PART 1 - GENERAL

1.1 DESCRIPTION

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
D. Section 23 21 23, HYDRONIC PUMPS.
E. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
F. Section 23 21 13, HYDRONIC PIPING.
G. Section 23 31 00, HVAC DUCTS and CASINGS
H. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.
I. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.
J. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training.

1.3 DEFINITION

A. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.
B. BACNET: Building Automation Control Network Protocol, ASHRAE Standard 135.
C. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.
D. FTT-10: Echelon Transmitter-Free Topology Transceiver.
E. SCBA: Self-Contained Breathing Apparatus.

1.4 QUALITY ASSURANCE

A. Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION, and comply with the following.
B. Refer to PART 3 herein after and Section 01 00 00, GENERAL REQUIREMENTS for test performance.
C. Comply with AHRI requirements for testing and certification of the chillers.
D. Refer to paragraph, WARRANTY, Section 00 72 00, GENERAL CONDITIONS, except as noted below:

1. Provide a 5-year motor, transmission, and compressor warranty to include materials, parts and labor.

E. Refer to OSHA 29 CFR 1910.95(a) and (b) for Occupational Noise Exposure Standard

F. Refer to ASHRAE Standard 15, Safety Standard for Refrigeration System, for refrigerant vapor detectors and monitor.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air Conditioning, Heating and Refrigeration Institute (AHRI):

370-01.....Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment

495-1999 (R2002).....Refrigerant Liquid Receivers

550/590-03.....Standard for Water Chilling Packages Using the Vapor Compression Cycle

560-00.....Absorption Water Chilling and Water Heating Packages

575-94.....Methods for Measuring Machinery Sound within Equipment Space

C. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

ANSI/ASHRASE-15-2007....Safety Standard for Mechanical Refrigeration Systems

GDL 3-1996.....Guidelines for Reducing Emission of Halogenated Refrigerants in Refrigeration and Air-Conditioning Equipment and Systems

D. American Society of Mechanical Engineers (ASME):

2007 .....ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels - Division 1"

E. American Society of Testing Materials (ASTM):

C 534/ C 534M-2008.....Preformed, Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C 612-04.....Mineral-fiber Block and Board Thermal Insulation

F. National Electrical Manufacturing Association (NEMA):

250-2008.....Enclosures for Electrical Equipment (1000 Volts Maximum)

G. National Fire Protection Association (NFPA):

70-2008.....National Electrical Code

H. Underwriters Laboratories, Inc. (UL):

1995-2005..... Heating and Cooling Equipment

1.6 SUBMITTALS

A. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

SPEC WRITER NOTE: There could be more than one type of chillers required for the project. Edit paragraph B and associated subparagraphs to suit project requirements in the chiller selection.

B. Manufacturer's Literature and Data.

1. Scroll chillers, including motor starters, control panels, and vibration isolators, and remote condenser data shall include the following:
   a. Rated capacity.
   b. Pressure drop.
   c. Efficiency at full load and part load WITHOUT applying any tolerance indicated in the AHRI 550/590/Standard.
   d. Refrigerant
   e. Fan performance
   f. Accessories.
   g. Installation instructions.
   h. Start up procedures.
   i. Wiring diagrams, including factor-installed and field-installed wiring.
   j. Sound/Noise data report. Manufacturer shall provide sound ratings. Noise warning labels shall be posted on equipment.

C. Maintenance and operating manuals for each piece of equipment in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

D. Run test report for all chillers.

E. Product Certificate: Signed by chiller manufacturer certifying that chillers furnished comply with AHRI requirements. The test report shall include calibrated curves, calibration records, and data sheets for the instrumentation used in factory tests.

