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12/04

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SECTION 09385

DIMENSION STONE TILE
12/04

PART 1 GENERAL

1.1 SUMMARY

This section includes dimension stone tile and related setting materials applied to floors.

1.2 REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI 108	Specifications for Installation of Ceramic Tile
ANSI A118.1	(1992) Dry-Set Portland Cement Mortar
ANSI A118.3	(1992) Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive
ANSI A118.6	(1992) Ceramic Tile Grouts

ASTM INTERNATIONAL (ASTM)

ASTM C 1028	(1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM C 1353	Standard Test Method Using the Taber Abraser for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic
ASTM C 241	(1990; R 1997e1) Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C 629	Standard Specification for Slate Dimension Stone

TILE COUNCIL OF AMERICA (TCA)

TCA EJ171	Handbook for Ceramic Tile Installation
TCA F113	Handbook for Ceramic Tile Installation
TCA W242	Handbook for Ceramic Tile Installation

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings:

Show locations of each type of stone tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints.

SD-03 Product Data:

For each type of product indicated.

SD-04 Samples:

Full-size units of each type of stone tile in each finish required.

1.4 QUALITY ASSURANCE

Source Limitations for Stone Tile: Obtain each type of stone product through one source from a single producer.

PART 2 PRODUCTS

2.1 DIMENSION STONE TILE

2.1.1 Floor Tile; General

Abrasion resistance: Minimum value of 10, as determined per ASTM C 1353 or ASTM C 241.

Static Coefficient of Friction: Determined by testing identical products per ASTM C 1028.

Level Surfaces: Minimum 0.6
Ramp Surfaces: Minimum 0.8

Slate: ASTM C 629, Classification II, Interior.

Varieties and Sources: provide Virginia Slate Company East Moorland Green Floor Tile or approved equal.
Finish: Sand Rubbed

Edges: Square

Module Size: 24 x 24 inches for floor tile, 6 x 24 inches for base tile.

Nominal Tile Thickness: 1/2 inch

Joint Width: 1/8 inch

2.1.2 Setting and Grouting Materials

Setting Materials:

Thin Set Mortar: ANSI A118.1, non sagging dry-set Portland cement.

Setting Adhesive: ANSI A118.3, water cleanable epoxy.

Grout Materials:

Grout for joints 1/8 inch and narrower: ANSI A118.6 dry set.
Colors: As selected from manufacturer's full range.

2.1.3 Accessories

Sealer for Floors: Colorless, slip and stain resistant sealer, not affecting color or physical properties of stone surfaces as recommended by ston tile manufacturer for application indicated.

2.1.4 Fabrication

General: Fabricate tiles that are free of cracks, seams, starts, and other defects impairing their function for use as indicated.

Facial Dimensions: Do not vary facial dimensions from specified dimensions by more than plus or minus 1/64 inch for tiles with polished or honed faces; plus or minus 1/32 inch for tiles with sand-rubbed, natural-cleft, or thermal-finished faces.

Thickness of Stone Tiles with Smooth Finish: Do not vary facial dimensions from specified dimensions by more than plus or minus 1/64 inch. Thickness of Stone Tiles with Natural-Cleft or Thermal Finish: Do not vary from specified thickness by more than plus or minus 1/16 inch.

Backs of Pieces: Dress smooth and flat.

Natural-cleft stone need not be dressed if gap does not exceed 1/16 inch when tested with a 24-inch straightedge.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

Installation Methods: Comply with TCA's "Handbook for Ceramic Tile Installation." For TCA designations indicated.

Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" applicable to installation methods and setting and grouting materials indicated.

Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile. Where cut edges will be visible after installation, finish to match factory-fabricated edges.

Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting.

Mix tiles to achieve a uniformity random distribution of color shadings and patterns.

Expansion and Control Joint Installation Method: Comply with TCA EJ171. Joint sealant materials and installation are specified in Section 07920 "Sealants and Caulkings".

