6
180	4	6
180	5	9
180	6	5
180	7	15
180	8	6
180	9	15
183	1	4
198	1	2
198	2	6
202	1	1
238	1	3
156	1	1
186	1	6

INDOOR PLANTS INVENTORY		
Building	Floor/Room	Quantity
306	4	3
249	1	2
264	1	3
190	2	3
200	1	10
200	2	18
303	1	4
303	2	3
300	2	10
302	2	6
301	Patio	31
301	1	3
301	2	3
301	3	5
301	4	10
306	3	1
306	4	5
321	1	1
321	2	0
321	3	1
321	4	0
321	5	6
Total Plants		226

Appendix A.2 Blank

Appendix A.3 Special Locations for Re-Lamping

Bldg./Location	Name	Areas
144	Environmental Laboratory	High Bays
150	25' Space Simulator	high areas
167	Cafeteria	Dining areas
170	Fabrication Shop	Machine Shop, Weld Fabrication, Metal

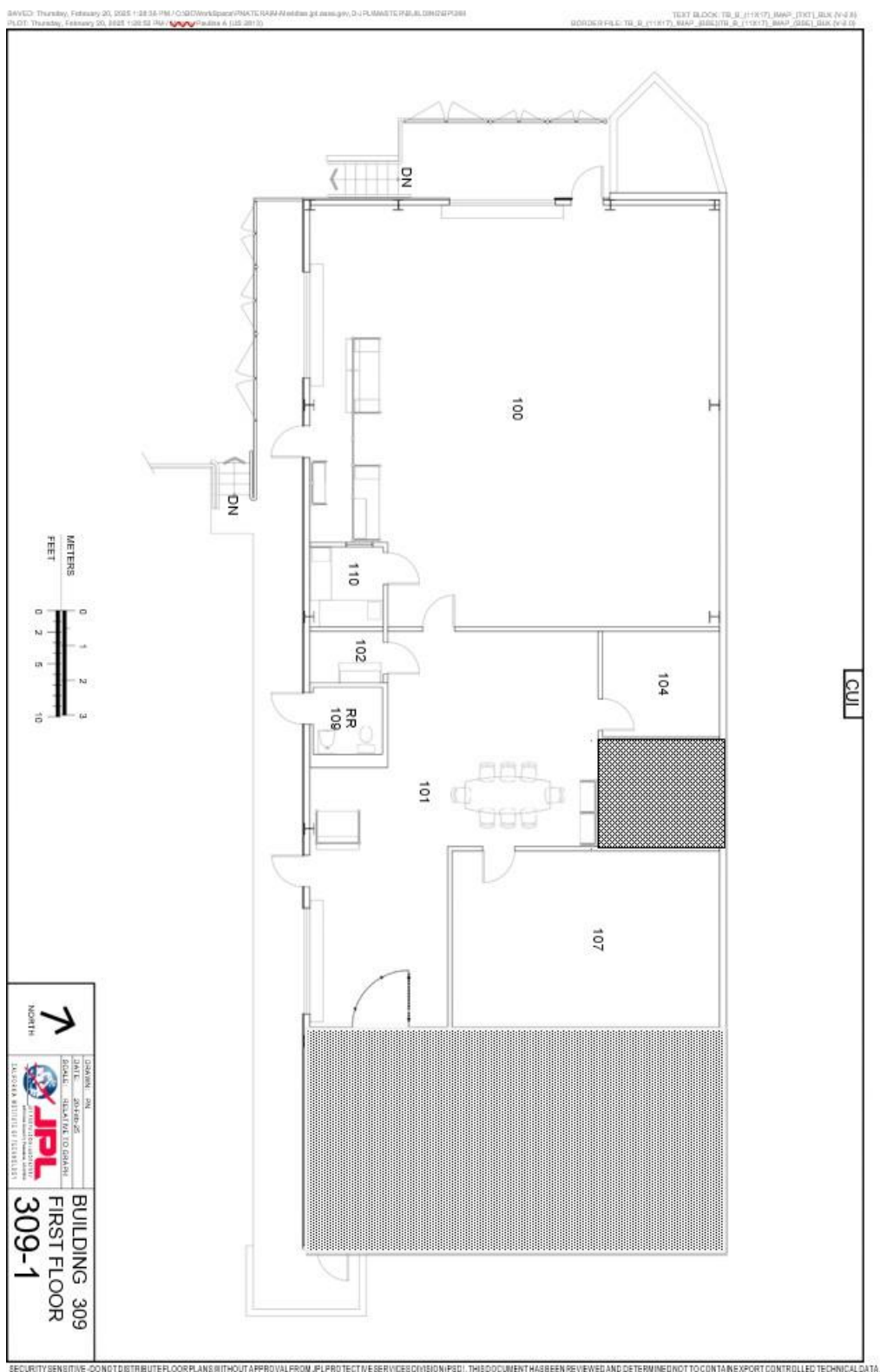
		Storage, Metal Fabrication
179	Spacecraft Assembly Facility	High Bays
233	Systems Development	High Bays
248	10' Space Simulator	High areas
317	In-Situ Instruments Lab.	Mars yard
318	Optical Interferometry Development	high areas
18	Structural Test Lab	High Bays
186	Science Exhibits and Engineering	Auditorium
321	Flight Project Center	Auditorium
West Lot	Parking lot lights	
Street lights Bank 63	Street lights	
Street lights Bank 64	Street lights	

Appendix A.4 Gym Equipment

Asset	Description	BLDG	Model	Ser #	Manufacturer
EE001	TREADMILL	180	TCS500	12-TCS500551G	TRUE
EE002	TREADMILL	180	TCS500	12-TCS500549G	TRUE
EE003	TREADMILL	180	TCS500	12-TCS500550G	TRUE
EE006	EXERCISE BIKE, RECUMBENT	321	LC-9100HR	CEA 660048	LIFE FITNESS
EE007	ELLIPTICAL TRAINER	180	EFX546	DCH23N0019	PRECOR
EE008	ELLIPTICAL TRAINER	180	EFX 546	DCH28N0031	PRECOR
EE009	WEIGHTS, FREE (IN RACK)	180	N/A	N/A	TUFFSTUFF
EE0010	BENCH, OBLIQUE FLEXOR	180	FWADJ A	295	HAMMER
EE0012	UNIVERSAL GYM	180	APOLLO 7000	120423-06204	TUFFSTUFF
EE0015	CHIN-UP BAR	180	N/A	N/A	UKN
EE011	BENCH FLAT/INCLINE/DECLINE	180			
EE014	HAMPTON FREE WAITS	180			
EE0030	DELUXE GYM (APOLLO 5)	321	AP-5425	N/A	TUFFSTUFF
EE0031	DUMBBELL, SET, 5 - 50 LBS	321	HF-5-50	N/A	HAMPTON
EE0032	BICEP CURL	321	PS-206	12995	TUFFSTUFF
EE0033	SMITH MACHINE	321	PL-400	12994	TUFFSTUFF
EE0034	CABLE CROSSOVER	321	PS-250X	12998	TUFFSTUFF
EE0035	AB CRUNCH	321	PS-220	12997	TUFFSTUFF
EE0036	CHIN/DIP ASSIST	321	PS-215	12996	TUFFSTUFF
EE0037	BENCH, FLAT/INCLINE/DECLINE	321	PF-300X	12992	TUFFSTUFF
EE0038	BENCH, FLAT/INCLINE/DECLINE	321	PF-300X	12993	TUFFSTUFF
EE0039	ATTACHMENT BAR CLUB PACK	321	CP-MBU	N/A	TUFFSTUFF
EE0040	CYCLE, RECUMBENT	321	PCSCE-ALLXX-01	ANN104156	LIFE FITNESS
EE0042	TREADMILL	321	PCSTE-DOMLN-02	DTN105179	LIFE FITNESS
EE0043	TREADMILL	321	PCSTE-DOMLN-02	DTN300833	LIFE FITNESS
EE0044	CYCLE, RECUMBENT	321	PCSRE-ALLXX-01	ANN302728	LIFE FITNESS
EE0045	CROSS TRAINER, ELLIPTICAL	321	PRO3700	L08101601762	OCTANE
EE0046	CROSS TRAINER, ELLIPTICAL	321	PRO3700	L09071602791	OCTANE
EE0047	CROSS TRAINER, ELLIPTICAL	321	PRO3700	L09071602779	OCTANE
EE0048	BARBELL, SET, 400 LBS (HOG-R)	321	HOG-R-400LB	N/A	HAMPTON

265

B309



Appendix A.6 JPL-Provided Equipment

Qty	Description
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2	CalSense Irrigation Remote Controllers
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1	B321 Lighting controller laptop
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1	B321 Elevator programming laptop
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Individually assigned computers, tablets, cell phones, monitors, keyboards, printers, etc.