F. Provide seismic restraints for refrigeration equipment to withstand seismic forces.

PART 2 - PRODUCTS

2.1 Cabinet and Frame

A. The unit base frame shall be fabricated with a 3x6 inch, 11 gauge rectangular tube steel. Structural cross members shall be placed at critical locations to support internal components. Vertical frame members shall be 3x3x11 gauge square tube steel. The unit base frame shall be furnished with lifting lugs capable of accepting cable or chain hooks for rigging. Prior to unit assembly, the entire frame shall be covered with a minimum one-mil coat of air-dried sandstone rust inhibiting coating for maximum corrosion protection.

B. The exterior surfaces of the wall shall be fabricated from 20-gauge galvanized steel. The interior shall be lined with 16-gauge galvanized steel. The panels shall be galvanized steel, pre-coated with 1 mil of sandstone baked polyester coating which will withstand 1,000 hours of salt spray per ASTM B-117 over an epoxy primer.

C. Electrical wiring shall be run in a full-length electrical raceway below the condenser fans and at the base frame for power wiring and controls. Exterior roof panels shall be crowned for drainage and easily removable for service access.

2.2 Air-Cooled Condensing and Economizer Section

A. Condenser and Economizer coils shall be constructed of seamless copper tubes, mechanically expanded into aluminum fins. Each coil shall include an integral 10°F sub-cooling circuit. The mechanical refrigerant system shall be capable of operating at ambient conditions down to 25°F. Condenser fans shall be direct drive, propeller type. All fans shall be VFD controlled to vary the speed to maintain a minimum head pressure. The unit shall be provided with a waterside economizer coil (WiSE) to maximize energy saving. The coils shall be built together in the same casing to minimize dirt trapping, save space and to improve static pressure drop. It shall consist of a water-cooling coil directly upstream of the DX coil. The DX coil shall be .50" OD, .017" wall thickness seamless copper tubes expanded into .006" thick corrugated aluminum fins. The Wise coil shall be .50" OD, .025" wall thickness seamless copper tubes expanded into .006" thick corrugated aluminum fins.Coil headers shall be copper with copper connections and shall be chemically cleanable. The coil shall be contained in a 16 gauge stainless steel casing. The WiSE coil and condensers shall be completely factory piped including tower water valve and required controls.

2.3 Refrigeration Circuit Specialties

A. Each independent refrigerant circuit shall be completely piped, tested, dehydrated, and fully charged with oil and refrigerant R410A. Each refrigerant circuit includes compressor, condenser with integral liquid sub-cooler, liquid line service and charging valve, filter drier, sight glass, fusible plug, and thermostatic expansion valve.

2.4 Scroll Compressors

A. The compressor shall utilize an orbiting scroll with axial and radial compliance for compression. Compressors shall be high efficiency, suction-gas cooled, single speed, hermetic type, with three Teflon bearings and a cast iron motor frame. Compressors shall be mounted on rubber-in-shear isolators. The compressor circuit shall include high

and low pressure taps, a discharge service valve, and a check valve at the discharge outlet to prevent reverse rotation. Compressors shall have internal motor protection for over-temperature and over-current conditions. Other safety devices include a crankcase heater, high-pressure cutout, and low pressure freeze protection. Capacity reduction shall be performed with compressor staging and hot gas bypass on tandem compressor models. Capacity reduction shall be performed with digital scroll compressors

2.5 Digital Scroll Compressors

A. Each circuit shall include a digital scroll compressor. The compressor shall utilize an orbiting scroll with axial and radial compliance for compression and have digitally controlled capacity modulation technology. The compressor shall be capable of seamlessly modulating capacity from 10% to 100%. A solenoid valve is to be used to achieve modulation. The compressor shall be a high efficiency, suction gas cooled, hermetic type, with Teflon bearings and a cast iron motor frame. The compressor shall be mounted outside of the air stream on rubber-in-shear isolators. The compressor shall have an oil level sight glass, oil level adjustment fitting, high and low pressure taps, and full port discharge and suction service valves. The compressor shall have a check valve in the discharge fitting to control discharge gas flow and to silently prevent reverse rotation. The compressor shall have four motor winding temp sensors with a solid state module for compressor overload protection. Other safety devices shall include a crankcase heater, high pressure and low pressure freeze protection.