Butter backs of tiles with setting material before setting, and place before back buttering and setting bed have skinned over.

3.2 STONE FLOOR TILE INSTALLATION

Concrete Slab Substrates: For floor tile installed with dry-set or latex-portland cement mortars, provide concrete substrates that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards for installations indicated.

Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
Remove protrusions, bumps, and ridges by sanding or grinding.

Thin-Set Installation, Bonded to Subfloor: TCA F113 (thin-set mortar bonded to concrete subfloor).

Thin-Set Installation, Bonded to Wall: TCA W242/water cleanable epoxy adhesive over gypsum board on metal studs or solid backing.

3.3 INSTALLATION TOLERANCES

Variation in Surface Plane of Flooring: Do not exceed 1/8 inch in 10 feet from level or slope indicated when tested with a 10-foot straightedge.

Variation in Plane between Adjacent Units (Lipping): Do not exceed the following differences between faces of adjacent units as measured from a straightedge parallel to tiled surface:

Units with Polished or Honed Faces: 1/64 inch.
Units with Sand-Rubbed Faces: 1/32 inch.
Units with Thermal-Finished or Natural-Cleft Faces: Depth of thermal finish or 3/16 inch, whichever is less.

Variation in Joint Width: Do not vary joint thickness more than 1/16 inch or one-fourth of nominal joint width, whichever is less.

3.4 ADJUSTING AND CLEANING

Remove and replace material that is stained or otherwise damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

Clean stone tiles after setting and grouting is complete; use procedures recommended by stone producer and manufacturer for types of application indicated.

Apply sealer to cleaned stone tile flooring, according to sealer manufacturer's written instructions.

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SECTION 16287

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12/04

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SECTION 16287

30 - 130 KVA THREE-PHASE UNINTERRUPTIBLE POWER SYSTEM
12/04

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty three-phase, solid-state, uninterruptible power system (UPS). The UPS shall provide high-quality AC power for sensitive electronic equipment loads. The UPS shall consist of the UPS module, two battery strings, a communication port and protocol compatible with Johnson Controls, Inc. Metasys Integrator Release 7.00, and other features as described.

1.2 REFERENCES

The UPS shall be designed in accordance with the applicable sections of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

AMERICAN NATIONAL STANDARDS INSTITUE (ANSI)

ANSI C62.41	(2002) IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15	Radio Frequency Devices (47 CFR 15)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001	Quality Management System

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA PE 1	(1992) Uninterruptible Power Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1778	(2004) Uninterruptible Power Supply Equipment

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330,

"Submittals," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

System configuration with single-line diagrams.

Functional relationship of equipment including weights, dimensions, and heat dissipation.

Detailed layouts of customer power and control connections.

Detailed installation drawings including all terminal locations.

SD-03 Product Data

Descriptions of equipment to be furnished, including deviations from these specifications.

Size and weight of shipping units to be handled by installing contractor.

SD-06 Test Reports

Written test reports in accordance with Part 3.1 of this section.

SD-10 Operation and Maintenance Data

Operation and Maintenance Data

1.4 SYSTEM DESCRIPTION

1.4.1 Design Requirements - UPS Module

A. Voltage. Input/output voltage specifications of the UPS shall be:
Rectifier Input: 208 volts, three-phase, 4-wire-plus-ground.
Bypass Input (for dual-input modules): 208 volts, three-phase, 4-wire-plus-ground.
Output: 208 volts, three-phase, 4-wire-plus-ground.

B. Output Load Capacity. Specified output load capacity of the UPS shall be 40 kVA at 0.8 lagging power factor, or as scheduled on drawings.

1.4.2 Design Requirements - Matching Battery Cabinet

A. Battery Cells: Sealed, lead-acid, valve-regulated.

B. Reserve Time: 15 minutes at full load, 0.8 power factor, with ambient temperature between 20° and 30°C.

C. Recharge Time: to 95% capacity within ten (10) times discharge time.

1.4.3 Modes of Operation

The UPS shall be designed to operate as an on-line, double-conversion, reverse-transfer system in the following modes:

A. Normal - The critical AC load is continuously supplied by the UPS inverter. The rectifier/charger derives power from a utility AC source

and supplies DC power to the inverter while simultaneously float-charging a power reserve battery.

