

SECTION 01 61 03
EQUIPMENT – BASIC REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements of this specification section apply to all equipment provided on the Project including those found in other Divisions even if not specifically referenced in individual “Equipment” articles of those specification sections.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 00, Procurement and Contracting Requirements.
 - 2. Division 01, General Requirements.
 - 3. Section 03 30 00, Cast-in-Place Concrete
 - 4. Section 05 50 00, Metal Fabrications.
 - 5. Section 07 92 00, Joint Sealants.
 - 6. Section 09 90 00, Painting and Coating.
 - 7. Section 10 14 00, Signage.
 - 8. Section 40 27 00, Process Piping—General.
 - 9. Section 40 90 00, Instrumentation and Control for Process Systems.
 - 10. Section 44 42 56.11, Vertical Inline Multistage Centrifugal Pumps.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. The following is a list of standards which may be referenced in this section:
 - a. American Bearing Manufacturers Association (ABMA).
 - b. American Gear Manufacturers Association (AGMA).
 - c. ASTM International (ASTM):
 - 1) E1934, Standard Guide for Examining Electrical and Mechanical Equipment with Infrared Thermography.
 - 2) F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - d. Hydraulic Institute (HI): 9.6.4, Rotodynamic Pumps for Vibration Measurements and Allowable Values.
 - e. International Electrotechnical Commission (IEC).
 - f. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
 - g. International Organization for Standardization (ISO):
 - 1) 1940, Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance Tolerances.

- 2) 21940-11, Mechanical Vibration - Rotor Balancing - Part 11: Procedures and Tolerances for Rotors with Rigid Behavior.
 - h. International Electrical Testing Association (NETA): ATS, Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems.
 - i. National Electrical Manufacturers Association (NEMA):
 - 1) 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2) ICS 6, Enclosures for Industrial Control and System.
 - 3) MG 1, Motors and Generators.
 - j. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
 - k. National Institute for Certification in Engineering Technologies (NICET).
 - l. National Institute of Standards and Technology (NIST).
 - m. Occupational Safety and Health Administration (OSHA): 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
 - n. UL.
 - 1) 508, Standard for Safety Industrial Control Equipment.
 - 2) 508A, Standard for Safety Industrial Control Panels.
 - 3) 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations.
 - o. Vibration Institute.
- B. All testing required by this specification section to be provided and paid for by Contractor.
- C. Vibration Testing Program:
- 1. Testing Firm:
 - a. An independent firm performing, as the sole or principal part of its business for a minimum of 10 years, the inspection, testing, calibration, and adjusting of systems.
 - b. Must have an established monitoring and testing equipment calibration program with accuracy traceable in an unbroken chain, according to NIST.
 - 2. Field Personnel:
 - a. Minimum of 3 years field experience covering all phases of field vibration testing and data gathering.
 - b. Qualified Vibration Category II certification from the Vibration Institute.

3. Analysis Personnel:
 - a. Minimum 5 years combined field testing and data analysis experience.
 - b. Qualified Vibration Category III certification from the Vibration Institute.
- D. Electrical Equipment and Connections Testing Program:
1. Testing Firm:
 - a. An independent firm performing, as the sole or principal part of its business for a minimum of 10 years, the inspection, testing, calibration, and adjusting of systems.
 - b. Must have an established monitoring and testing equipment calibration program with accuracy traceable in an unbroken chain, according to NIST.
 2. Field Personnel:
 - a. Minimum of 1 year field experience covering all phases of electrical equipment inspection, testing, and calibration.
 - b. Relay test technician having previous experience with testing and calibration of relays of the same manufacturer and type used on Project and proficient in setting and testing the types of protection elements used.
 - c. Supervisor certified by NETA or NICET.
 3. Analysis Personnel:
 - a. Minimum 3 years combined field testing and data analysis experience.
 - b. Supervisor certified by NETA or NICET.
- E. Miscellaneous:
1. A single manufacturer of a “product” shall be selected and utilized uniformly throughout Project even if:
 - a. More than one manufacturer is listed for a given “product” in Specifications.
 - b. No manufacturer is listed.
 2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations shown on Electrical Power Drawings and defined in the Electrical specifications.

