

Block 14 - Description (continued)

Wallops Island Generator Replacement – NNG07192812E

ADD:

SPECIFICATION CHANGES

BRACKETS:

Section	Subpart	Bracket Change
15050	2.3.2	Keep "Lever Handle"
15050	2.5.2.2	Keep "be of commercially available, proprietary design, rolled steel"
15055	1.3.3.1	Remove all text within brackets. Sentence should read "Qualification documents for 125 psig or above shall be in accordance with ASME BPVC SEC IX."

SPECIFICATION SECTION REFERENCES:

Section	Subpart	References	Change
04200S	2.3	03300A	Change reference to 03300
04200S	3.8	03300A	Change reference to 03300
15050	1.3	01330	Change reference to 01330W
15055	1.2	01330	Change reference to 01330W
15072	1.3	01330	Change reference to 01330W
15085	1.4	01330	Change reference to 01330W
15725	1.2	01330	Change reference to 01330W
16065	2.2	16145	Delete reference to 16145
16263	2.10.3	15400	Delete reference to 15400
16263	2.24	15080	Delete reference to 15080
16263	3.4	09900	Change reference to 09920S

NEW SPECIFICATION SECTIONS ADDED:

16225 Motors
16446 Panelboards

SPECIFICATION SECTION 16050 CHANGES TO ADD:

"Switches" has been added under SD-01 Preconstruction Submittals and SD-03 Product Data.

Subpart '2.4 Switches' and '2.4.1 Safety Switches' has been added.

Subpart '3.3 Safety Switches' has been added.

DRAWING CHANGES

MECHANICAL:

Sheet M-101: Add the following sentence to New Work Note 2

Inner and outer pipes shall be constructed from 0.035" thick 316 stainless steel. Provide 2" high temperature fibrous insulation between inner and outer shell.

Questions with responses that pose a significant contribution and will become a part of the Specification Record per Amendment No. 2

Questions from National Electric Systems Inc.

Request for Clarification:

- Spec Section 16263 Generator Set
Par 2.10.3 references a pneumatic starting system compressed air system to be per 15400 – there is no 15400 in the package
- Par 2.24 references thermal insulation per Sect 15080 – there is no 15080 in the package

Response:

- Specification section 16263 Generator Set, delete reference to Section 15400 and 15080 as they are not needed.

Questions from Matt Henderson

- Are there any life safety loads on this generator requiring a 10 second start time per NFPA 110?

Response:

There are no life safety loads on the generator. The 10 second start time specified in 16263 Section 1.3.1 is a requirement driven by the mission-criticality of orbital tracking equipment.

- Is a Tier 1 emissions compliant engine acceptable for this project?

Response:

The generator system must be certified and tested to meet EPA Source Performance Standards for non-road diesel engines.

Questions from Robin L. Weeks, Engine Systems, Inc

- I see what appears to be standard language regarding generator performance, non-linear loads, etc, but I don't see any actual list of loads. There are two items of specific interest in Section 16263 on page 11, namely the Motor Starting KVA (Max) of 2,550 KVA, and the Max Step Load Increase of 25%. Are these correct? Does this imply that there are no significant motor loads to be started? Do you have a specific loading sequence and identification of what those loads consists of?

Response:

Motor started KVA (Max) of 2,550 KVA, and the Max Step Load Increase of 25% is correct. There are no significant motor loads to be started in any loading sequence. The generator will normally perform in one of two fashions 1) black start or 2) paralleling with utility for exercise or rolling

backup. In the second case, there will be no significant step load increase. Subsequently, there is no loading sequence and no detailed list of equipment. The generator rating was specified around a single load profile for the system plus capacity for growth.

- There is some noise requirements listed on pages 20-21. However, on page 12 there is a statement that “a large overhead door will be opened during operation of the generator”. It doesn’t seem feasible to have a set of noise requirements while at the same time keeping a roll-up door opened during operation. There will be no way to treat the noise emanating from the diesel engine itself which will have an approximate sound power level of 123 dB© (ref 0.000000000012 watt). Ordinarily we would expect a closed engine room, with sufficient ventilation to provide adequate combustion and cooling air, and sound attenuation in the walls and ducts as needed to meet any external noise requirements.

Response:

Sound requirements are specified for the generator room assuming an open roll-up door.