B. Emergency - Upon failure of utility AC power, the critical AC load is supplied by the inverter, which without any switching, obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.

C. Recharge - Upon restoration of utility AC power, after a utility AC power outage, the rectifier/charger shall automatically restart, walk-in, and gradually assume the inverter and battery recharge loads.

D. Bypass - If the UPS must be taken out of service for maintenance or repair, or should the inverter overload capacity be exceeded, the static transfer switch shall perform a reverse transfer of the load from the inverter to the bypass source with no interruption in power to the critical AC load.

1.4.4 Performance Requirements

1.4.4.1 AC Input to UPS

A. Voltage Configuration for Standard Units: three-phase, 4-wire plus ground.

B. Voltage Range: +10%, -20% of nominal.

C. Frequency: Nominal frequency +/-5%.

D. Power Factor: Up to 0.96 lagging at nominal input voltage and full rated UPS output load with optional input filter. Minimum 0.80 lagging without optional input filter.

E. Inrush current: 800% of full load current maximum.

F. Current Limit: 115% of nominal AC input current maximum. 100% of nominal for optional generator operation.

G. Input Current Walk-In: 15 seconds to full rated input current maximum. Field selectable 5 through 15 seconds.

H. Current Distortion: 10% reflected THD maximum at full load when fitted with optional input filter. 30% THD maximum at full load without optional input filter.

I. Surge Protection: Sustains input surges without damage per criteria listed in ANSI C62.41 Category A and B.

1.4.4.2 AC Output, UPS Inverter

A. Voltage Configuration: three-phase, 4-wire plus ground

B. Voltage Regulation:

+/-0.5% three-phase RMS average for a balanced three-phase load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor.

+/-1.0% three-phase RMS average for a 100% unbalanced load for the

combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor.

C. Frequency: Nominal frequency +/-0.1%.

D. Frequency Slew Rate: 5.0 Hertz per second maximum. Field selectable from 0.1 to 5.0 Hz per second.

E. Phase Displacement:

+/-0.5 degree for balanced load,
+/-1.0 degrees for 100% unbalanced load.

F. Bypass Line Sync Range:

+/-0.5 Hertz,
Field selectable +/-0.5 to 5.0 Hz.

G. Voltage Distortion:

1% total harmonic distortion (THD) for linear loads.
2.5% THD for 100% nonlinear loads (3:1 crest factor) without kVA/kW derating.

H. Load Power Factor Range: 1.0 to 0.7 lagging without derating.

I. Output Power Rating: Rated kVA at 0.8 lagging power factor.

J. Overload Capability:

125% for ten minutes (without bypass source).
150% for one minute (without bypass source).
200% for 10 cycles, pulse paralleling with the static switch.

K. Inverter Output Voltage Adjustment: +/-5% manual adjustment.

L. Voltage Transient Response:

100% load step	+/-2.5%.
Loss or return of AC input power	+/-1.0%.
Manual transfer of 100% load	+/-3.0%.

M. Transient Recovery Time: to within 1% of output voltage within one cycle.

N. Voltage Unbalance: 100% unbalanced load +/-1%.

O. Fault Clearing: Sub-cycle current of at least 300%.

1.5 ENVIRONMENTAL CONDITIONS

The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:

A. Operating Ambient Temperature
UPS Module: 32°F to 104°F (0°C to 40°C).
Battery: 77 +/-9 F (25 +/-5 C).

B. Storage/Transport Ambient Temperature

UPS Module: -4°F to 158°F (-20°C to 70°C).
Battery: -4°F to 92°F (-20°C to 33°C)

C. Relative Humidity
0 to 95%, non-condensing.

D. Altitude
Operating: to 6,600 ft. (2,000 meters) above Mean Sea Level. Derated for higher altitude applications.
Storage/Transport: to 40,000 ft. (12,200 meters) above Mean Sea Level.