Appendix A.7 JPL-Provided Software

Qty	Description
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1	ArboPro CD (software)
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Appendix A.8 Roof Data

BLDG	BLDG Name	Year Installed	Age/FY25	Sq Ft.
11	SPACE SCIENCES LABORATORY	2013	12	11,146
18	STRUCTURAL TEST LABORATORY	2018	7	9,256
35	Security Radio Equipment	2003	22	160
67	MATERIAL RESEARCH	2015	10	8,827
79	LOW -TEMP LABORATORY	1999	26	9,907
82	HIGH VACUUM LABORATORY	2012	13	12,807
83	QUALITY ASSURANCE	1999	26	7,965
84	CHEMICAL MATERIALS LABORATORY	2017	8	1,764
90	PYROTECHNICS LABORATORY	2017	8	1,338
103	ELECTRONIC FABRICATION SHOP	2020	5	33,650
107	LASER RESEARCH LABORATORY	2017	8	6,257
111	TECHNICAL INFORMATION	2019	6	26,690
114	ADMINISTRATION	2003	22	4,343
117	LIQUID AND SOLID PROPELLANT LAB.	2008	17	4,654
121	ANALYTICAL INSTRUMENTS LABORATORY	2017	8	2,614
122	ENERGY CONVERSION SYSTEMS	2016	9	5,396
125	COMBINED ENGINEERING SUPPORT	2017	8	28,227
126	INFORMATION SYSTEMS DEVELOPMENT	2024	1	29,202
129	COMBUSTION RESEARCH LABORATORY	2001	24	2,442
138	MISSION OPERATIONS	2000	25	3,000

144	ENVIROMENTAT LABORATORY	2000	25	21,331
148	MAGIZINE - PROPELLANT	2002	23	3,400
149	ENERGY CONVERSION LABORATORY	2017	8	2,937
150	ENERGY CONVERSION DEVELOPMENT	2003	22	18,264
156	COMPUTER PROGRAM OFFICES	2008	17	12,838
157	APPLIED MECHANICS	2006	19	15,745
158	MATERIALS RESEARCH PROCESSING LAB.	2006	19	11,937
159	PUMP HOUSE (WATER)	2001	24	675
161	TELECOMMUNICATIONS LABORATORY	2008	17	18,824
167	CAFETERIA	2018	7	8,990
168	INSTRUMENTS SYSTEMS	2002	23	8,500
169	EARTH SPACE SCIENCE	2002	23	8,400
170	FABRICATION SHOP	2019	6	31,600
171	MATERIAL SERVICES	2018	7	19,046
177	TRANSPORTATION	1999	26	5,669
179	SPACECRAFT ASSEMBLY FACILITY	2024	1	39,701
180	ADMINISTRATION	2010	15	17,659
183	PHYSICAL SCIENCES LABORATORY	2017	8	6,743
184	PROGRAMMING OFFICE	2018	7	2,512
185	PUBLIC OUTREACH ADMINISTRATION	2018	7	2,225
186	ELECTRONIC LABORATORY ANNEX	2003	22	19,343
189	PROCUREMENT OFFICES	2014	11	2,693
190	GUARD SHELTER South Gate	2008	17	7,845
197	SOLID PROPELLANT ENGINEERING LAB.	1997	28	9,178
198	CONTROL SYSTEMS LABORATORY	1998	27	14,939
199	CELESTRIAL SIMULATOR			3,050
200	FACILITIES ENGINEERING & SERVICE	2024	1	16,215
201	ADMINISTRATIVE SUPPORT SYSTEMS	2016	9	6,273
202	PROCUR. & COMMUNICATIONS SUPPORT	2008	17	8,163
212	ANTENNA LABORATORY	2020	5	3,677
224	SEWER STATION	2009	16	160
226	SEWER STATION			100
227	SOLVENT STORAGE			160
229	PISTOL RANGE STORAGE			371
230	SPACE FLIGHT OPERATIONS COMMAND FAC	2006	19	29,336
231	MICROWAVE TECHNOLOGY SUPPORT	2008	17	4,334
233	SYSTEMS DEVELOPMENT	2002	23	30,825
234	STORAGE	2016	9	9,903
238	TELECOMMUNICATIONS	2003	22	12,645
239	PROPELLANT CONDITIONING LAB	2001	24	860
241	RECEIVING & SHIPPING & ADMIN	1999	26	14,489
243	REMOTE ANTENNA RANGE CONTROL			922
244	CHEMICAL ENGINEERING	2003	22	2,871
245	SPECTROSCOPY LABORATORY	2020	5	1,987

248	TEN-FOOT SPACE SIMULATOR	2003	22	5,327
249	VISITORS RECEPTION	2000	25	4,873
250	MAIN GUARD SHELTER west gate	2010	15	199
251	GYRO LABORATORY	2008	17	7,250
253	MAGNETIC LABORATORY	2008	17	1,575
256	MODEL RANGE CONTROL			385
257	MAIN GUARD SHELTER west gate			256
259	LIQUID NITROGEN BOTTLING STORAGE			567
260	ILLUMINATOR EQUIPMENT			302
262	RADIOMETER			107
264	SPACE FLIGHT SUPPORT	2008	17	15,314
264	SPACE FLIGHT SUPPORT	2022	3	567
268	PUMP HOUSE	2010	15	817
271	OIL STORAGE			294
272	EAST ILLUMINATOR			106
275	PYROTECHNIC STORAGE			328
276	PROPELLANT STORAGE			352
277	ISOTOPE THERMOELECTRIC SYS. LAB.	2010	15	10,593
279	GUARD SHELTER South Gate			36
280	STATIC TEST FACILITY			1,440
284	TRANSPORTATION FACILITY OFFICE			1,225
286	GUARD STATION east gate	2010	15	101
287	GUARD ISLAND east gate			30
288	PROJECT EQUIPMENT STORAGE	2008	17	1,500
289	MAIN SEWAGE LIFT STATION			951
290	ANTENNA INSPECTION			596
291	ACQUISTIONS ADMN SUPPORT	2004	21	4,234
294	GUARD SHELTER (VISITORS LOT)			30
295	ANTENNA TEST FACILITY			181
298	FREQUENCY STANDARDS LAB	2002	23	8,718
299	ASSEMBLY HANDLING & SHIPPING EQUIP.	2006	19	9,000
300	EARTH & SPACE SCIENCE LABORATORY	2006	19	32,255
301	CENTRAL ENGINEERING	2010	15	45,840
302	MICRODEVICES LABORATORY	2007	18	24,658
303	ENGINEERING SUPPORT BUILDING	2008	17	16,947
305	HAZARDOUS WASTE/CRYOGENIC STORAGE	2004	21	2,438
305	HAZARDOUS WASTE/CRYOGENIC STORAGE	2004	21	2,438
306	OBSERVATIONAL INSTRUMENTS LAB	2008	17	5,250
306	OBSERVATIONAL INSTRUMENTS LAB	2014	11	2,000
306	OBSERVATIONAL INSTRUMENTS LAB	2016	9	15,750
309	MAINTENANCE STORAGE FACILITY			3,496
310	Emergency Services Facility - Bldg. 310			12,000
312	SHELTER MAINTENANCE FACILITY			1,678
313	ENVIRONMENTAL TESTING	2010	15	3,969

315	COOLING TOWER SOUTHERN SECTOR			345
316	HAZARDOUS MATERIALS STORAGE FACILITY			2,000
317	In-Situ Instruments Lab	2022	3	6,450
318	Optical Interferometry Development Laboratory (OID)	2006	19	14,494
320	Environmental Test Laboratory Support Facility			1,600
321	Flight Center	2009	16	35,469
323	Monolithic Microwave Intergrated Circuit Assembly	2005	20	4,350
324	Recycling Facility			1,350
325	Flight Hardware Logistics			4,153
336	MARS YARD			1,200
338	Nitrogen Facility Office			250
340	West Pre-Inspection Guard Station			70
344	General Storage Facility			150
350	Flight Electronics Integration Facility	2025	0	86,820
353	Lithium Battery Test Laboratory	2018	6	3600
355	Modular Data Center	2020	4	
357	Netted Aerial Robotic Testing Facility			
1706	Trailer			1,650
1710	Trailer			1,650
1712	Trailer			1,650
1713	Trailer			550
1716	Trailer			5,040
1717	Trailer			720
1719	Trailer			1,440
1720	Trailer	2001	24	12,240
1721	Trailer			2,880
179 N		2021	4	9,925

Appendix A.9

Systems Data

Electrical and other systems data are shown in Appendixes A.1 through A.21.