- Related to noise, I need to give the radiator vendors a noise requirement to quote to. Typically they quote 85 dB(A) at 3 feet. Will this be acceptable? Again, based upon the open engine room, it doesn’t seem necessary to quote a stringent noise requirement for the radiator since the engine room noise will be the limiting factor.

Response:

85 dB(A) at 3 feet will be acceptable.

- If the engine room door is opened during operation, and based upon the layout drawings which show the generator end of the diesel skid is in front of that door, I’d be concerned about rain and snow (moisture) getting into the generator. This is not a desirable situation. Are there any plans to prevent the ingress of moisture into the generator?

Response:

This concern was raised during design and determined not to be an issue. There are no plans in the contract to mitigate moisture entry through roll-up door area.

Question from Dorey Electric, Ben Watkins:

- Dorey Electric Company is trying to obtain a salvage value for the existing generator set to be removed from the above subject project. The dealers that we have been talking to need to serial number from the existing generator set and any pictures that you could make available. This would allow the dealers to accurately price the equipment.

Response:

Serial Number 6PA00976

Arrangement Number 7C1623

The existing 1100 kW generator was installed in the 1985-1987 time period. The nameplate data is 1375 kVA, 1100 kW, 60 Hz, 480V, 1800 rpm, 0.8 power factor, 3 phase, 4 wire, wye series connected. It is

manufactured by Caterpillar, model 3512 and has auto-start and capability for manual operation and paralleling with the utility. It uses No. 2 fuel oil and has a 75 gallon day tank. It generates 480V, 3 phase power.

Questions from Bay Electric Co, Inc

- Sheet E-602, Drawing 15017 Titled Power Riser Diagrams does not show the size of wire and conduit needed to run from the Generator breaker to the Generator Terminal Box. Would you please send that information to us ASAP?

Response:

Three single-conductor 2/0, 15kV plus a 4/0 – 600V insulation in 4" rigid steel conduit will be acceptable.

- Also would you please indicate where we take the equipment that is being turned over to you and where we will pick up the equipment you are furnishing?

Response:

All exchanges of equipment will be on site at Wallops Flight Facility and will be coordinated through the Contracting Officer's Technical Representative.

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

04/05

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z535.1 (2002) Safety Color Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FB 1 (2001) Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

NEMA KS 1 (2001) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

NEMA OS 1 (1996) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

NEMA RN 1 (1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NEMA TC 13 (2000) Electrical Nonmetallic Tubing (ENT)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2005) National Electrical Code 2005 Edition

UNDERWRITERS LABORATORIES (UL)

UL 1 (2004) UL Standard for Safety - Flexible Metal Conduit

UL 1242 (2003) UL Standard for Safety - Intermediate Metal Conduit

UL 489 (2003; Bulletin Feb 11, 1992; Bulletin Mar 16, 1992) UL Standard for Safety Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

UL 6 (2003) UL Standard for Safety for Electrical Rigid Metal Conduit-Steel

UL 757 (2003) UL Standard for Safety - Electrical Metallic Tubing

UL 870

(2002) UL Standard for Safety Wireways,
Auxiliary Gutters, and Associated Fittings

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330W
SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the
specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted for the
following:

- Conduits, Raceway and Fittings
- Wire and Cable
- Splices and Connectors
- Switches
- Outlets, Outlet Boxes, and Pull Boxes
- Circuit Breakers
- Lamps and Lighting Fixtures

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following
items:

- Conduits, Raceway and Fittings
- Wire and Cable
- Splices and Connectors
- Switches
- Outlets, Outlet Boxes, and Pull Boxes
- Circuit Breakers
- Lamps and Lighting Fixtures
- Spare Parts

SD-06 Test Reports

- Continuity and Insulation Resistance Test
- Phase-Rotation Tests
- Insulation Resistance Test

SD-08 Manufacturer's Instructions

Manufacturer's Instructions shall be submitted.

1.3 PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall have the standard finish by the manufacturer when used for most indoor installations. Aluminum shall not be used in contact with earth or concrete and, where connected to dissimilar metal, shall be protected by approved fittings and treatment. Ferrous metals such as, but not limited to, anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous spare parts not of corrosion-resistant steel shall be hot-dip galvanized except where other equivalent protective treatment is specifically approved in writing.

1.4 GENERAL REQUIREMENTS

Material, Equipment, and Fixture Lists shall be submitted for the following items showing manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site.