1.03 DEFINITIONS

- A. Product: Manufactured materials and equipment.
- B. Major Equipment Supports – Supports for Equipment:
 - 1. Located on or suspended from elevated slabs with supported equipment weighing 2,000 pounds or greater, or;
 - 2. Located on or suspended from roofs with supported equipment weighing 500 pounds or greater, or;
 - 3. Located on slab-on-grade or earth with supported equipment weighing 5,000 pounds or more.
- C. Equipment:
 - 1. One or more assemblies capable of performing a complete function.
 - 2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.
 - 3. Not limited to items specifically referenced in “Equipment” articles within individual specifications.
- D. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project Site.
 - 2. Installer and applicator are synonymous.
- E. Baseplate or Equipment Base Plate or Machine Base: Are fabricated frames of structural shapes and plates with enough strength and sturdiness to serve as the surface to which other equipment is attached to and supported by. Baseplates can be directly mounted and grouted to concrete equipment support bases or machined and bolted to a sole plate.
- F. Sole Plate:
 - 1. A thick steel machined plate that is attached to and grouted to a concrete equipment support base.
 - 2. Base plates are bolted to a sole plate when a sole plate is specified and/or provided.

1.04 SUBMITTALS

- A. Action Submittals:
 - 1. General for All Equipment:
 - a. See Section 01 33 23, Submittal Procedures, for requirements for the mechanics and administration of the submittal process.

- b. See specific equipment specification sections for additional submittal requirements which may not be included herein.
- c. Data sheets that include manufacturer's name and complete product model number.
 - 1) Clearly identify all optional accessories that are included.
- d. Acknowledgement that products submitted comply with the requirements of the standards referenced.
- e. Manufacturer's delivery, storage, handling, and installation instructions.
- f. Equipment identification utilizing numbering system and name utilized in the Drawings.
- g. Equipment Installation Details:
 - 1) Location of anchorage.
 - 2) Type, size, and materials of construction of anchorage.
 - 3) Anchorage setting templates.
 - 4) Manufacturer's installation instructions.
- h. Equipment area classification rating.
- i. Shipping and operating weight.
- j. Equipment Physical Characteristics:
 - 1) Dimensions (both horizontal and vertical).
 - 2) Materials of construction and construction details.
- k. Equipment factory primer and paint data.
- l. Manufacturer's recommended spare parts list.
- m. Equipment lining and coatings.
- n. Equipment utility requirements include air, natural gas, electricity, and water.
- o. Ladders and Platforms Provided with Equipment:
 - 1) Certification that all components comply fully with OSHA requirements.
 - 2) Full details of construction/fabrication.
 - 3) Scaled plan and sections showing relationship to equipment.
- 2. Mechanical and Process Equipment:
 - a. Operating Characteristics:
 - 1) Technical information including applicable performance curves showing specified equipment capacity, rangeability, and efficiencies.
 - 2) Brake horsepower requirements.
 - 3) Copies of equipment data plates.
 - b. Piping and duct connection size, type and location.
 - c. Equipment bearing life certification.
 - d. Equipment Foundation Data:
 - 1) Equipment center of gravity.
 - 2) Criteria for designing vibration, special or unbalanced forces resulting from equipment operation.
- 3. Electric Motors: See Section 26 20 00, Low-Voltage AC Induction Motors for submittal requirements.

4. Systems Schematics and Data:
 - a. Provide system schematics where required in system specifications.
 - 1) Acknowledge all system components being supplied as part of the system.
 - 2) Utilize equipment, instrument and valving tag numbers defined in the Contract Documents for all components.
 - 3) Provide technical data for each system component showing compliance with the Contract Document requirements.
 - 4) For piping components, identify all utility connections, vents and drains which will be included as part of the system.
 - b. For factory painted equipment, provide paint submittals in accordance with Section 09 90 00, Painting and Coating.
 - c. Qualifications for:
 - 1) Electrical equipment and connections testing firm and personnel.
5. Equipment Monitoring and Testing plans, in accordance with Part 3 of this specification section:
 - a. Vibration testing.
 - b. Electrical equipment and connection testing.