Appendix A.9.1

High Voltage Distribution System

High Voltage Distribution System

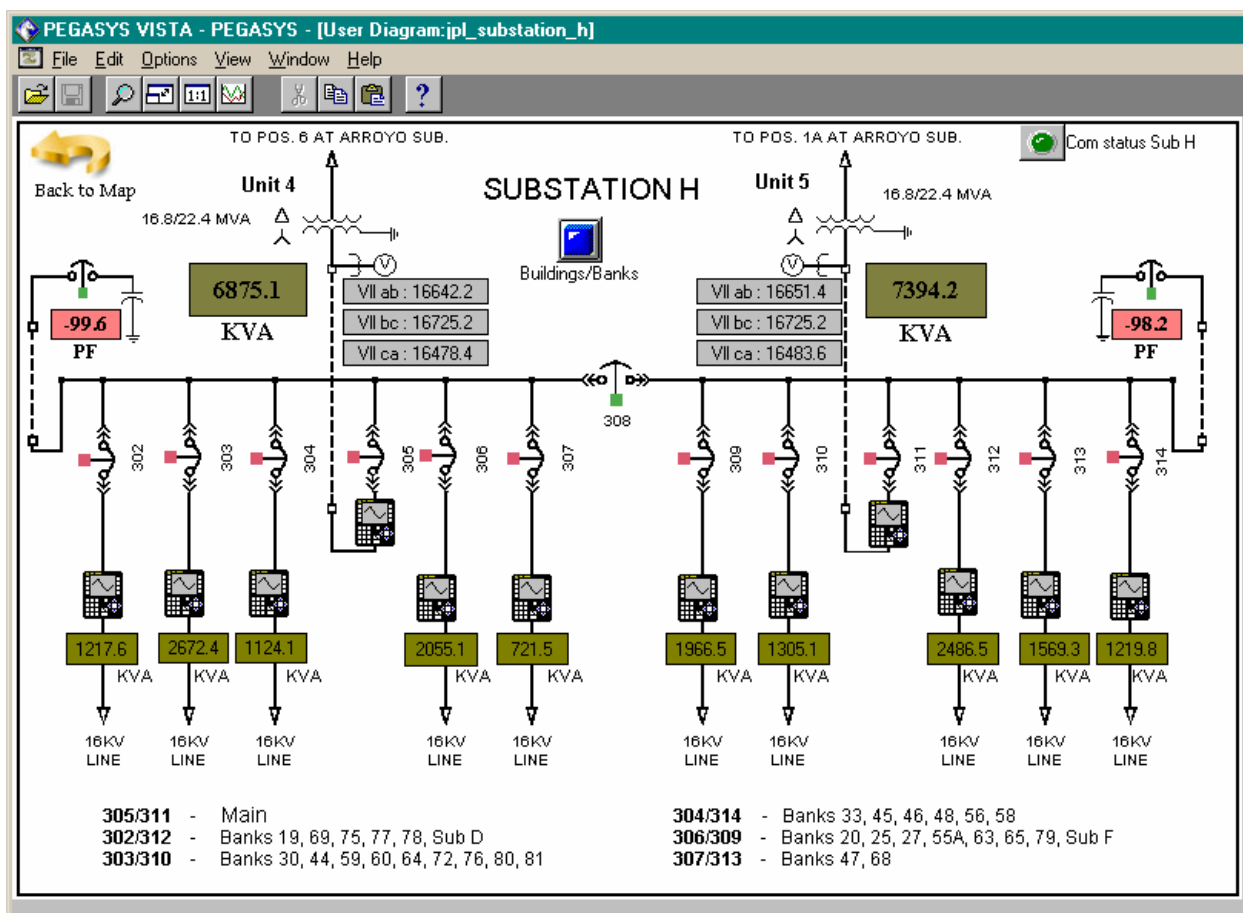
Southern California Edison Co. (Edison) supplies 66 kV electrical power to JPL via the Edison Arroyo Sub-station located on an easement within the JPL site boundaries. The Arroyo Sub-station is fed from three separate Edison sub-transmission sources – Gould, Eagle Rock and La Canada Sub-stations.

JPL receives its power from the Arroyo Sub-station into a JPL-owned Sub-station (Sub-H) at 66 kV under the TOU-8 tariff. Two 22.5 MVA transformers step down the voltage to 16.5 kV for distribution via underground cables to various substations and banks.

Sub-station H feeds 16.5 kV power to one Switching Station and 43 transformer banks that step down voltage to 480 V and 2.4 kV (only one transformer steps down to 2.4 kV) .

Annual electrical consumption averages about 95 Million kWh.

The following graphic from JPL's Power Monitoring System shows an outline of the circuits fed from Sub-H.



ELECTRICAL BANKS

6, 7, 8, 9, 10, 13, 14, 16, 19, 20,
24, 25, 27, 30, 33, 34, 44, 45, 46, 47,
48, 51, 52, 55, 56, 58, 59, 60, 63, 64,
65, 68, 69, 72, 74, 75, 76, 77, 78, 79,
80, 81, 82, 83, SUB H, SWITCHING STATION NORTH

Appendix A.9.2 Meters

JPL Meter Summary	
	Quantities
Substation H Meters	13
Switching Station North Meters	10
Electric Building & Bank Meters	175
EV Meters	4
PV Meters	3
Natural Gas Smart Meters	71
Natural Gas Manual Read Meters	22
CHW BTU Meters	26
CDW BTU Meters	25
HHW BTU Meters	14
Medium Temp BTU Meters	1
Cooling Tower Blow Down & Make Up Meters	33
Irrigation Flow Meters	11
Total Meters	408
<i>details in Maximo as needed</i>	

Appendix A.9.3 Battery Banks

BATTERY BANKS		
BUILDING	LOCATION	CELLS
150	PUMP ROOM	20
157	2nd FLOOR CHASE	27
179	NORTH M.R. (UNIT 1)	16
179	NORTH M.R. (UNIT 2)	8
179	NORTH M.R. (UNIT 3)	8
179	SOUTH M.R.	30
202	ROOM 104	12
233	2nd FLOOR M.R.	6
238	BANK 55	18
SUB-H	WEST OF B-300	60
SS-N	WEST OF B-18	40
BANK 74	230	60

Appendix A.9.4

Transformer Banks & Buildings Served

	Sub-H Circuits				
SS-N	T-4	T-5	Bank #	Bank Location	Building Loads
Circuits	North	South			
416	306		10	East of B18	18, 280, 288
416	306		27	West of B114	111, 114, 114A, 156, 184, 185, 161
416	306		65	East of B125	122, 125, 189, 199, 229, (296 Tower Cross Tie), T1719, T 1720
416	306		79	N/W of B298	251, 253, 298
419		309	14	West of B288	79, 310, T1704, T1705, T1706, T1707, T1708
419		309	20	N/E of B126	126, West Parking Lot
419		309	55	1st Floor B238	238
419		309	63	South of B18	82, 83, 84, 129, 177, 259, 284, (296 Tower Cross Tie)
426	306		6	N/E of B245	245, 337, Mesa Road Antenna & New Dist. Panel @ old Bank 54 location.
426	306		7	East of B138	67, 138, (355 MDC)
426	306		8	East of B313	150, 313
426	306		25	South of B148	148,149,166 Tower, 220,246,325,344,T1709,1710,1711,1712
426	306		34	North of B248	227, 248, 267, 268
429		309	9	West of B144	144, 228, T1716, T1717
429		309	24	South of B299	90, 117, 140, 141, 299, 312, 323
429		309	52	South of B212	35, 212, 243, 256, 260, 262, 272, 273, 290, 295, 347
	302		13	North of B305	86, 87, 88, 89, 98, 143, 145, 197, 237, 239, 244, 275, 267, 305, (336 Mars Yard)
	302		69	East of B277	277, 333
	302		77	1ST S/E B302	103, 302
	302		83	North of B-350	350
		312	19	N/E of B277	11, 107, 121, 159, 173, (285 East Bridge), 286, 287, 316, East Parking Lot, 175 & (258 Water Tanks)
		312	75	South of B300	300, 309
		312	78	1st Floor B303	303, 317
	303		30	West of B291	190, 195, 200, 201, 224, 231, 234, 279, 291