Manufacturer's Instructions shall be submitted including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

PART 2 PRODUCTS

2.1 MATERIALS

Materials and equipment to be provided shall be the standard cataloged products of manufacturers regularly engaged in the manufacture of the products.

2.1.1 Rigid Steel Conduit

Rigid steel conduit shall be in accordance with UL 6 and shall be galvanized by the hot-dip process. Where underground and in corrosive areas, rigid steel conduit shall be polyvinylchloride (PVC) coated in accordance with NEMA RN 1 or shall be painted with bitumastic.

Fittings for rigid steel conduit shall be threaded.

Gaskets shall be solid. Conduit fittings with blank covers shall have gaskets, except in clean, dry areas or at the lowest point of a conduit run where drainage is required.

Covers shall have captive screws and shall be accessible after the work has been completed.

2.1.2 Electrical Metallic Tubing (EMT)

EMT shall be in accordance with UL 797 and shall be zinc coated steel. Couplings and connectors shall be zinc-coated, raintight, gland compression with insulation throat. Crimp, spring, or setscrew type fittings shall not be acceptable.

2.1.3 Flexible Metallic Conduit

Flexible metallic conduit shall be in accordance with UL 1 and shall be galvanized steel.

Fittings for flexible metallic conduit shall be specifically designed for such conduit.

Liquidtight flexible metallic conduit shall be provided with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive fumes.

Fittings for liquidtight flexible metallic conduit shall be specifically designed for such conduit.

2.1.4 Intermediate Metal Conduit

Intermediate metal conduit shall be in accordance with UL 1242 and shall be galvanized.

2.1.5 Rigid Nonmetallic Conduit

Rigid nonmetallic conduit shall be in accordance with NEMA TC 13 and shall be PVC with wall thickness not less than Schedule 40.

2.1.6 Wireways and Auxiliary Gutters

Wireway and auxiliary gutters shall be a minimum 4- by 4 inch trade size conforming to UL 870.

2.2 WIRE AND CABLE

Conductors installed in conduit shall be copper 600-volt type THHN. All conductors AWG No. 8 and larger, shall be stranded. All conductors smaller than AWG No. 8 shall be solid.

Flexible cable shall be Type SO and shall contain a grounding conductor with green insulation.

Conductors installed in plenums shall be marked plenum rated.

2.3 SPLICES AND CONNECTORS

Splices in AWG No. 8 and smaller shall be made with approved insulated electrical type .

Splices in AWG No. 6 and larger shall be made with indentor crimp-type connectors and compression tools . Joints shall be wrapped with an insulating tape that has an insulation and temperature rating equivalent to that of the conductor.

2.4 SWITCHES

2.4.1 Safety Switches

Safety switches shall be in accordance with NEMA KS 1, and shall be the heavy-duty type with enclosure, voltage, current rating, number of poles, and fusing as indicated. Switch construction shall be such that, with the switch handle in the "ON" position, the cover or door cannot be opened. Cover release device shall be coinproof and shall be so constructed that an external tool must be used to open the cover. Provisions shall be made to lock the handle in the "OFF" position, but the switch shall not be capable of being locked in the "ON" position.

Switches shall be of the quick-make, quick-break type. Terminal lugs shall be approved for use with copper conductors.

Safety color coding for identification of safety switches shall conform to ANSI Z535.1.

2.5 OUTLETS, OUTLET BOXES, AND PULL BOXES

Outlet boxes for use with conduit systems shall be in accordance with NEMA FB 1 and NEMA OS 1 and shall be not less than 1-1/2 inches deep. Pull

and junction boxes shall be furnished with screw-fastened covers.

2.6 CIRCUIT BREAKERS

Circuit-breaker interrupting rating shall be not less than those indicated and in no event less than 10,000 amperes root-mean-square (rms) symmetrical at 208 volts, respectively. Multipole circuit breakers shall be the common-trip type with a single handle. Molded case circuit breakers shall be bolt-on type conforming to UL 489.

2.7 LAMPS AND LIGHTING FIXTURES

Manufacturers and catalog numbers shown are indicative of the general type desired and are not intended to restrict the selection to fixtures of any particular manufacturer. Fixtures with the same salient features and equivalent light distribution and brightness characteristics, of equal finish and quality, will be acceptable. Lamps of the proper type and wattage shall be provided for each fixture.