2.6 Brazed Plate Heat Exchanger

A. The chiller heat exchanger shall be constructed of type 304 stainless steel plates oven brazed with pure copper. Each plate is embossed with a high efficiency heat transfer surface. The plates shall form alternating channels which refrigerant and fluids run counter flow to each other. The heat exchanger shall have a sealing plate to prevent moisture and frost freezing. The heat exchanger is pressure tested at 600 psig. The maximum operating pressure shall be 450 psig.

2.7 WiSE/ Condenser Piping

A. Two (2) butterfly valves shall be assembled on a tee to control flow through the waterside economizer coil and the chiller. Each valve is installed with couplings on either side of the valve so it may be removed without disturbing the piping or the other valve. The valves shall have cast bronze bodies with a rubber-coated disc capable of bubble tight shut off at 300 psig. Each valve shall be driven by a separate analog actuator. The flow characteristics of the system are determined by the sequence of operation of the control system. The sequence of operation follows later in this document.

2.8 Main Control Panel

A. The main control panel will have access door(s) for direct access to the controls. The panel is equivalent to NEMA type 3R (rainproof) and contains a single externally operated, molded case

switch (non-automatic circuit breaker) suitable for copper wire up to and including 3" conduit. Wire and conduit entrance will be inside of unit curbing.

B. The control panel includes the following:

1. A power terminal block.
2. A power transformer with primary and secondary 114 Volt circuit breakers
3. A 24 volt control transformer.
4. Necessary relays.
5. A 115 volt terminal strip.
6. A 24 volt control terminal strip containing wired terminals for all controls, numbered in accordance with the wiring diagram.
7. An isolated 24 volt field wiring terminal strip.
8. An electrical print pocket, electrical print and a startup form.
9. Starter and disconnect switch factory mounted and wired.

A. The above components are in addition to electrical components associated with other sections which shall be incorporated in the main control panel to facilitate maintenance and trouble shooting.

2.9 Pumps and Pump System Components

A. Pump Type

1. Furnish and install pumps with capacities as shown on plans. Pumps shall be in-line type, close-coupled single stage design for installation in vertical or horizontal position, and capable of being serviced without disturbing piping connections.
2. Pump casing shall be of Class 30 cast iron. The impeller shall be of cast bronze, closed type, dynamically balanced, keyed to the shaft and secured by locking capscrew.

B. The liquid cavity shall be sealed off at the motor shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225°F. A bronze shaft sleeve shall completely cover the wetted area under the seal.

C. Pump shall be rated for minimum of 175 psi working pressure. The pump case shall have gauge tappings at the suction and discharge nozzles and will include drain ports.

D. Motor shall meet NEMA specifications and shall be of the size, voltage, and enclosure called for on the plans. It shall have heavy-duty, grease lubricated ball bearings, completely adequate for the maximum load for which the pump is designed.

E. Each pump shall be factory tested per Hydraulic Institute standards. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

F. Pumps shall be manufactured by ITT Bell & Gossett.

2.10 Suction Diffuser

A. The Flow Straightening Fitting shall be of ductile iron construction with grooved system and pump connections. The fitting shall have a stainless steel combination diffuser-strainer-orifice cylinder with

3/16" diameter perforations to protect the system pump, and full-length flow straightening vanes shall provide non-turbulent flow to the suction side of the system pump. The start-up strainer shall be of 16-mesh bronze. The suction side pipe shall be supported to eliminate pipe strain at the fitting/pump connection. All internal components shall be replaceable.

2.11 Triple Duty Valve

A. The triple duty valve shall perform the functions of a center guided non-slam check valve, shutoff valve, and calibrated balancing valve. The valve shall be of heavy-duty cast iron construction with 125 psi ANSI flanged connections suitable for working pressures up to 175 psi for operating temperatures up to 250°F. The valve shall be fitted with a bronze seat, replaceable bronze disc with EPDM seat insert brass stem, and chatter preventing stainless steel spring. The valve design shall permit repacking under full system pressure.