E. Audible Noise
Noise generated by the UPS under any condition of normal operation shall not exceed 65 dBA measured 1 meter from surface of the UPS.

1.5.1 UPS Delivery Submittals

Submittals upon UPS delivery shall include a complete set of submittal drawings and one (1) instruction manual that shall include a functional description of the equipment with block diagrams, safety precautions, instructions, step-by-step operating procedures and routine maintenance guidelines, including illustrations.

1.6 WARRANTY

1.6.1 UPS Module

The UPS manufacturer shall warrant the UPS module against defects in materials and workmanship for 12 months after initial start-up or 18 months after ship date, whichever period expires first.

1.6.2 Battery

The battery manufacturer's standard warranty shall apply.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer Qualifications

A minimum of twenty year's experience in the design, manufacture, and testing of solid-state UPS systems is required. The system shall be designed and manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified.

1.7.2 Factory Testing

Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification.

PART 2 PRODUCTS

2.1 FABRICATION

2.1.1 Materials

All materials of the UPS shall be new, of current manufacture, high grade and free from all defects and shall not have been in prior service except as required during factory testing.

The maximum working voltage, current, and di/dt of all solid-state power components and electronic devices shall not exceed 75% of the ratings established by their manufacturer. The operating temperature of solid-state component sub-assembly shall not be greater than 75% of their ratings. Electrolytic capacitors shall be computer grade and be operated at no more than 95% of their voltage rating at the maximum rectifier charging voltage.

2.1.2 Wiring

Wiring practices, materials and coding shall be in accordance with the requirements of the National Electrical Code (NFPA 70). All bolted connections of bus bars, lugs, and cables shall be in accordance with requirements of the National Electrical Code and other applicable standards. All electrical power connections are to be torqued to the required value and marked with a visual indicator.

Provision shall be made for power cables to enter or leave from the top or bottom of the UPS cabinet.

2.1.3 Construction and Mounting

The UPS unit, comprised of input transformer (if required), rectifier/charger with input filter, inverter, static transfer switch, output transformer and maintenance bypass switch, shall be housed in a single free-standing NEMA type 1 enclosure. Cabinet doors/covers shall require a tool for gaining access. Casters and stops shall be provided for ease of installation. Front access only shall be required for expedient servicing, adjustments, and installation. The UPS cabinet shall be structurally adequate and have provisions for hoisting, jacking, and forklift handling.

The UPS cabinet shall be cleaned, primed, and painted with the manufacturer's standard color. The UPS shall be constructed of replaceable subassemblies. Printed circuit assemblies shall be plug connections. Like assemblies and like components shall be interchangeable.

2.1.4 Cooling

Cooling of the UPS shall be by forced air. Low-velocity fans shall be used to minimize audible noise output. Fan power shall be provided by the UPS output.

The thermal design, along with all thermal and ambient sensors, shall be coordinated with the protective devices before excessive component or internal cabinet temperatures are exceeded.

2.1.5 Grounding

The AC output neutral shall be electrically isolated from the UPS chassis. The UPS chassis shall have an equipment ground terminal. Provisions for local bonding shall be provided by the Contractor.

2.2 COMPONENTS

2.2.1 Input Transformer

When required, the input transformer shall be factory installed inside the UPS module cabinet without increasing the standard footprint.

2.2.2 Rectifier/Charger

2.2.2.1 General

The term rectifier/charger shall denote the solid-state equipment and controls necessary to convert incoming AC power to regulated DC power for input to the inverter and for battery charging. The rectifier/charger shall be a phase-controlled, solid-state SCR type with constant voltage/current limiting control circuitry.