Ballasts shall be high power factor and be energy efficient. Ballasts shall have a Class P terminal protective device for 120 and 277-volt operation as indicated and shall be rapid-start fluorescent. Ballasts shall be "A" sound rated. Fluorescent lamps shall be standard reduced wattage type.

PART 3 EXECUTION

3.1 CONDUITS, RACEWAYS AND FITTINGS

Conduit runs between outlet and outlet, between fitting and fitting, or between outlet and fitting shall contain not more than the equivalent of three 90-degree bends, including those bends located immediately at the outlet or fitting.

Crushed or deformed conduit shall not be installed. Trapped conduit runs shall be avoided where possible. Care shall be taken to prevent the lodgment of foreign material in the conduit, boxes, fittings, and equipment during the course of construction. Clogged conduit shall be cleared of obstructions or shall be replaced.

Conduit and raceway runs concealed in or behind walls, above ceilings, or exposed on walls and ceilings 5 feet or more above finished floors and not subject to mechanical damage may be electrical metallic tubing (EMT).

3.1.1 Rigid Steel Conduit

Field-made bends and offsets shall be made with approved hickey or conduit bending machine. Conduit elbows larger than 2-1/2 inches shall be long radius.

Conduit stubbed-up through concrete floors for connections to free-standing equipment with the exception of motor-control centers, cubicles, and other such items of equipment, shall be provided with a flush coupling when the floor slab is of sufficient thickness. Otherwise, a floor box shall be provided and set flush with the finished floor. Conduits installed for future use shall be terminated with a coupling and plug set flush with the floor.

3.1.2 Electrical Metallic Tubing (EMT)

EMT shall be grounded in accordance with NFPA 70, using pressure grounding connectors especially designed for EMT.

3.1.3 Flexible Metallic Conduit

Flexible metallic conduit shall be used to connect recessed fixtures from outlet boxes in ceilings, transformers, and other approved assemblies.

Bonding wires shall be used in flexible conduit as specified in NFPA 70, for all circuits. Flexible conduit shall not be considered a ground conductor.

Electrical connections to vibration-isolated equipment shall be made with flexible metallic conduit.

Liquidtight flexible metallic conduit shall be used in wet and oily locations and to complete the connection to motor-driven equipment.

3.1.4 Intermediate Conduit

Field-made bends and offsets shall be made with approved hickey or conduit bending machine. Intermediate metal conduit shall be used only for indoor installations.

3.1.5 Rigid Nonmetallic Conduit

Rigid PVC conduit shall be direct buried.

A green insulated copper grounding conductor shall be in conduit with conductors and shall be solidly connected to ground at each end. Grounding wires shall be sized in accordance with NFPA 70.

3.1.6 Wireway and Auxiliary Gutter

Straight sections and fittings shall be bolted together to provide a rigid, mechanical connection and electrical continuity. Dead ends of wireways and auxiliary gutters shall be closed. Unused conduit openings shall be plugged.

Wireways for overhead distribution and control circuits shall be supported at maximum 5-foot intervals.

Auxiliary gutters used to supplement wiring spaces for equipment not contained in a single enclosure shall contain no switches, overcurrent devices, appliances, or apparatus and shall be not more than 30 feet long.

3.2 WIRING

Feeder and branch circuit conductors shall be color coded as follows:

For 208/120V

<u>CONDUCTOR</u>	<u>COLOR AC</u>
Phase A	Blue
Phase B	Red

For 208/120V

<u>CONDUCTOR</u>	<u>COLOR AC</u>
Phase C	Black
Neutral	White
Equipment Grounds	Green

For 480/277V

<u>CONDUCTOR</u>	<u>COLOR AC</u>
Phase A	Brown
Phase B	Orange
Phase C	Yellow
Neutral	Neutral Gray
Equipment Grounds	Green with Yellow Stripes

Conductors up to and including AWG No. 2 shall be manufactured with colored insulating materials. Conductors larger than AWG No. 2 shall have ends identified with color plastic tape in outlet, pull, or junction boxes.

Splices shall be in accordance with the NFPA 70. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made and at the equipment terminal of each conductor. Terminal and conductor identification shall match as indicated.

Where several feeders pass through a common pullbox, the feeders shall be tagged to clearly indicate the electrical characteristics, circuit number, and panel designation.