B. Cv rating shall be provided at every 10% increment opening for the straight and angle valve. Manufacturer shall supply the Cv rating for read-out of flow determination and system pressure drop.

C. The valve shall be equipped with brass readout valves (with integral check valve) to facilitate taking differential pressure readings across the orifice for accurate system balance.

2.12 Strainer

A. A "Y" type Screwed end strainer with extra heavy iron body designed for working pressures of 400 PSI @ 150°F. Screen the be perforated stainless steel. The seat to be machined in the body, designed to make the screen self aligning and at the same time holding the screen securely in place by a straight threaded and gasketed cap.

2.13 Buffer Tank

A. A Wheeler 400 Gallon Chilled Water Buffer Tank will be factory installed. (42" O.D. x 78" O.A.H.) 125# A.S.M.E. design tank. To include: misc. couplings, 2 - 4" flanges or grooved openings, 1 - 12 x 16 manhole, center baffle, lift lugs, ring base, shop prime exterior.

2.14 Controller

A. The controller will operate using a high-speed 32-bit microprocessor. The controller will have 8MB of Flash RAM to store the operating program and 16MB SDRAM battery backed by a 3V lithium cell for execution. The battery is rated for 10 years with 720 hours of cumulative power outage. Each controller will have a time clock, a port for keypad display and networked sensors, a port for remote I/O expansion and an open protocol port for EIA-232, or EIA-485 communication. The open protocol port can communicate at 9.6K, 19.2K, 38.4K or 76.8K BAUD, depending on the protocol's standard. The controller input and output minimum configuration will be as follows: 12 Universal Inputs and 8 Universal Outputs.

2.15 Protocols

A. The I/O Pro 812u's open protocol port will be factory programmed for BACnet either Master / Slave Token Passing (MSTP) or Point-to-Point (PTP), BACnet over ARCnet at 156K Baud, BACnet over Ethernet or IP through its 10BaseT port. The contractor shall determine the required protocol, prior to release, and advise the chiller manufacturer.

2.16 Controller Power

A. The controller requires 24 VAC 50 – 60 Hz.

2.17 Keypad Display

A. The keypad display consists of a four line, total 160 character backlit Liquid Crystal Display (LCD) and a 22 key keypad. The keypad display can be used to set time schedules, increment/decrement set points, read and clear faults/alarms and monitor unit operations.

2.18 Universal Outputs

A. The controller and expander's output circuits can be configured by changing jumper settings to provide either:

1. 0-20 mA (UO 1-8)
2. 0-10 VDC (UO 1-8)
3. Digital relay (UO 1-8)

B. Each output has a status indicating LED and a potentiometer for manual adjustment of analog signals. Outputs are rated for 24VDC max, 50mA max.

2.19 Component Listing

A. Both the controller and expander boards are listed by UL916 (Canadian Std C22,2 No.205-M1983), CE, FCC Part 15 – Subpart B - Class A.

2.20 Temperature Sensors

A. Mammoth uses 10K ohm thermistors to read air, water and surface temperatures. A 10K ohm thermistor is a description of its resistance reading at 77°F (25°C). A thermistor resistor characteristic is such that as the temperature decreases the resistance increase and as the temperature increases the resistance decreases.

2.21 **Water Flow Switch**

A. A paddle type flow switch shall prove water flow before compressor(s) are started or if flow is interrupted shut down the compressors.

2.22 Chiller DDC Control Sequence

A. This is a description of a typical Chiller Control Sequence and how the inputs and outputs will be configured. The Keypad will allow for the following modes of operation:

1. **Off Mode** - In Off Mode, the chiller is shut down.
2. **Time Clock Mode** - In Time Clock Mode, the chiller will switch between occupied and unoccupied operation via the controllers time schedule or field supplied signal
3. **Remote Start/Stop Mode** - In Remote Start/Stop Mode, the chiller switches between occupied and unoccupied operation via a field supplied signal.
4. **Occupied Mode** - In Occupied Mode, the chiller is fully operational per the sequence of operation.