	303		60	East of B171	171, 202, 241, 308
	303		72	S/E B179	179
	303		76	East Parking B301	301
	303		81	N/W OF B315	315 Cooling Tower
		310	16	Basement of B321	321
		310	44	South of B158	158
		310	59	South of B157	157
		310	64	North of B170	170, 271
		310	80	East of B306	306, 324, 349
		310	82	West of B318	318
	304		45	North of B168	168, 186, 249, 250, 257, 270, 294
	304		48	Pit North of B233	233
	304		58	1st Floor B183	183
		314	33	N/W OF B198	198
		314	46	Basement of B180	167, 180, 293
		314	56	South of B169	169, 289, T1721
	307		47	B230 Rm B88	230
	307		51	B230 Rm B68	230
	307		74	East of B230	230
		313	68	1st Floor B264	264

Appendix A.9.9 Stationary Generators and ATS/MTS

	Asset	Model	Building	Fuel	Make	KW	HP	BHP
1	G8224	DSKBA-1955029	35-Mesa	Diesel	Cummings	20	38	
2	G8150	350REOZD	150	Diesel	Kohler	355	476	550
3	G8232	DSGAA-4215043	150	Diesel	Cummins	100	134	160
4	G8242	3306	150/144	Diesel	Cat	250	335	377
5	G8225	3116	159	Diesel	Cat	125	168	192
6	G8221	DS00030D6SGTK0664	177	Diesel	MTU	30	47	36
7	G8000	6068HF485	179-S	Diesel	Kohler	200	268	315
8	G8231	89A02253-S	180	NG	Generac	30	40	
9	G8230	89A02194-S	183	NG	Generac	30	40	

10	G3454	C15	202-S	Diesel	Cat	568	671	671
11	G8220	DS00030D65SRAK0664	346	Diesel	MTU	30	47	61
12	G8247	3304	224	Diesel	Cat	125	168	186
13	S2208	3516	230-X	Diesel	Cat	1500	2,011	2151
14	S2209	3516	230-Y	Diesel	Cat	1500	2,011	2151
15	S2210	3516	230-Z	Diesel	Cat	1500	2,011	2151
16	G2395	100RZG	244	NG	Kohler	100	134	144
17	G8139	DGBC4478023	249	Diesel	Onan	40	54	68
18	G8159	C18	277	Diesel	Cat	600	825	90
19	G0461	40RE0ZJB	286	Diesel	Kohler	40	54	
20	G8217	A225810006	298	NG	Kato	235	315	450
21	G8229	DFEK 1206470	302	Diesel	Cummings	500	755	535
22	G8238	LSG-8751-6005-A	308	NG	Kohler	80	107	132
23	G8145	400ROZD	310	Diesel	Kohler	405	543	568
24	G8250	5U936C	340	Unleaded	Generac	5.5	7	
25	G3735	D200-2	126-N	Diesel	Cat	200	27	27
26	G3733	30REOZK	170	Diesel	Kohler	31	42	42
27	G3906	C4.4	245	Diesel	Cat	40	54	54
28	G8252	DXGNR7000	257	Unleaded	Dewalt	7	9	9
29	G7572	C18 PKAM	350	Diesel	Cat	500		
30	G4152	8V1600 DS400	355	Diesel	MTU	400	536	600

Transfer Switches			
	Generator	Location	Transfer Switch
1	G-8224	35-Mesa	ATS
2		35-Mesa	ATS-1
3	G-3735	126	ATS
4	G-8150	150/248	ATS-1
5		150/248	ATS
6	G-8232	150/248	MTS
7	G-8242	150/144	ATS
8	G-8225	159	MTS
9	G-3733	170	ATS
10	G-8221	177	ATS
11	G-8000	179	ATS
12	G-8231	180	ATS
13	G-8230	183	ATS
14	G-3454	202/171	ATS
15	G-8247	224	ATS
16	S-2208	230-X	PCC
17	S-2209	230-Y	PCC
18	S-2210	230-Z	PCC
19	G2395	244	ATS
20	TBD	245	ATS
21	TBD	248	MTS
22	G8139	249	ATS
23	TBD	257	N/A
24	G8886	268	N/A
25	G-8159	277	ATS-1
26	G0461	286	ATS
27	G-8217	298	ATS
28	G-8229	302	ATS-1
29	G8238	308	ATS
30	G-8145	310	ATS
31	G8250	340	MTS
32	G8220	345	ATS
33	TBD	350	ATS (1)
34	TBD	350	ATS (2)
35	TBD	355	ATS

Appendix A.9.10

Operating Procedures for Maintenance of Substation "H"

This procedure shall be followed when performing maintenance on Substation "H".

1. Prior to **scheduling** any work at the sub-station, the following actions shall be taken:

- (a) Seek approval from JPL CTM or Designee.
- (b) Check mission criticality in Buildings 230 and 264.
- (c) Publish pertinent information in "This Week" to inform laboratory community of schedule and possible impacts.

2. OPERATING PRINCIPLE:

Under normal operating conditions, electrical loads on Circuit 305 (North Main) and Circuit 311 (South Main) are divided approximately equally. When performing maintenance, all transformer banks and substations are switched to either the North Main, Circuit 305 or the South Main, Circuit 311.

3. PROCEDURE:

The following steps will be followed when performing maintenance on either the North or South bus bars.

DE-ENERGIZING CIRCUITS

The following steps will de-energize the circuit/s to be serviced.

- a. Inform Southern California Edison switchyard personnel of date and times of shutdown and start-up, at least two (02) working days prior to the scheduled date.
- b. One day prior to the shutdown:
 - 1. Close the tie-breaker in Substation "H".
 - 2. Transfer all building circuits on the affected bus bar to the opposite bus bar, which will remain energized.
 - 3. Lock all de-energized circuits (banks and substations) in the open position.
 - 4. Put all keys in lock box (lock out/tag out).
- c. Day of shutdown:
 - 1. All crew members meet at substation "H"
 - 2. Inform JPL Guard Console just prior to commencing switching at the sub-station.
 - 3. Open tie-breaker, rack out and lock.
 - 4. Open capacitor bank on de-energized circuit.
 - 5. Close de-energized ground for capacitor bank.
 - 6. Check auto transfer is ON (**GREEN** light ON).
 - 7. Hold test button for 15 seconds to transfer to emergency (**RED** light ON).
 - 8. Disable auto transfer switch and place in Manual mode (normally in Automatic position).
 - 9. Switch voltage selector switch to bus bar that will remain energized.

10. Open Circuits on the Main to be de-energized. [(North Main) 302, 303, 304, 306, 307 and 305 **or** (South Main) 312, 310, 314, 309, 313 and 311.]
11. Request Southern California Edison personnel to open the breaker on the transformer serving side of the bus bar to be de-energized [Unit 4 (T2304) **or** Unit 5 (T2305)].
12. Check for voltage at disconnect to be de-energized. [Unit 4 **or** Unit 5.]
13. Open 66kV disconnect on de-energized transformer [Unit 4 **or** Unit 5.]
14. Ground line side of the de-energized disconnect switch [Unit 4 **or** Unit 5.]
15. Lock out de-energized disconnect [Unit 4 **or** Unit 5.]
16. Ground de-energized Main circuit.
17. Check voltage at the rear of each cubicle section and apply ground to de-energized circuit.
18. The substation is now ready for maintenance on the de-energized circuit.

RESTORING POWER BACK TO NORMAL

The following steps will return circuits back to normal operation.

Substation Preparation

1. Remove all electrical grounds, tools and materials.
2. Close all cubicle doors.
3. Lock each cubicle on the rear side of the de-energized circuit.
4. Rack in breakers on the de-energized bus bar.
5. Remove electrical grounds from de-energized 66kV disconnect [Unit 4 or Unit 5]
6. Close 66kV disconnect of the de-energized circuit.
7. Request Southern California Edison personnel turn power ON to de-energized breaker [Unit 4 or Unit 5].
8. Inform JPL Guard Console of status.
9. Close de-energized Main. [Circuit 305 or 311].
10. Check for voltage on energized Main. [Circuit 305 or 311].
11. Close circuits on just-energized side of the bus bar. [Circuits 302, 303, 304, 306 and 307 **or** 312, 310, 314, 309 and 313].
12. Open ground for capacitor bank on the just-energized side of the bus bar.
13. Close capacitor bank on the just-energized side of the bus bar.
14. Close tie-breaker.
15. Switch loads in the field (transformer banks and substations) and achieve approximate balance across the two bus bars.
16. Open tie-breaker.
17. Inform JPL Guard Console of status.