2.2.2.2 AC Input Current Limiting

The rectifier/charger unit shall be provided with AC input current limiting whereby the maximum input current shall be limited to 115% of the full input current rating. The rectifier/charger shall operate at a reduced current limit mode whenever the critical load is powered from the UPS static bypass circuit such that the maximum UPS input current will not exceed 115% of full load input current. In addition, the rectifier/charger shall have a separate battery current limit, adjustable from 0 to 15% of the full load input current. An optional second circuit shall limit the battery recharge current to zero when activated by a customer-supplied contact closure to signal a customer function such as generator operation.

2.2.2.3 Input Current Walk-In

The rectifier/charger shall contain a timed walk-in circuit that causes the unit to gradually assume the load over a 15-second time interval after input voltage is applied. Walk-in time shall be field selectable for 5 through 20 seconds.

2.2.2.4 Fuse Failure Protection

Power semiconductors in the rectifier/charger shall be fused with fast-acting fuses, so that loss of any one power semiconductor shall not cause cascading failures.

2.2.2.5 DC Filter

The rectifier/charger shall have an output filter to minimize ripple voltage into the battery. Under no conditions shall ripple voltage into the battery exceed 1% RMS. The filter shall be adequate to insure that the DC output of the rectifier/charger will meet the input requirements of the inverter. The inverter shall be able to operate from the rectifier/charger with the battery disconnected.

2.2.2.6 Automatic Rectifier Restart

Upon restoration of utility AC power, after a utility AC power outage and prior to a UPS automatic end-of-discharge shutdown, the rectifier/charger shall automatically restart, walk-in, and gradually assume the inverter and battery recharge loads.

2.2.2.7 Battery Recharge

In addition to supplying power for the inverter load, the rectifier/charger shall be capable of producing battery charging current sufficient to replace 95% of the battery discharge power within ten (10) times the discharge time. After the battery is recharged, the rectifier/charger shall maintain the battery at full charge until the next emergency operation.

2.2.2.8 Overvoltage Protection

There shall be DC over-voltage protection so that if the DC voltage rises to the pre-set limit, the UPS is to shut down automatically and initiate an uninterrupted load transfer to the static bypass line.

2.2.3 Inverter

2.2.3.1 General

The term inverter shall denote the solid-state equipment and controls to convert DC power from the rectifier/charger or battery to regulated AC power for supporting the critical load. The inverter shall use Insulated Gate Bipolar Transistors (IGBTs) in a phase-controlled, pulse width modulated (PWM) design capable of providing the specified AC output.

2.2.3.2 Overload Capability

The inverter shall be capable of supplying current and voltage for overloads exceeding 100% and up to 200% of full load current. A status indicator and audible alarm shall indicate overload operation. The UPS shall transfer the load to bypass when overload capacity is exceeded.

2.2.3.3 Fault Clearing and Current Limit

The inverter shall be capable of supplying an overload current of 150% of its full-load rating for one minute. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The critical load will be transferred to the static bypass automatically and uninterrupted. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective fuses.

2.2.3.4 Step Load Response

The output voltage shall be maintained to within 2.5% with a 0-to-100% step load change or a 100%-to-0 step load change. The output voltage shall recover to within 1% of nominal voltage within 1 cycle.

2.2.3.5 Voltage Distortion

For linear loads, the output voltage total harmonic distortion (THD) shall not be greater than 1%. For 100% rated load of 3:1 crest factor nonlinear loads, the output voltage total harmonic distortion shall not be greater than 2.5%. The output rating is not to be derated in kVA nor kW due to the 100% nonlinear load with 3:1 crest factor.

2.2.3.6 Output Power Transformer

A dry-type power transformer shall be provided for the inverter AC output. It shall have copper wiring exclusively. The transformers hottest spot winding temperature shall not exceed the temperature limit of the transformer insulation class of material when operating at full load at maximum ambient temperature.