3.3 SAFETY SWITCHES

Switches shall be securely fastened to the supporting structure or wall, utilizing a minimum of four 1/4 inch bolts. Sheet metal screws and small machine screws shall not be used for mounting. Switches shall not be mounted in an inaccessible location or where the passageway to the switch may become obstructed. Mounting height shall be 5 feet above floor level, when possible.

3.4 BOXES AND FITTINGS

Pullboxes shall be furnished and installed where necessary in the conduit system to facilitate conductor installation. Conduit runs longer than 100 feet or with more than three right-angle bends shall have a pullbox installed at a convenient intermediate location.

Boxes and enclosures shall be securely mounted to the building structure with supporting facilities independent of the conduit entering or leaving the boxes.

3.5 IDENTIFICATION PLATES AND WARNINGS

Identification plates shall be furnished for lighting and power panelboards, motor control centers, all line voltage heating and ventilating control panels, fire detector and sprinkler alarms, door bells, pilot lights, disconnect switches, manual starting switches, and magnetic starters. Process control devices and pilot lights shall have identification plates.

Identification plates shall be furnished for all line voltage enclosed circuit breakers, identifying the equipment served, voltage, phase(s) and power source. Circuits 480 volts and above shall have conspicuously located warning signs in accordance with OSHA requirements.

3.6 PAINTING

Exposed conduit, supports, fittings, cabinets, pull boxes, and racks shall be thoroughly cleaned and painted as specified in Section 099205 ARCHITECTURAL PAINTING.

3.7 FIELD TESTING

After the installation is complete wire and cable shall be given a continuity and insulation resistance test. Insulation resistance test shall be with a 1000 DC - volt insulation test set. Readings shall be recorded after a minimum of 3 minutes and until the reading is constant for 1 minute. Resistance between phase conductors and ground shall be no less than 25 megohms.

Phase-rotation tests shall be conducted on three-phase circuits using a phase-rotation indicating instrument. Phase rotation of electrical connections to connected equipment shall be A, B, C left to right, or top to bottom facing the equipment.

Transformers shall be given an insulation resistance test. Resistance between each phase and ground shall be not less than 25 megohms.

Final acceptance will depend upon the satisfactory performance of the equipment under test. No conductor or circuit shall be energized until the installation has been approved by the Contracting Officer. Final test data shall be provided to the Contracting Officer. Data shall have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Data - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --

SECTION 16225

MOTORS

04/05

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11 (1990; R 2000) Load Ratings and Fatigue Life for Roller Bearings

ABMA 9 (1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 112 (1996) Standard Test Procedure for Polyphase Induction Motors and Generators

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2003) Acceptance Testing Specifications for Electrical Power Distribution Equipment Systems

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1 (2003) Mechanical Vibration - Balance Quality Requirements of Rigid Rotors - Part 1: Determination of Permissible Residual Unbalance

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2002) Motors and Generators

U.S. DEPARTMENT OF ENERGY (DOE)

DOE CI-1 (2001) How to Buy a Premium Energy-Efficient Electric Motor

1.2 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330W SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Outline drawings for Motors shall indicate overall physical features, dimensions, ratings, service requirements, and weights of equipment.

SD-03 Product Data

Equipment and performance data shall be submitted for Motors consisting of use life, system functional flows, safety features, and mechanical automated details. Curves indicating tested and certified equipment response and performance characteristics shall also be submitted.

Submit Manufacturer's Catalog Data in accordance with paragraph entitled, "Equipment," of this section

SD-07 Certificates

Certificates shall be submitted for the following tests showing conformance with the referenced standards contained in this section. Certified copies of previous test reports on identical motors may be submitted in lieu of factory test reports.

Factory Test Results
Efficiency
Power-Factor
Service Factor
Temperature Rating
Noise
Full-Load
Locked-Rotor
Insulation Resistance
Winding Resistance
High-Potential Tests

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for Motors including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

1.4 DESIGN REQUIREMENTS

The following motor design data shall be provided prior to final turnover-number of motor rotor bars, Stator slots, rotational speed; number of cooling fan blades; RPM of motor; bearing manufacturer, bearing type, bearing style and number of balls/elements; number of commutator bars and commutator brushes; and SCR firing frequencies.

PART 2 PRODUCTS

2.1 EQUIPMENT

Submit manufacturer's catalog data for motors and enclosures.

Design, fabrication, testing, and performance of motors shall be in accordance with NEMA MG 1 and ISO 1940-1 and shall meet or exceed the

requirements as specified herein.