Appendix A.10 Water Distribution Site Plan

JPL's water distribution site plan is in a separate file: Attachment 4 Water Distribution Site Plan

Appendix A.11 Blank

Appendix A.12 Blank

Appendix A.13 Blank

Appendix A.14 Crane and Hoist Inventory

ASSET #	DESCRIPTION	LOCATION	TONS	CRANE SN	MANUFACTURER
C0180	CRANE, BRIDGE, 10-TON, # 014580	18-104	10	9350517	KONECRANES
C0181	CRANE, BRIDGE, 1-TON	18-102	1	A4469	CHECO
C0182	CRANE, BRIDGE, 5-TON, #014580	18-104	5	9350516	KONECRANES
C0183	CRANE, BRIDGE, 10-TON, #014575	18-110	5	9150346	KONECRANES
C0790	CRANE, 3-TON, BRIDGE, # 005	79-100	3	47257 11800109701	CRANEVEYOR
C0791	HOIST, JIB, 2-TON, #004	79-DOCK	2	66489-1	ABELL-HOWE
C0792	CRANE, MONORAIL, 1-TON, # 006	79-104	1	FLG-M	DUFF NORTON
C0793	CRANE, BRIDGE, 1,000-LBS, # 008	79-107	1/2	45147	CRANEVEYOR
C0794	CRANE, BRIDGE, 3-TON, # 007	79-106	3	44039	CRANEVEYOR
C0795	CRANE, HOIST, 1/4-TON, # 053128	79-105	1/4	N/A	MASSDAM
C0820	CRANE, HOIST, 500-LBS, # 009	82-116	1/4	JLA-161-VK-F	YALE
C1440	CRANE, BRIDGE, 10-TON, # 012	144-100	10	49373881	CHECO
C1441	CRANE, BRIDGE, 10-TON, # 013	144-99	10	3555	CHECO
C1442	CRANE, MONORAIL, 2-TON, # 014	144-119	2	4178	WESTERN
C1444	CRANE, BRIDGE, 1-TON, # 015	144-102	1	4014141WR1-C-105-YPD	CRANEVEYOR
C1447	CRANE, GANTRY, 1-TON	144-103D	1	100915834	KONECRANES
C1480	HOIST, JIB, 1-TON, # 016	148-ROOF	1	1044	DEMAG
C1500	CRANE, BRIDGE, 10-TON, # 017	150-1000	10	B-2859-D	CHECO
C1501	CRANE, BRIDGE, 10-TON, # 018	150-100C	10	B-2859-C	CHECO
C1502	CRANE, MONORAIL, 5-TON, # 020	150-100	5	T44183-MIT44183	P&H
C1503	CRANE, BRIDGE, 3-TON, # 019	150-100	3	CHL19124-8	P&H
C1504	CRANE, MONORAIL, 1-TON, #20	150-101	1	602095-M	P&H
C1505	CRANE, MONORAIL, 1-TON, #21	150-101	1	L5522XV-M	C&M CRANE
C1571	CRANE, GANTRY, 1,000-LBS, # 072	157-102	1/2	05-68341-1	CALDWELL
C1580	CRANE, BRIDGE, 1000-LBS, # 022	158-ROOF	1/2	2417	CONTRX
C1700	CRANE, BRIDGE, 3.5-TON, # 028	170-125	3.5	A4129	CHECO
C1701	CRANE, BRIDGE, 3-TON, # 027	170-130	3	Y36038-B	AMER-MONO
C1702	CRANE, BRIDGE, 1-TON, # 025	170-132	1	L-28CH3-B	AMER-MONO
C1703	CRANE, BRIDGE, 2-TON, # 026	170-137	2	26985-B 126985	ELECTRO-LIFT
C1704	CRANE, MONORAIL, 1500-LBS, # 024	170-212	3/4	L-3748SJ-M	CM

C1705	CRANE, MONORAIL, 1500-LBS, # 023	170-213	3/4	L-0849LJ-M	CM
C1790	CRANE, MONORAIL, 15-TON, # 029	179-AIR.	15	HKW22026-M	KONECRANES
C1791	CRANE, BRIDGE, 15-TON, # 031	179-HB1	15	3619.1	P&H
C1792	CRANE, BRIDGE, 15-TON, # 030	179HB2	15	34028EG1-8	WESTMONT
C1793	CRANE, HOIST, 1.5-TON, # 032	179-301	1.5	287821-F 1287821	HARRINGTON
C1795	CRANE, HOIST, 1/2-TON, # 053130	179-HB2	1/2	L-4034-RH-F	CM
C1800	CRANE, GANTRY, 1,000-LBS, # 033	180-ROOF	1/2	GJ-200-G	DAYTON
C1830	CRANE, MONORAIL, 1-TON, # 035	183-104	1	6-65-8946-F	BUDGIT
C1831	CRANE, MONORAIL, 2-TON, # 036	183-OUT	2	L-190S1-M	CM
C1832	CRANE, HOIST, 800-LBS, #034	183-214	.4	40981379-F	THERN
C1833	CRANE, HOIST	183-167	1	E0910281 M	KONECRANES
C1834	CRANE, HOIST	183-624	1	00154194-M	HARRINGTON
C2121	CRANE, MONORAIL, 40', # 039	212-115	1	61505071-M	DEMAG
C2122	CRANE, MONORAIL, 60', # 040	212-116	1	61505072-M	DEMAG
C2123	CRANE, HOIST-TOWER, 1/2-TON	212-MESA	1/2	27916E	DETROIT HOIST
C2300	CRANE, BRIDGE, 5-TON, # 041	230 BSMT.	5	V31429-B	WRIGHT
C2330	CRANE, BRIDGE, 5-TON, # 044	233-180	5	A4469	CHECO
C2331	CRANE, HOIST, 2-TON, 233-140 NE	233-140 NE	2	12-67-32225-F	BUDGIT
		233-140			
C2332	CRANE, 2-TON, HOIST, 233-140 SW	SW	2	12-67-32223-F	BUDGIT
C2333	CRANE, BRIDGE, 1-TON, # 045	233-103	1	403594-1	CRANEVEYOR
C2334	CRANE, 1-TON, BRIDGE, # 046	233-114	1	403594-2	CRANEVEYOR
	CRANE, MONORAIL, 1000-LBS, #				
C2380	041	238-105	1/2	EC1-A-180-EYD-M	COFFING
C2381	CRANE, MONORAIL, 1-TON, # 049	238-213	1	050-42476-00-M	IR
C2382	CRANE, HOIST, 1000-LBS, #047	238-212	1/2	EC1A181EYD-F	COFFING
C2480	CRANE, BRIDGE, 5-TON, # 051	248-100	5	V-25106-B	NATIONAL
C2481	CRANE, 1.5-TON, #052	248-203	1.5	V28247-M	WRIGHT
C2771	HOIST, BRIDGE, 3-TON, # 057	277-82	3	1045	CHECO
C2772	CRANE, BRIDGE, 1-TON, # 056	277-118	1	1045	CHECO
C2800	CRANE, BRIDGE, 5-TON, # 058	280-101	5	H30887-B	AMERICAN
C2960	CRANE, MONORAIL, 2-TON, # 059	296	2	H-4890-M	P&H
C2990	CRANE, BRIDGE, 1-TON, # 071	299-100	1	403633	CRANEVEYOR
		300-MEZZ-			
C3001	CRANE, MONORAIL, 500-LBS, # 060	1	1/4	34-15-54568-M	ACCO
		300-MEZZ-			
C3002	CRANE, MONORAIL, 500-LBS, # 061	2	1/4	34-15-54567-M	ACCO
C3060	CRANE, BRIDGE, 5-TON, # 062	306-134	5	2020 IL1-72567	KONE
C3061	CRANE, BRIDGE, 2-TON, # 063	306-135	2	489453-B J 489453	HARRINGTON
C3062	CRANE, BRIDGE	306-134A		58623274	KONECRANES
C3130	CRANE, BRIDGE, 10-TON, # 064	313-100	10	927428 1902753	FACILITIES ENG.
C3131	CRANE, BRIDGE, 10-TON, # 065	313-100	10	927428	FACILITIES ENG.
C3170	CRANE, BRIDGE, 2-TON, #066	317-101	2	A0104970-8	ACE
C3180	CRANE, BRIDGE, 5-TON, #067	318-126	5	SGTR-14	CRANE AMERICA
C3440	CRANE, BRIDGE, 5-TON	344-100	5	407122	CRANEVEYOR

C3441	CRANE, BRIDGE, 10-TON	344-AIRLOCK	10	104177	FACILITIES ENG.
CPGY1	CRANE, GANTRY, PORTABLE, 5-TON, # 012	(PORTABLE)	5	N/A	SPANCO CRANE

M0499	HOSE, TROLLEY AND RAIL SYSTEM	310-138A	NEDERMAN	2154048	1221732
M0552	HOIST, ELECTRIC CHAIN	238-213	INGERSOLL-RA	Q50-2ND100P10-6A4	Q50-42476-00

Appendix A.15 Power Certification

Power reliability within the SFOF facilities (Buildings 230 & 264) is critically important not only to flight projects, but also to JPL. When power problems occur, up-to-date documentation shall be readily available to permit rapid problem isolation and repair. To ensure that the appropriate level of attention is applied to power installations within these two buildings, the following procedures shall be followed.