B. Informational Submittals:

1. See specific equipment specification sections for additional submittal requirements which may not be included herein.
2. Notification, at least 1 week in advance, that testing will be conducted at factory.
3. Submit sample Manufacturer's Field Service Report (MFSR). Report shall use manufacturer's standard report or use the form in the Exhibits and have at least the following information:
 - a. Certification that equipment has been installed properly, has been initially started up, has been calibrated and/or adjusted as required, and is ready for operation.
 - b. Certification for major equipment supports that equipment foundation design loads shown on the Drawings or specified have been compared to actual loads exhibited by equipment provided for this Project and that said design loadings are equal to or greater than the loads produced by the equipment provided.
 - c. Testing and monitoring reports in accordance with Part 3 of this specification section.
4. Submit completed Manufacturer's Field Service Report (MFSR) for each piece of equipment supplied.
5. Operation and Maintenance Data: See Section 01 78 23, Operation and Maintenance Data, for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install equipment as shown on the Drawings and in accordance with manufacturer's directions.
- B. Utilize templates for anchorage placement for slab-mounted equipment.
- C. For equipment having drainage requirements such as seal water, provide 3/4-inch PVC or clear plastic tubing from equipment base to nearest floor or equipment hub drain.
 - 1. Route clear of major traffic areas and as approved by Contracting Officer.
- D. DO NOT construct foundations until major equipment supports are approved.
- E. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings from closest operating floor level.
- F. Equipment Base:
 - 1. Construct level in both directions.
 - 2. Take particular care at anchor bolt locations so these areas are flat and level.
- G. Machine Bases/Sole Plates:
 - 1. Grease or tape anchorages and jack screws to inhibit grout from adhering to bolts and other anchors.
 - a. Jack screws number and size by equipment manufacturer.
 - 1) Jack Screw:
 - a) Type 316 stainless steel minimum.
 - b) 0.5 inches diameter minimum.
 - 2) Jack screw pad.
 - 3) Two-inch diameter minimum.
 - 4) Anchored in place with a structural epoxy adhesive.
 - 2. Install machine base of rotating equipment on equipment base.
 - 3. Level in both directions using jack screws, with a machinist level, according to machined surfaces on base.
 - a. Base shall be level within vertical tolerance of the lesser of
 - (a) 0.005 inch per foot with no more than 0.0005 inch difference

between any two points, or (b) equipment manufacturer's written instructions.

4. Level machine base on equipment base and align couplings between driver and driven equipment.

H. Rotating Equipment Couplings:

1. Align in the annular and parallel positions.
 - a. For equipment rotating at 1,200 rpm or less, align both annular and parallel within 0.001 inch tolerance for couplings 4-inch size and smaller.
 - b. Couplings Larger than 4-inch Size: Increase tolerance 0.0005 inch per inches of coupling diameter, i.e., allow 6-inch coupling 0.002-inch tolerance, and allow a 10-inch coupling 0.004-inch tolerance.
 - c. For equipment rotating at speeds greater than 1,200 rpm allow both annular and parallel positions within a tolerance rate of 0.00025-inch per inch coupling diameter.
2. If equipment is delivered as a mounted unit from factory, verify factory alignment onsite after installation and realigned if necessary.
3. Check surfaces for runout before attempting to trim or align units.

I. Grouting:

1. Level onto equipment base with jack screws in accordance with the Contract Documents, provide a dam or formwork around base to contain grout between equipment base and equipment support pad.
2. Preparation:
 - a. Extend dam or formwork to cover leveling shims and blocks.
 - b. Do not use nuts below the machine base to level the unit.
 - c. Saturate top of roughened concrete surface with water before grouting.
3. Grout Installation:
 - a. Install grout until entire space under machine base is completely filled to underside of base.
 - 1) Voids are unacceptable.
 - b. Puddle grout by working a stiff wire through the grout and vent holes, to ensure grout is installed properly and to release air entrained in grout or base cavity.
4. After Grout Installation:
 - a. When grout is sufficiently hardened, remove dam or formwork and finish exposed grout surface to fine, smooth surface.
 - b. Completely cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too-rapid evaporation of water from grout.

- c. Check for voids by tapping along the top deck of the mounting plate. A solid thud indicates grout-filled areas while a drum-like hollow sound indicates a void requiring filling.
 - 1) Void areas are to be filled by drilling 1/8 inch NPT holes in opposite corners of each void area. Grout to be pumped into one void with a grout gun until grout emerges from the other vent hole.
- d. When grout is fully hardened (after not less than 7 days), remove jack screws, and tighten nuts on anchor bolts and similar anchors to required torque.
- e. Inspect and verify levelness of machine base and, if not in accordance with requirements, remedy by removing base and reinstalling in accordance with the Contract Documents.
- f. Inspect driver-driven equipment for proper alignment. When not in accordance with requirements, remedy so that the Work is not defective.

3.02 INSTALLATION CHECKS

- A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit Site of work and inspect, check, adjust and approve equipment installation.
 - 1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.
- B. Secure from equipment manufacturer's representative(s) a written report and deliver to Contracting Officer immediately prior to leaving Job Site. Report shall certify that equipment:
 - 1. Has been properly installed and lubricated.
 - 2. Is in accurate alignment.
 - 3. Is free from any undue stress imposed by connecting piping or anchor bolts.
 - 4. Has been operated under full load conditions and that it operated satisfactorily.
- C. No separate payment shall be made for installation checks: All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

3.03 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS

- A. Identify equipment and install hazard warning signs in accordance with Section 10 14 00, Signage.