B. **Unit Start Up**

1. When the chiller is in an unoccupied state the start pump output module will be de-energized. During this time the economizer valve will be closed.
2. When the chiller is switched into an occupied state, by either the time schedule, by a specific keypad command or by the remote start/stop contact closure, the start pump output module will be energized.

C. **Unit Leaving Water Temperature Set-Point Reset**

1. Reset during Economizer and Mechanical Cooling can based on an air or water temperature source (i.e. outside air temperature, evaporator entering water temperature). This is achieved by setting the:
   - maximum reset set-point (the max. amount of reset possible for a temp. at the full spt.)
   - temperature full reset set-point (the temperature at which the reset will reach maximum)
   - temperature no reset set-point (the temperature at which the reset will be 0□F).

Temp	Full Reset Spt	No Reset Spt
(Type.)	45°F	65°F
Reset	Max °F	0°F
(Type.)	10°F	0°F

D. **Mechanical Cooling**

1. Mechanical Cooling can be enabled if the outside air temperature is above the lock out temperature (50°F ± 1°F), and the evaporator water flow switch indicates water flow.

E. With these conditions passed and the controller indicating "stage up" for approximately 5 minutes (see leaving water temp control section), the first compressor stage is energized. If the controller should indicate "stay", before the first stage is operating, it will take a minimum of approximately 5 minutes to start first compressor stage from that point in time.

F. Each compressor stage will have a mechanical safety circuit and will be wired to the controller for indication. Once the unit is in Mechanical Cooling the controller reads all active compressors' safeties. Any of these safeties will shut down the affected compressor and will require manual reset. With a compressor stage active, the controller can now react every 2½ to 10 minutes depending on the conditions, to activate a new compressor stage or de-activate an operating compressor stage.

G. **Water Side Economizer (WiSE)**

1. Before water flow has been proven, or during mechanical cooling only mode, the economizer valve will remain closed. In economizer operation the economizer valve shall operate to maintain the supply control set-point. If economizer operation cannot provide enough cooling to satisfy the set point, mechanical cooling will be energized. Once mechanical cooling is operating, the valve is either set at 100% open or closed, when a high limit condition is sensed. The high limit condition is based on comparing the unit entering air temperature and the unit entering water temperature. If the unit entering water temperature is greater than the unit entering air temperature, the economizer is in a "high limit condition". This high limit function is called "comparative sensible high limit" operation. The high limit control set-point indicating "comparative" can be changed to "fixed" to select a temperature value (50°F to 90°F) for a fixed entering water high limit set-point operation. The program will use this value, for comparison, instead of the entering air temperature. Both high limit functions are subject to a 4°F differential. Meaning the economizer will not drop out of high limit until the water temperature is 4°F below the unit entering air temperature.

H. **Compressor Staging Sequence**

Increasing Capacity:

All Compressors off

Compressor #1 on

Compressor #1 and #2 on

Compressor #1, #2 and #3 on

Compressor #1, #2, #3 and #4 on

Decreasing Capacity:

All Compressors on

Last Compressor on Turned off

Next to Last Compressor on Turned off

Continue this sequence until all compressors are off

I. BMS Load Limit

1. The chiller program shall be provided with a Building Management System (BMS) load limit option. By closing a set of contacts, the BMS can limit the number of operating compressors.

J. Internal Time Schedule

1. The controller shall include a time clock for use if the owner decides to not use the BAS time clock. It shall include a 7-day week and 1-day holiday time schedule. The schedule is set through a provided 32 character backlit super-twist LCD with 12 membrane keys. The time schedule has two start and stop times for each day plus holidays. A given holiday is selected by indicating the month, day, and duration of the holiday (1-99 days).