Testing and performance of polyphase induction motors shall be in accordance with IEEE Std 112, Method B.

Efficiency labeling shall be in accordance with NEMA MG 1.

Allowable balance limits shall be in accordance with ISO 1940-1, Table 1

2.1.1 Efficiency

Motors shall have efficiencies in accordance with the recommended levels specified in DOE CI-1.

2.2 MOTOR TYPES

Motors shall be of the following types:

1/3 HP and smaller, single phase - capacitor start

1/2 HP and larger, three-phase - induction squirrel-cage type, NEMA Design B, having normal starting torque and low starting current

Motors shall be designed for across-the-line starting and shall be designed with torque characteristics to carry the specified rated starting load.

Motors shall have factory-sealed ball bearings with an L-10 rated life of not less than 30,000 hours in accordance with ABMA 9 or ABMA 11.

2.3 SIZES OF MOTORS

2.3.1 Motors

Motors shall be of a sufficient size for the duty to be performed and shall not exceed the full-load rating when the driven equipment is operating at specified capacity under the most severe loading conditions.

2.3.2 Electrically Driven Equipment

When electrically driven equipment differs from that indicated, adjustments shall be made to the motor size, wiring and conduit systems, disconnect devices, and circuit protection to accommodate the equipment actually installed, at no additional cost to the Government. Control and protective devices shall be in accordance with Section 16286 OVERCURRENT PROTECTIVE DEVICES."

2.4 VOLTAGE RATINGS

Motors shall have the following minimum voltage ratings:

<u>MOTOR TYPE</u>	<u>MOTOR SIZE HORSEPOWER</u>	<u>SERVICE</u>	<u>MOTOR VOLTAGE RATING</u>
Fractional horsepower, single-phase	1/3 and smaller	120/208-volt, 3-phase, 4-wire	115-volt, 60-hertz
Fractional and integral	1/2 and larger	120/208-volt, 3-phase,	200-volt, 3-phase

MOTOR SIZE			MOTOR
<u>MOTOR TYPE</u>	<u>HORSEPOWER</u>	<u>SERVICE</u>	<u>VOLTAGE RATING</u>
horsepower, 3-phase		4-wire	60-hertz

2.5 TEMPERATURE RATING AND INSULATION

Motors shall be designed for continuous operation at the rated full load in an ambient temperature of 104 degrees F.

Insulation level shall be at least Class B.

2.6 MOTOR HOUSINGS

The motor housing shall have a smooth surface in the vertical, horizontal, and axial directions at each bearing housing for attaching a magnet mounted accelerometer in order to monitor the motor vibration. The surface shall be on the bearing housing. The axial surface will be as close to the motor centerline as possible. The surface will have a finish of 63 micro-inch minimum. Diameter of finished surface shall be 2 inch minimum and must be corrosion resistant. As an option sound disks can be used to meet the smooth surface requirement. Disk shall have a minimum thickness of 3/8 inch.

Surface shall be level within 1 degree or .001 inch.

The smooth surface shall be identified (using a label or plate) "Vibration data collection point - Do Not Paint"

2.7 MOTOR ENCLOSURES

Motors installed in indoor, clean, dry, nonhazardous locations shall have open-type drip-proof enclosures. Enclosures shall have a hinged access cover at each vibration collection point. Cover must be large enough to enable the placement of a magnet/accelerometer data collection instrument.

Motors installed in outdoor, nonhazardous locations shall have waterproof enclosures.

Motors with weatherproof/waterproof enclosures shall have permanent accelerometers installed in the horizontal, vertical, and axial directions. The enclosure shall have a penetration installed to enable the accelerometer cables to be routed to outside the enclosure. A data collection box shall be mounted to the outside of the motor enclosure in a location that is easily accessible. Data collection box shall be rated NEMA 4R.

2.8 SERVICE FACTOR

Service factor of general purpose and other open ac motors shall be in accordance with NEMA MG 1.

Totally enclosed ac motors shall have a service factor of 1.15.

2.9 FACTORY TESTS

Factory test all motors in accordance with the requirements of NEMA MG 1.