2.2.3.7 Phase Balance

Electronic controls shall be provided to regulate each phase so that an unbalanced loading will not cause the output voltage to go outside the specified voltage unbalance or phase displacement. With 100% load on one phase and 0% load on the other 2 phases or 100% load on 2 phases and 0% load on the other phase, the voltage balance is to be within 1% and the phase displacement is to be 120 degrees within 1 degree.

2.2.3.8 Fuse Failure Protection

Power semiconductors in the inverter unit shall be fused with fast-acting fuses, so that loss of any one power semiconductor will not cause cascading failures.

2.2.3.9 Inverter Shutdown

For rapid removal of the inverter from the critical load, the inverter control electronics shall instantaneously turn off the inverter transistors. Simultaneously, the static transfer switch shall be turned on to maintain continuous power to the critical load.

2.2.3.10 Inverter DC Protection

The inverter shall be protected by the following disconnect levels:

DC Overvoltage Shutdown

DC Undervoltage Warning (Low Battery Reserve), user adjustable from 1 to 99 minutes

DC Undervoltage Shutdown (End of Discharge)

2.2.3.11 Overdischarge Protection

To prevent battery damage from overdischarging, the UPS control logic shall automatically raise the shutdown voltage set point as discharge time increases beyond fifteen (15) minutes.

2.2.3.12 Inverter Output Voltage Adjustment

The inverter shall use a software control to adjust the output voltage from +/-5% of the nominal value.

2.2.3.13 Output Frequency

The output frequency of the inverter shall be controlled by an oscillator. The oscillator shall be temperature compensated and hold the inverter output frequency to +/- 0.1% for steady state and transient conditions. Drift shall not exceed 0.1% during a 24-hour period. Total frequency deviation, including short time fluctuations and drift, shall not exceed 0.1% from the rated frequency.

2.2.4 Display and Controls

2.2.4.1 Monitoring and Control

The UPS shall be provided with a microprocessor based unit status display and controls section designed for convenient and reliable user operation. A

graphical display shall be used to show a single-line diagram of the UPS, and shall be provided as part of the monitoring and controls sections of the UPS. All of the operator controls and monitors shall be located on the front of the UPS cabinet. The monitoring functions such as metering, status and alarms shall be displayed on the graphical LCD display. Additional features of the monitoring system shall include:

Menu-driven display with pushbutton navigation

Real time clock (time and date)

Alarm history with time and date stamp

Battery backed-up memory

2.2.4.2 Metering

The following parameters shall be displayed:

Input AC voltage line-to-line

Input AC current for each phase

Input frequency

Battery voltage

Battery charge/discharge current

Output AC voltage line-to-line and line-to-neutral for each phase

Output AC current for each phase

Output frequency

Percent of rated load being supplied by the UPS

Battery time left during battery operation

2.2.4.3 Alarm Messages

The following alarm messages shall be displayed:

Input Line Fault

Input Phase Rotation Error

Input Over/Under Frequency

Input Current Limit

Rectifier Fail

Battery Test Failed

Battery Low Warning (Adjustable 1 To 99 Minutes)

Battery Low Transfer

DC Overvoltage Steady State

Bypass Frequency Error

Load On Bypass

Excessive Auto Retransfers

SBS SCR Shorted

Bypass Sync Error

Input Phase Loss

I DC Peak

Output Undervoltage Transfer

Output Overvoltage Transfer

Inverter Overload

SBS Overload

Inverter Overload Transfer

Transfer Failed Shutdown

Hardware Shutdown

Output Power Supply Fail

Inverter Control Fault Transfer

EPO Latched (remote EPO activated)

System Fan Fail

Ambient Overtemperature Limit

Overtemp Timeout Shutdown

An audible alarm shall be provided and activated by any of the above alarm conditions.