1. Receive customer call and generate a work order from the CMMS
2. Go to the job site, identify equipment, and verify if required power is available.
3. If surge-protected outlet strip is at the site, trace the circuit with “circuit tracer” to ensure proper identification of the power panel/PDU and circuit breaker.
4. Inspect power cords and equipment; ensure total connected load does not exceed the outlet strip’s ampacity.
5. Fill out certification sticker and attach to all connected loads (CPU, monitors, peripherals, and printers). Record equipment NASA number or DNS number and enter the required information into the Circuit Finder Data Base.

Appendix A.16 Elevator Inventory

	Building	Description	Type	Make	Year Installed	Age/2023
1	79	ELEVATOR, ELECTRIC, SCREW DRIVE, pass		PORCH LIFT	1948	75
2	79	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	MONTGOMERY	1997	26
3	111	LIFT, HANDICAP, pass		PORCH LIFT	1950	73
4	125	ELEVATOR, HYDRO-ELECTRIC, freight	Hydro	UNITED ELEVA	1955	68
5	126	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	Montgomery IMCE	1953	70
6	150	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	ERM	1963	60
7	157	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Otis	1965	58
8	168	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Otis	1963	60

9	168	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Otis	1963	60
10	169	ELEVATOR, ELECTRIC-TRACTION, freight	Traction	Otis	1965	58
11	170	LIFT, HANDICAP, pass		PORCH LIFT	1963	60
12	171	ELEVATOR, ELECTRIC-TRACTION- freight	Traction	WESTINGHOUSE	1965	54
13	171	ELEVATOR, HYDRO-ELECTRIC #2- pass	Hydro	DOVER	1969	58
14	179	ELEVATOR, Hydro pass #2	Hydro	Inter Industries		16
15	179	LIFT, HANDICAP, ELECTRIC CHAIN DRIVE, #1		Garaventa	2007	16
16	180	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Otis	1963/2013	60/10
17	180	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Otis	1963/2013	60/10
18	180	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Otis	1963/2013	60/10
19	183	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Otis/MCE	1965	58
20	183	ELEVATOR, ELECTRIC-TRACTION, freight	Traction	Otis/MCE	1965	58
21	186-AEX	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	SUPERIOR		8
22	190	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	AMTECH RELIA	1990	33
23	198	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Millar/MCE	1961	62
24	212	ELEVATOR, HYDRO-ELECTRIC	Hydro	ERM	1961	62
25	230	ELEVATOR, ELECTRIC-TRACTION-pass	Traction	Otis	1984	54
26	230	ELEVATOR, ELECTRIC-TRACTION, freight	Traction	U.S. ELEVATO	1969	54
27	230	ELEVATOR, HYDRO-ELECTRIC-freight	Hydro	Coast Elevator	1969	39
28	230	LIFT, HANDICAP, pass		Garaventa	1969	54
29	233	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	ERM/Armor	1971	52
30	238	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	OTIS/MCE	1965	58
31	238	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	OTIS/MCE	1965	58
32	238	ELEVATOR, ELECTRIC-TRACTION, freight	Traction	Otis	1965	58
33	264	ELEVATOR, ELECTRIC-TRACTION, freight	Traction	Dover/Mont	1975	48
34	264	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Dover/Mont	1975	48
35	264	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Dover/Mont	1975	48
36	277	ELEVATOR, HYDRO-ELECTRIC, freight	Hydro	U.S. ELEVATO	1971	52
37	300-BSE	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	MONTGOMERY	1988	35
38	301	ELEVATOR, HYDRO-ELECTRIC, freight	Hydro	MONTGOMERY	1986	37
39	301	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	MONTGOMERY	1986	37
40	301	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	MONTGOMERY	1986	37
41	301	LIFT, HANDICAP, SCREW DRIVE, pass		PORCH LIFT	1986	37
42	302	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	WESTINGHOUSE	1986	37
43	303	ELEVATOR, HYDRO-ELECTRIC, freight	Hydro	MONTGOMERY	1988	35
44	303	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	MONTGOMERY	1988	35
45	306	ELEVATOR, ELECTRIC-TRACTION, freight	Traction	Dover/Mont	1992	31
46	306	ELEVATOR, ELECTRIC-TRACTION, pass	Traction	Dover/Mont	1992	31
47	310	ELEVATOR, HYDRO-ELECTRIC, pass	Hydro	Elite	1999	24
48	317	ELEVATOR, HYDRO-ELECTRIC, freight	Hydro	Millar	2000	23
49	321	ELEVATOR, pass	Traction	Otis	2009	14
50	321	ELEVATOR, pass	Traction	Otis	2009	14

51	321	ELEVATOR, pass	Traction	Otis	2009	14
52	321	LIFT, HANDICAP, pass		Garaventa	2009	14
53	325	ELEVATOR, LIFT, 1.5-TON, freight/material only	Hydro	McKinney	2002	21
54	349	ELEVATOR, TRACTION, PASSENGER, #1	Traction	Thyssen	2014	9
55	349	ELEVATOR, TRACTION, PASSENGER, #2	Traction	Thyssen	2014	9
56	349	ELEVATOR, TRACTION, PASSENGER, #3	Traction	Thyssen	2014	9
57	350	ELEVATOR, (TYPE) PASSENGER	Traction	(TBD)	2024	
58	350	ELEVATOR, (TYPE) FREIGHT	Traction	(TBD)	2024	
59	350	ELEVATOR, (TYPE) PASSENGER	Traction	(TBD)	2024	

Appendix A.17 Blank

Appendix A.18 Roof Davits

Below are the davits and socket locations (inspected and certified annually):

180

238 roof + (Life lines on cat walks)

264

300

301

303

306

321

350

Below are the horizontal lifeline and anchor points that are inspected twice annually:

156

161

103

251

253

179

183

157

280

Appendix A.19 Building Structure List

				2024
BLDG. #	BUILDING NAME	SF	YR. BUILT	AGE
11	SPACE SCIENCES LABORATORY	9,043	1958	66
18	STRUCTURAL TEST LABORATORY	14,731	1945	79
35	Security Radio Equipment	160	2003	21
35A	Radio/Repeater Complex	160	2002	22
67	MATERIAL RESEARCH	14,523	1945	79
79	LOW -TEMP LABORATORY	21,527	1958	66
82	HIGH VACUUM LABORATORY	11,407	1958	66
83	QUALITY ASSURANCE	10,302	1948	76
84	CHEMICAL MATERIALS LABORATORY	1,415	1948	76
90	PYROTECHNICS LABORATORY	797	1948	76
103	ELECTRONIC FABRICATION SHOP	23,861	1951	73
107	LASER RESEARCH LABORATORY	5,461	1947	77
111	TECHNICAL INFORMATION	44,390	1950	74
114	ADMINISTRATION	9,317	1951	73
114A	Coffee Cart Shelter	240	2005	19
117	LIQUID AND SOLID PROPELLANT LAB.	4,148	1954	70
121	ANALYTICAL INSTRUMENTS LABORATORY	3,543	1956	68
122	ENERGY CONVERSION SYSTEMS	7,373	1951	73
125	COMBINED ENGINEERING SUPPORT	66,114	1958	66
126	INFORMATION SYSTEMS DEVELOPMENT	50,084	1953	71
129	COMBUSTION RESEARCH LABORATORY	2,499	1953	71
138	MISSION OPERATIONS	11,385	1958	66
140	PROPULSION MATERIALS STORAGE	203	1954	70
141	PROPULSION MATERIALS STORAGE	127	1954	70
144	ENVIRONMENTAL LABORATORY	28,734	1966	58
145	MAGAZINE - PROPELLANT	58	1953	71
148	ENERGY CONVERSION LABORATORY	6,611	1956	68
149	ENERGY CONVERSION DEVELOPMENT	5,494	1975	49
150	SPACE SIMULATOR FACILITY	21,489	1962	62
156	COMPUTER PROGRAM OFFICES	23,995	1957	67
157	APPLIED MECHANICS	29,918	1966	58
158	MATERIALS RESEARCH PROCESSING LAB.	29,707	1963	61
159	PUMP HOUSE (WATER)	606	1959	65
161	TELECOMMUNICATIONS LABORATORY	37,273	1958	66
166	Cooling Tower	1,100	1958	66
167	CAFETERIA	37,006	1964	60
168	INSTRUMENTS SYSTEMS	42,132	1963	61
169	EARTH SPACE SCIENCE	42,500	1965	59
170	FABRICATION SHOP	35,533	1963	61
171	MATERIAL SERVICES	74,028	1967	57
175	WATER RESERVOIR	0	1959	65
177	TRANSPORTATION	5,081	1958	66
179	SPACECRAFT ASSEMBLY FACILITY	64,723	1961	63