Polyphase induction motors shall be factory-tested in accordance with IEEE Std 112, Method B. Tests shall consist of measurements of voltage, frequency, speed, and current under no-load conditions; voltage, frequency, and current under locked-rotor conditions; and efficiency, noise, power factor, and thermal protection. Routine tests on wound-rotor induction motors shall include the measurement of wound-rotor open-circuit voltage across the slip rings under locked-rotor conditions. Electrical tests shall consist of winding resistance, insulation resistance, and high-potential tests. Submit certified copies of factory test results for approval prior to shipment from the factory. Previous test reports on identical motors are not acceptable for these tests.

PART 3 EXECUTION

3.1 INSTALLATION

Motors shall be installed, aligned, and connected in accordance with the equipment manufacturer's instructions.

Motors shall be bolt mounted. Motor feet shall be coplanar within 0.001 inch. Base mounting points shall be accessible and adjustable to enable machine alignment. Motors over 7.5 hp shall have alignment jack bolts installed to enable alignment.

Alignment of motors shall be rechecked and adjusted as required after the motor has been in operation for not less than 48 hours.

3.2 ALIGNMENT

Before attempting alignment, the contractor will demonstrate that the load does not have any load/force imposed by the piping system. Minimum alignment values (below) are for motor and load at normal running temperatures. Values must be compensated for thermal growth. Limited movement of the motor or load (commonly known as bolt-bound) must be corrected to ensure alignment capability. Hold down bolts shall not be undercut in order to perform adjustment.

Shims shall be commercially die-cut, without seams or folds, and be made of corrosion resistant stainless steel. No more than four shims shall be used at any single point.

Motor and load shall be aligned to the following minimum specifications:

Speed(RPM)	Close-Coupled Offset (mils)	Close-Coupled Angle(mils/in.)	Spool Piece Angle (mils/in. @ coupling pt.)
600	6.0	2.0	3.0
900	5.0	1.5	2.0
1200	4.0	1.0	1.5
1800	3.0	0.5	1.0
3600	1.5	0.4	0.5
7200	1.0	0.3	0.4

Motor/load alignment shall be performed under the direction of the manufacturer's representative.

Final alignment settings shall be provided as part of the final test data.

3.3 ELECTRICAL TESTS

Perform continuity test on all phases.

Perform insulation resistance and polarization index test on each phase of motor. Insulation tests on motors rated less than 480-volts shall be conducted using 500-volt insulation test set.

Test data shall include the location and identification of motors and megohm readings versus time. Test data shall be recorded at 15, 30, 45 seconds, and in 1 minute increments thereafter up to 10 minutes. Megohm readings shall not be less than 25 megohms for each phase and each phase reading shall be within 10 percent of the other two.

Perform inspections and test procedures on all motors in accordance with NETA ATS 7.15.1 for rotating machinery, AC motors.

Calculate the polarization index of each phase by dividing the 10 minute reading by the 1 minute reading. The polarization index shall be greater than 1.25. Any values lower shall be rejected and the motor returned to the factory.

-- End of Section --

SECTION 16446

PANELBOARDS

04/05

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|-----------|--|
| NEMA 250 | (2003) Enclosures for Electrical Equipment
(1000 Volts Maximum) |
| NEMA AB 1 | (1999) Molded Case Circuit Breakers and
Molded Case Switches |
| NEMA PB 1 | (2000) Panelboards |

UNDERWRITERS LABORATORIES (UL)

- | | |
|-------|--------------------|
| UL 67 | (2003) Panelboards |
|-------|--------------------|

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

- | | |
|-------------|--|
| FED-STD 595 | (1994b) Colors Used in Government
Procurement |
|-------------|--|

1.2 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Detail Drawings shall be submitted for the panelboards consisting of fabrication and assembly drawings for all parts of the work in sufficient detail to enable the Government to check conformity with the requirements of the contract documents. Drawings shall include details of bus layout.

Outline Drawings for panelboards shall indicate overall physical features, dimensions, ratings, service requirements, and weights of equipment.

Statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system or material meet specified requirements. Statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330W SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Detail Drawings and Outline Drawings shall be submitted for panelboards in accordance with paragraph entitled, "General Requirements," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Panelboards
Directory Card and Holder
Filtered Panelboard

SD-04 Samples

Keys shall then be properly tagged and delivered to the Contracting Officer.

SD-06 Test Reports

Test reports shall be submitted for the following tests in accordance with the paragraph entitled, "Site Testing," of this section. Panelboards shall not be energized until the recorded test data have been submitted to and approved by the Contracting Officer.