2.2.4.4 Status Messages

The following UPS status messages shall be displayed:

Normal operation

On SBS

Load on UPS

Load on bypass

User Shutdown

Battery Discharging

2.2.4.5 Controls

UPS start-up, shutdown, and bypass operations shall be accomplished through the front-panel pushbutton controls. Menu-driven user prompts shall be provided to guide the operator through system operation without the use of additional manuals. Pushbuttons shall be provided to display the status of the UPS and to test and reset visual and audible alarms. A mimic screen shall be available on the LCD screen to depict a single-line diagram of the UPS, with switch positions and power flow.

2.2.4.6 On-Line Battery Test

The UPS shall be provided with a menu-driven On-Line Battery Test feature. The test shall ensure the capability of the battery to supply power to the inverter while the load is supplied power in the normal mode. If the battery fails the test, the system shall automatically do the following:

Maintain the load through the UPS

Display a warning message

Sound an audible alarm

The battery test feature shall have the following user selectable options:

Interval between tests (2 to 9 weeks)

Date and time of initial test

Enable/disable test

2.2.5 Static Transfer Switch

2.2.5.1 General

A static transfer switch and bypass circuit shall be provided as an integral part of the UPS. The static switch shall be a naturally commutated high-speed static (SCR-type) device rated to conduct full load current continuously. The switch shall have an overload rating of 110% rated load continuously, 200% rated load for five seconds. The static transfer switch shall also have fault-clearing capabilities of 1100 amperes for 1 second, 3000 amperes for 10 cycles, and 6000 amperes peak for the first half cycle.

The static transfer switch control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals, and operating and alarm conditions. This control circuit shall provide an uninterrupted transfer of the load to an alternate bypass source, without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS, or for bypassing the UPS for maintenance.

2.2.5.2 Uninterrupted Transfer

The transfer control logic shall automatically turn on the static transfer switch, transferring the critical AC load to the bypass source, after the transfer logic senses any of the following conditions:

Inverter overload capacity exceeded

Critical AC load overvoltage or undervoltage

Battery protection period expired

UPS fault condition

The transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if any of the following conditions are present:

Inverter/bypass voltage difference exceeding preset limits

Bypass frequency out of limits

Bypass out-of-synchronization range with inverter output

2.2.5.3 Uninterrupted Retransfer

Retransfer of the critical AC load from the bypass source to the inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic shall inhibit an automatic retransfer of the critical load to the inverter if one of the following conditions exists:

Bypass out of synchronization range with inverter output

Inverter/bypass voltage difference exceeding preset limits

Overload condition exists in excess of inverter full load rating

UPS fault condition present

2.2.6 Internal Maintenance Bypass Switch

2.2.6.1 General

A manually operated maintenance bypass switch shall be incorporated into the UPS cabinet to directly connect the critical load to the bypass AC input power source, bypassing the rectifier/charger, inverter, and static transfer switch.

2.2.6.2 Isolation

All energized terminals shall be shielded to ensure that maintenance personnel do not inadvertently come in contact with energized parts or terminals. A means to de-energize the static switch shall be provided when the UPS is in the maintenance bypass mode of operation.

2.2.6.3 Maintenance Capability

With the critical load powered from the maintenance bypass circuit, it shall be possible to check out the operation of the rectifier/charger, inverter, battery, and static transfer switch.

2.2.7 Battery Power Pack

The battery power pack shall include sealed, lead-acid valve regulated battery cells housed in a separate cabinet that matches the UPS cabinet

styling to form an integral system line-up. Battery cells shall be mounted on slide-out trays for ease of maintenance. A battery disconnect circuit breaker with undervoltage release (UVR) shall be included for isolation of the battery pack from the UPS module. The UPS shall automatically be disconnected from the battery by opening the breaker when the battery reaches the minimum discharge voltage level. Casters and leveling feet shall also be provided with the battery power pack cabinet for ease of installation. When the application calls for the battery cabinet to be bolted to the UPS cabinet, the interconnecting cables are to be provided, precut and prelugged.

2.2.8 Accessories

2.2.8.1 Input Filter

The rectifier/charger shall include an input filter to reduce reflected input current distortion to 10% THD at full load with nominal input voltage. The input filter shall maintain the input power factor at 0.90-0.96 lagging minimum from full load to half load with nominal input voltage.