180	ADMINISTRATION	105,568	1964	60
183	PHYSICAL SCIENCES LABORATORY	96,483	1965	59
184	TELECOMMUNICATIONS	2,066	1959	65
185	PROGRAMMING OFFICE	1,978	1959	65
186	PUBLIC OUTREACH ADMINISTRATION	23,745	1963	61
189	ELECTRONIC LABORATORY ANNEX	3,232	1959	65
190	PROCUREMENT OFFICES	16,451	1960	64
195	GUARD SHELTER South Gate	56	1960	64
197	SOLID PROPELLANT ENGINEERING LAB.	7,987	1962	62
198	CONTROL SYSTEMS LABORATORY	67,172	1961	63
199	CELESTIAL SIMULATOR	3,366	1961	63
200	FACILITIES ENGINEERING & SERVICE	29,491	1961	63
201	ADMINISTRATIVE SUPPORT SYSTEMS	12,000	1963	61
202	PROCUR. & COMMUNICATIONS SUPPORT	17,416	1961	63
212	ANTENNA LABORATORY	10,562	1961	63
220	ICS TERMINAL	38	1964	60
224	SEWER STATION	200	1961	63
226	SOLVENT STORAGE	74	1962	62
227	PISTOL RANGE STORAGE	200	1961	63
228	COOLING TOWER (A & B)	1,225	1961	63
229	SHIELDED ROOM BUILDING	371	1962	62
230	SPACE FLIGHT OPERATIONS COMMAND FAC	160,316	1963	61
231	MICROWAVE TECHNOLOGY SUPPORT	8,353	1964	60
233	SYSTEMS DEVELOPMENT	43,313	1964	60
234	LUMBER STORAGE	2,133	1963	61
237	COOLING TOWER	500	1962	62
238	TELECOMMUNICATIONS	84,174	1965	59
239	PROPELLANT CONDITIONING LAB	860	1964	60
241	RECEIVING & SHIPPING & ADMIN	26,752	1963	61
243	REMOTE ANTENNA RANGE CONTROL	1,298	1965	59
244	CHEMICAL ENGINEERING	3,680	1964	60
245	SPECTROSCOPY LABORATORY	4,159	1965	59
248	TEN-FOOT SPACE SIMULATOR	7,473	1965	59
249	VISITORS RECEPTION	4,873	1966	58
250	MAIN GUARD SHELTER west gate	210	1966	58
251	GYRO LABORATORY	6,280	1965	59
253	MAGNETIC LABORATORY	1,552	1965	59
256	MODEL RANGE CONTROL	597	1965	59
257	MAIN GUARD SHELTER west gate	35	1966	58
258	WATER RESERVOIR	0	1965	59
259	LIQUID NITROGEN BOTTLING STORAGE	567	1966	58
260	ILLUMINATOR EQUIPMENT	479	1968	56
262	RADIOMETER	49	1968	56
264	SPACE FLIGHT SUPPORT	122,264	1971	53
267	WATER RESERVOIR		1969	55
268	PUMP HOUSE	640	1969	55
271	OIL STORAGE	162	1968	56

272	EAST ILLUMINATOR	106	1970	54
273	ANTENNA TOWER	110	1969	55
275	PYROTECHNIC STORAGE	328	1970	54
276	PROPELLANT STORAGE	352	1970	54
277	ISOTOPE THERMOELECTRIC SYS. LAB.	23,782	1972	52
279	GUARD SHELTER South Gate	27	1970	54
280	STATIC TEST FACILITY	1,440	1972	52
284	TRANSPORTATION FACILITY OFFICE	1,225	1973	51
285	ARROYO BRIDGE	160	1971	53
286	GUARD STATION east gate	120	1972	52
287	GUARD ISLAND east gate	36	1972	52
288	PROJECT EQUIPMENT STORAGE	3,444	1973	51
289	MAIN SEWAGE LIFT STATION	951	1976	48
290	ANTENNA INSPECTION	596	1972	52
291	ACQUISITIONS ADMN SUPPORT	7,492	1974	50
293	INSTRUMENTATION CABLE AMPLIFIER	333	1975	49
295	ANTENNA TEST FACILITY	181	1980	44
296	CENTRAL COOLING TOWER	9,000	1983	41
298	FREQUENCY STANDARDS LAB	18,772	1986	38
299	ASSEMBLY HANDLING & SHIPPING EQUIP.	10,860	1986	38
300	EARTH & SPACE SCIENCE LABORATORY	98,400	1985	39
301	CENTRAL ENGINEERING	201,856	1986	38
302	MICRODEVICES LABORATORY	65,956	1986	38
303	ENGINEERING SUPPORT BUILDING	82,855	1989	35
305	HAZARDOUS WASTE/CRYOGENIC STORAGE	4,900	1989	35
306	OBSERVATIONAL INSTRUMENTS LAB	79,444	1989	35
308	SEWAGE PUMP STATION	654	1993	31
309	MAINTENANCE STORAGE FACILITY	4,000	1995	29
310	Emergency Services Facility - Bldg. 310	21,495	1999	25
312	SHELTER MAINTENANCE FACILITY	1,678	1996	28
313	ENVIRONMENTAL TESTING	3,988	1996	28
315	COOLING TOWER SOUTHERN SECTOR	6,235	1997	27
316	HAZARDOUS MATERIALS STORAGE FACILITY	3,835	1996	28
317	In-Situ Instruments Lab	18,309	2001	23
318	Optical Interferometry Development Laboratory (OID	16,050	2002	22
320	Environmental Test Laboratory Support Facility	1,225	2002	22
321	Flight Center	194,602	2009	15
323	Monolithic Microwave Integrated Circuit Assembly	3,120	2005	19
324	Recycling Facility	1,350	2003	21
325	Flight Hardware Logistics Program Bldg. 325	7,849	2003	21
326	East Mesa Remote Antenna Transmitter	500	N/A	
328	West Pre-Inspection Guard Station check point	36	2005	19
332	Ground Water Treatment Plant	4	2006	18
336	Mars Yard	1,200	2007	17
338	Nitrogen Facility Office	250	2007	17
339	Coffee Kiosk	50	2014	10

340	Traffic Circle Kiosk check point	70	2010	14
344	DHP formerly B322	4,354	2013	11
347	Mesa GNSS Project	0	2012	12
349	Parking Structure	0	2014	10
350	Flight Electronics Integration Facility	86,820	2024	0
353	Lithium Battery Test Laboratory	3600	2018	6
355	Modular Data Center	0	2020	4
357	Netted Aerial Robotic Testing Facility	0	2023	1
T1706	Trailer	1,650	1996	28
T1712	Trailer	1,650	1996	28
T1713	Trailer F	550	1996	28
T1716	Trailer - Modular Office	5,040	1998	26
T1717	Trailer - Rest Room	720	1998	26
T1719	Trailer	1,440	2000	24
T1720	Trailer	12,420	2000	24
T1721	Trailer	6528	2001	23

Appendix A.20 CMMS (Maximo) Inventory List

On attached Excel format

Items not noted on the excel spreadsheet include:

- Exit/emergency/street lighting
- MCC/transformers/breakers/disconnects/banks/ats's/panels
- EMCS jaces/sensors/panels and sound suppression systems
- Fire dampers/ION filters
- Roofs/asphalt
- Irrigations controls and plants