Continuity Tests
Insulation Tests

SD-07 Certificates

Statements shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for Panelboards including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

PART 2 PRODUCTS

2.1 PANELBOARDS

Power-distribution panelboards and lighting and appliance branch-circuit panelboards shall be totally enclosed in a steel cabinet, dead-front circuit breaker type with copper buses, surface- or flush-mounted as indicated. Panelboards shall conform to NEMA PB 1 and NEMA AB 1. Branch circuit panels shall have buses fabricated for bolt-on type circuit breakers.

An outer door or cover, hinged on one side, shall be provided on surface-mounted panelboards to provide gutter space access. A center door shall be provided for circuit breaker access only.

Voltage and current rating, number of phases, and number of wires shall be as indicated. Four-wire distribution panelboards and lighting and appliance branch-circuit panelboards shall be provided with an isolated

full-capacity neutral bus. Panelboards shall be rated for 120/208-volt, three-phase, 60-hertz current.

Three-phase, 4-wire distribution lighting and branch circuit panelboards shall be provided with an isolated full-capacity bus providing spaces for single-pole circuit breakers and spaces indicated as spare.

Panelboards shall be provided with a separate grounding bus bonded to the enclosure. Grounding bus shall be a solid bus bar of rectangular cross section equipped with binding screws for the connection of equipment grounding conductors.

Each panelboard, as a complete unit, shall have a short-circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or as indicated.

Panelboards and main lugs or main breaker shall have current ratings as shown on the panelboard schedule.

Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Three-phase, four-wire busing shall be such that when any three adjacent single-pole breakers are individually connected to each of the three different phases, two- or three-pole breakers can be installed at any location. Current-carrying parts of the bus assembly shall be plated. Mains ratings shall be as shown.

Mechanical lugs furnished with panelboards shall be cast copper or copper alloys of sizes suitable for the conductors indicated to be connected thereto.

Panelboard box shall be galvanized code-gage sheet steel without knockouts. Entire panelboard front shall be hinged on one side with a piano hinge for the full height and shall also have captive screws opposite the hinged side.

Panelboard enclosures shall be NEMA 250, Type 1. Enclosures shall be provided with hinged fronts and corrosion-resistant steel pin-tumbler cylinder locks. Locks shall be keyed alike, and two keys shall be provided for each enclosure.

Panelboards shall be finished with baked fast drying enamel. Finish color shall be No. 61 gray conforming to FED-STD 595.

2.2 CIRCUIT BREAKERS

Circuit breakers shall be the molded-case type as specified in Section 16286 OVERCURRENT PROTECTIVE DEVICES. Frame and trip ratings shall be as indicated.

2.3 DIRECTORY CARD AND HOLDER

A directory card shall be mounted on the inside of hinged fronts and doors 0.030-inch thick minimum plastic in a metal frame, with spaces for circuit numbers, outlets controlled, and room numbers. Directory card shall identify each branch circuit with its respective and numbered circuit breaker.

2.4 FACTORY TESTING

Complete panelboards shall be tested in accordance with UL 67.

2.5 PRECAUTIONARY LABEL

To ensure persons are aware of immediate or potential hazard in the application, installation, use, or maintenance of panelboards, each panelboard shall be conspicuously marked on the trim or dead front shield with the text (or equivalent) **DANGER** symbol. If the panel is supplied with a door, the label shall be visible when the door is in the open position.

PART 3 EXECUTION

3.1 INSTALLATION

Panelboards shall be installed as indicated and in accordance with the manufacturer's instructions. Panels shall be fully aligned and mounted so that the height of the top operating handle will not exceed 72-inches above the finished floor.

Directory-card information shall be typewritten in capital letters to indicate outlets controlled and final room numbers served by each circuit and shall be mounted in holders behind protective covering.

3.2 SITE TESTING

Each panelboard enclosure key shall be shown to operate the enclosure locks in the presence of the Contracting Officer.

Panelboards shall be given continuity and insulation tests after the installation has been completed and before the panelboard is energized.

Test equipment, labor, and personnel shall be provided by the Contractor as required to perform the tests as specified. Continuity tests shall be conducted using a dc device with buzzer .

Insulation tests on panelboards rated 300 volts or less shall be conducted using a 500-volt minimum insulation-resistance test set. Readings shall be recorded after 1 minute and until the reading is constant for 15 seconds. Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.

Test data shall be recorded and shall include the location and identification of panelboards and megohm readings versus time.

-- End of Section --