K. Alarms, Faults and Warnings

1. During normal operation the watchdog blinks once every 3 seconds. If the unit is in an alarm or a fault condition the signal will be continuous. Alarms, faults and warnings are indicated on the keypad display.
   - Alarms shut down total unit operation and require manual reset.
   - Faults shut down affected item operation only and require manual reset.
   - Warnings are indicators on the control panel and reset automatically when condition is alleviated.

2. The following items are some of the alarms:

   Low Supply Leaving Water Temp

3. The following items are some of the Faults:

   Evaporator Leaving Water Temp Sensor Failure

   Outside Air Temp Sensor Failure

   Mechanical Cooling Safeties

4. The following items are some of the Warnings:

   Outside Air Temp Sensor Failure

   Evaporator Leaving Temp Sensor Failure

   System On / Off (System Switch/Emergency Shut-Down)

2.23 Listing of Control Points

A. Analog Inputs

1. Unit Leaving Water Temperature
2. Unit Entering Water Temperature
3. Outside Air Temperature

B. Digital Inputs

1. System Switch (Emergency Shutdown)
2. Remote Chiller Off/On
3. Chiller Enable (Water Flow Switch)
4. BMS Chiller Limit (i.e.; Load Limit)
5. Mechanical Cooling Fault (each compressor circuit)

C. Digital Outputs

1. Watch Dog and Alarm and Fault Indication
2. Start Pumps
3. Cooling Call (each compressor circuit)

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, piping and electrical to verify actual locations and sizes before chiller installation and other conditions that might affect chiller performance, maintenance, and operation. Equipment locations shown on drawings are approximate. Determine exact locations before proceeding with installation.

3.2 EQUIPMENT INSTALLATION

A. Install chiller on concrete base with isolation pads or vibration isolators.
   1. Vibration isolator types and installation requirements are specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT
   2. Charge the chiller with refrigerant, if not factory charged.
   3. Install accessories and any other equipment furnished loose by the manufacturer, including remote starter, remote control panel, and remote flow switches, according to the manufacturer written instructions and electrical requirements.
   4. Chillers shall be installed in a manner as to provide easy access for tube pull and removal of compressor and motors etc.

B. Install refrigerant monitoring and safety equipment in accordance with ASHRAE Standard 15.

C. Install refrigerant piping as specified in Section 23 23 00, REFRIGERANT PIPING and ASHRAE Standard 15.

D. Install thermometers and gages as recommended by the manufacturer and/or as shown on drawings.

E. Piping Connections:
   1. Make equipment connections with flanges and couplings for easy removal and replacement of equipment from the equipment room.
   2. Extend vent piping from the relief valve and purge system to the outside.

3.3 STARTUP AND TESTING

A. Engage manufacturer's factory-trained representative to perform startup and testing service.
B. Inspect, equipment installation, including field-assembled components, and piping and electrical connections.
C. After complete installation startup checks, according to the manufacturers written instructions, do the following to demonstrate to the VA that the equipment operate and perform as intended.
   1. Check refrigerant charge is sufficient and chiller has been tested for refrigerant leak.
   2. Check bearing lubrication and oil levels.
   3. Verify proper motor rotation.
   4. Verify pumps associated with chillers are installed and operational.
   5. Verify thermometers and gages are installed.
   6. Verify purge system, if installed, is functional and relief piping is routed outdoor.
   7. Operate chiller for run-in-period in accordance with the manufacturer’s instruction and observe its performance.
   8. Check and record refrigerant pressure, water flow, water temperature, and power consumption of the chiller.
   9. Test and adjust all controls and safeties. Replace or correct all malfunctioning controls, safeties and equipment as soon as possible to avoid any delay in the use of the equipment.
   10. Prepare a written report outlining the results of tests and inspections, and submit it to the VA.
D. Engage manufacturer’s certified factory trained representative to provide training for 16 hours / 8 hours for the VA maintenance and operational personnel to adjust, operate and maintain equipment, including self-contained breathing apparatus.

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