2.2.8.2 External Maintenance Bypass Cabinet

A matching external maintenance bypass cabinet shall be provided to enable the UPS module to be completely isolated from the electrical system while the critical load is powered through the external maintenance bypass line. This cabinet shall provide make-before-break operation for transfers to and from the external maintenance bypass line with a single rotary switch. The following components shall be provided: single rotary switch with auxiliary contacts, inter-cabinet wiring, casters, and leveling feet. This matching cabinet shall bolt to the side of the UPS module with a barrier shield to separate the two cabinets. Only front access shall be required for installation and service.

2.2.8.3 Programmable Relay Board

Eight sets of isolated Form C contacts shall be provided to indicate a change of status of any of the alarm conditions. Any of the UPS alarms can be programmed onto any channel of the programmable relay board.

2.2.8.4 Battery Circuit Breaker

A battery circuit breaker shall be provided to isolate the battery from the UPS. This breaker shall have an undervoltage release (UVR) and auxiliary contacts, and shall be in a separate wall mounted NEMA PE-1 enclosure. The battery breaker provides a manual disconnecting means, short circuit protection, and overcurrent protection for the battery system. When opened, there shall be no battery voltage in the UPS enclosure. The UPS shall be automatically disconnected from the battery by opening the breaker when the battery reaches the minimum discharge voltage level.

2.2.8.5 Internal Modem

The UPS shall come with an internal modem capable of dialing out from the UPS to notify up to two remote computers, terminals, PC's, or pocket pagers when important events occur. The modem will also be capable of connecting to a remote terminal, computer or PC, to perform all those functions normally available on the front panel including viewing monitoring screens.

2.2.8.6 SNMP

The UPS shall come equipped with an internal SNMP adapter, which will connect the UPS directly to any I.P. based network using Ethernet communications. The UPS will become a managed device on the network. From a network management station the system administrator shall be capable of monitoring important system measurements, alarm status and alarm history data. In the event of a utility failure the SNMP shall continue with live communication without the requirement of additional or separate UPS equipment until such time as the UPS shuts down for Low battery. On resumption of Utility power the SNMP shall resume full SNMP communication automatically.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

The following inspections and test procedures shall be performed by factory-trained field service personnel during the UPS startup.

3.1.1 Visual Inspection

Inspect equipment for signs of damage

Verify installation per drawings

Inspect cabinets for foreign objects

Verify neutral and ground conductors are properly sized and configured

Inspect battery cases

Inspect battery for proper polarity

Verify all printed circuit boards are configured properly

3.1.2 Mechanical Inspection

Check all control wiring connections for tightness

Check all power wiring connections for tightness

Check all terminal screws, nuts, and/or spade lugs for tightness

3.1.3 Electrical Inspection

Check all fuses for continuity

Confirm input voltage and phase rotation is correct

Verify control transformer connections are correct for voltages being used

Assure connection and voltage of the battery string(s)

3.2 MANUFACTURER'S FIELD SERVICE

3.2.1 Service Personnel

The UPS manufacturer shall directly employ a nationwide service organization, consisting of factory trained field service personnel dedicated to the start-up, maintenance, and repair of UPS and power equipment.

The manufacturer shall provide a fully automated national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours/day, 7 days/week, and 365 days/year.

3.2.2 Replacement Parts Stocking

Parts shall be available through an extensive network to ensure around-the-clock parts availability throughout the country.

Recommended spare parts shall be fully stocked by local field service personnel with back-up available from national parts center and the manufacturing location. The national parts center Customer Support Parts Coordinators shall be on-call 24 hours/day, 7 days/week, and 365 days/year for immediate parts availability.

3.2.3 UPS Operator Training

An operator training course for shall be provided by the UPS manufacturer. The training course shall cover UPS theory, safety, battery considerations and UPS operational procedures.

-- End of Section --