Appendix A.21 PDU/UPS List

#	Asset	Location	Description	Make	Model	Serial #	KVA
1	TBD	126	PDU-3N	Liebert	PPA100C241S2148	M17F090358	100
2	TBD	179-122	PDU	Liebert	PPA075C	M07G090182	75
3	TBD	179-148	PDU 148	Computer Pwr Systems	VPC50	36244	50
4	TBD	183-719	PDU	Liebert	PPA100C	M07G090155	100
5	TBD	198-B7	PDU	MGE	PMN084-42-075	L05-12166	75
6	TBD	198-B9G	PDU	Liebert	SCA050C4	368112-01	50
7	TBD	230-B28	PDU-30	Liebert	PPA050C331S8531	M18H090242	50
8	PDU 3741	230-301A	PDU-1C	ABB	PLXX24-0AAAXAXX-A000A-X0X2-01	E0019443-02	550
9	PDU 3748	230-301A	PDU-1D	ABB	PLXX24-0AAAXAXX-A000A-X0X2-01	E0019443-01	550
10	PDU12601	126-159	PDU-1	Liebert	PPC150C	M07G090196	150
11	PDU15601	156-129	PDU	Liebert	PPA075C	M07G090184	75
12	PDU17102	171-B1	PDU - 17102	Liebert	PPA075C	M07G090154	75

13	PDU17103	171-399A	PDU	Liebert	SCA100C	637095-001	100
14	PDU-2	171-B1	PDU	Emerson / Liebert	PPA075C334A9999	M17J090287	75
15	PDUS2301	230-102D	PDU-23	Liebert	PPA075C	M07G090167	75
16	PDUS23019	230-310 North	PDU-1A	Onyx Power Inc.	98-90530-00	T11-40-US-S-0727	550
17	PDUS2301E	230-304A	PDU-1E	Powersmiths	ES-550-5S250-E20M-480-240-MON-SFM-SPD	SO4003-56144	550
18	PDUS2301F	230-304A	PDU-1F	Powersmiths	ES-550-5S250-E20M-480-240-MON-SFM-SPD	SO4003-56145	550
19	PDUS2301G	230-304A	PDU-1G	Powersmiths	ES-550-5S250-E20M-480-240-MON-SFM-SPD	SO4003-56143	550
20	PDUS2301H	230-304A	PDU-1H	Powersmiths	ES-550-5S250-E20M-480-240-MON-SFM-SPD	SO4003-56146	550
21	PDUS2302	230-102D	PDU-29	Liebert	PPA050C	M07G090166	50
22	PDUS23020	230-310 South	PDU-1B	Onyx Power Inc.	98-90530-00	T11-40-US-S-0728	550
23	PDUS23021	230-B07	PDU-25	Liebert	PPA150C331A8249	M18F090255	150
24	PDUS23024	230-B28	PDU-31	Liebert	PPA225C	710790-001	225
25	PDUS23025	230-B28	PDU-24	Liebert	PPA150C	157112-2	150
26	PDUS23026	230-305	PDU-2	Liebert	PPA075C	M10C090129	75
27	PDUS23028	230-B07	PDU-8	Liebert	PPA075C331A1677	M17D090240	
28	PDUS23029	230-B07	PDU-9	Liebert	PPA075C331A1677	M17D090245	
29	PDUS2303	230-109E	PDU-22	Liebert	PC075H0506T3	88PC0154-A	75
30	PDUS23030	230-272	PDU-2A	Liebert	PPA050C331S8531	M18H090219	50
31	PDUS23031	230-272	PDU-2B	Liebert	PPA075C331S8531	M18H090220	75
32	PDUS23032	230-272	PDU-2C	Liebert	PPA075C331S8531	M18H090222	75
33	PDUS2304	230-152	PDU	Liebert	VPC5016A110621D-01000	36245	50
34	PDUS2305	230-180A	PDU-21	Liebert	PPA075C331S8249	M18F090275	75
35	PDUS26401	264-719	PDU 7-1	Liebert	PPA075C331S8531	M18H090231	75
36	PDUS26402	264-113A	PDU 1-1	Liebert	PPA075C331S8531	M18H090238	75
37	PDUS26403	264-115R	PDU 1-2	Emerson	PPA100C331S8531	M18H090254	100
38	PDUS26404	264-125	PDU 1-3	Liebert	PPA150C	M07H090107	150
39	PDUS26405	264-290	PDU 2-1	Liebert	PPA075C	M07G090181	75
40	PDUS26406	264-422	PDU 4-1	MGE	PMN126-42-125	L03-10527	125
41	PDUS26407	264-432	PDU 4-3	PDU's	PMN126-42-075	L03-10519	75
42	PDUS26408	264-443	PDU 4-2	Emerson	PPA030C231A2894	M15L090012	30
43	PDUS26409	264-522	PDU 5-1	Computer Power Systems	SYS3B0106405-0110	19377	75
44	PDUS26410	264-532	PDU 5-3	Liebert	PPA050C331S8531	M18H090263	50
45	PDUS26411	264-548	PDU 5-2	Liebert	PPA125C331S8531	M18H090247	125
46	PDUS30101	301-236	PDU	liberty	PPA050C	M07G090152	50
47	PDUS30102	301-264	PDU	Liebert	PPA075C	148749A	75
1	TBD	169-231	UPS	Liebert	24KVA, S3	347015/23162	24
2	TBD	179-113 Closet	UPS 179-122	Eaton 9390-120	TC1212321130010	EA213CAA04	120

3	UPS14401	144-218		EATON	9355-30	BC336KXX01	30
4	UPS14402	144-211		EATON	9155-8	FY042FBB08	8
5	UPS14501	144-104A		EATON	9155-8	BL213FBB08	8
6	UPS14502	144-119		EATON	9155-8	BL294FBB03	8
7	UPS14503	144-119		EATON	9155-8	BD351FBB03	8
8	UPS15001	150-201A		EATON	9155-10	FA336FBB05	10
9	UPS15002	150-100A		Mitsubishi	UP1133A-B303SU- 2	5-7M85026-03	
10	UPS2001	200-117		CYBERPWR	OR2200LCDRT2U		
11	UPS2020	202	UPS	Eaton	9315	EV295ZXX02	225
12	UPS2771	277 Mech Rm	UPS	Eaton	9390-160	ED382CBB03	160
13	UPS30601	306		EATON	9355-10	BM494JBA02	
14	UPS3061	306-501	UPS	APC	SUVTF30KB4F	WE0525110350	30
15	UPS3109	310-206	UPS	Eaton	9390-40	ED422CAB07	400
16	UPS35001	350-131			9355-30		30
17	UPS35501	355-100		SCHNEIDER	OG-GVMI225KG65K	U21822000981	
18	UPS3825	126/185	UPS-3N	Eaton	93PM100-2	EM185UXX10	100
19	UPS9866	264-UPS	UPS - Rotary 400 kW	Piller	UB500	9503002886	500
20	UPS9995	230-B73	UPS # 1- Rotary 400 Kw	Piller	UB500	9503006336	500
21	UPS9996	230-B73	UPS # 2- Rotary 400 kW	Piller	UB500	9503006335	500
22	UPS9997	230-B73	UPS # 3- Rotary 400 kW	Piller	UB500	6503006334	500
23	UPSM3578	317-210	UPS Unit #1	Emerson - Liebert	Liebert NX 480V 80kVA	M16LCI0004	80
24	UPSM3579	317-102	UPS Unit #2	Emerson - Liebert	Liebert NX 480V 80kVA	M16LCI0005	80
25	UPSM3838	183-830		LIEBERT	47SA010A0CH0063	M15K530021	10
26	UPSM3839	300-220	UPS	Powerware	9315-80	EU223ZBA02	80
27	UPSM3840	302-236	UPS	Mitsubishi	UT 360	LE 0137	80
28	UPSM3841	302-139	NEMS 887540	Mitsubishi	UP7011B-A12113SU-2	16-7M85559-01	10.4
29	UPSM3842	302-326A	UPS-2	Liebert	N208S0812600	0617701010BU7L4	16
30	UPSS23A	230-378	UPS-A, 450-550kVA	Eaton	Powerware	EE292BAA02	550
31	UPSS23B	230-378	UPS-B, 450-550kVA	Eaton	Powerware	EE292BAA03	550
32	UPSS23D	230-301B	UPS-D	Eaton	9395-550	EJ272BAA05	550
33	UPSSMPZ	230-378	UPS1-MPZ				