3.04 FIELD PAINTING AND PROTECTIVE COATINGS

- A. For required field painting and protective coatings, comply with Section 09 90 00, Painting and Coating.

3.05 FIELD QUALITY CONTROL

A. General:

1. Furnish equipment manufacturer's field quality control services and testing as specified in the individual equipment Specification Sections.
2. Execute pre-demonstration requirements in accordance with Section 01 91 14, Equipment Testing, and Facility Startup.
3. Perform and report on all tests required by the equipment manufacturer's Operation and Maintenance Manual.
4. Equip testing and analysis personnel with all appropriate Project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
 - a. The Drawings and Specifications.
 - b. Related construction change documentation.
 - c. Approved Shop Drawings.
 - d. Approved Operation and Maintenance Manuals.
 - e. Other pertinent information as required.

B. Equipment Monitoring and Testing Plans:

1. Approved in accordance with Shop Drawing submittal schedule.
2. Included as a minimum:
 - a. Qualifications of firm, field personnel, and analysis personnel doing the Work.
 - b. List and description of testing and analysis equipment to be utilized.
 - c. List of all equipment to be tested, including:
 - 1) Name and tag numbers identified in the Contract Documents.
 - 2) Manufacturer's serial numbers.
 - 3) Other pertinent manufacturer identification,

C. Instruments Used in Equipment and Connections Quality Control Testing:

1. Minimum Calibration Frequency:
 - a. Field Analog Instruments: Not more than 6 months.
 - b. Field Digital Instruments: Not more than 12 months.
 - c. Laboratory Instruments: Not more than 12 months.
 - d. If instrument manufacturer's calibration requirements are more stringent, those requirements shall govern.
2. Carry current calibration status and labels on all testing instruments.

3. See individual testing programs for additional instrumentation compliance requirements.

D. Testing and Monitoring Program Documentation:

1. Provide reports with tabbed sections for each piece of equipment tested.
2. Include all testing results associated with each piece of equipment under that equipment's tabbed section.
 - a. Include legible copies of all forms used to record field test information.
3. Prior to start of testing, submit one copy of preliminary report format for Contracting Officer review and comment.
 - a. Include data gathering and sample test report forms that will be utilized.
4. In the final report, include as a minimum, the following information for all equipment tested:
 - a. Equipment identification, including:
 - 1) Name and tag numbers identified in the Contract Documents.
 - 2) Manufacturer's serial numbers.
 - 3) Other pertinent manufacturer identification,
 - b. Date and time of each test.
 - c. Ambient conditions including temperature, humidity, and precipitation.
 - d. Visual inspection report.
 - e. Description of test and referenced standards, if any, followed while conducting tests.
 - f. Results of initial and all retesting.
 - g. Acceptance criteria.
 - h. "As found" and "as left" conditions.
 - i. Corrective action, if required, taken to meet acceptance.
 - j. Verification of corrective action signed by the Contractor, equipment supplier, and Contracting Officer or Contracting Officer's authorized representative.
 - k. Instrument calibration dates of all instruments used in testing.
5. Provide three bound final reports prior to Project final completion.

E. Electrical Equipment and Connections Testing Program:

1. Perform testing on Electrical equipment and connections in accordance with the Electrical specification requirements.
2. Testing of Motors: Bump motor to check for correct rotation.
3. Repair or replace equipment shown to be out of range of the acceptable tolerance until the equipment meets or exceeds acceptability standards.

F. Other Testing:

1. Perform tests and inspections not specifically listed but required to ensure equipment is safe to energize and operate.

3.06 DEMONSTRATION

- A. Demonstrate equipment in accordance with Section 01 79 00, Demonstration and Training.

3.07 SUPPLEMENT

- A. The supplement listed below, following “End of Section,” is a part of this specification:
 1. Exhibit A, Manufacturer Field Service Report.

END OF SECTION

EXHIBIT A
MANUFACTURER FIELD SERVICE REPORT

This field service report is generic in nature. An electronic copy of this form will be furnished upon request from the Contracting Officer. This report is to reflect that all requirements of the Operations and Maintenance Manual and the individual equipment specification requirements have been performed for the installation and operation and also to provide a baseline for amperage draw for each phase, vibration readings, rotation, alignment and all other applicable tests required to insure that the equipment has been installed properly. A MFSR will be required for each individual piece of equipment requiring a MFSR.

Definitions of Reports:

Initial Service Report: Required for construction preparations. Equipment delivered to Site is in good condition and conforms to specification requirements. Anchor bolts, hardware and ancillary items (piping, flanges, conduits, fuel/power supply) are compatible with equipment.

Interim Service Report: Required for equipment installation onto base or foundation. Piping connections, electrical and control connections or structural attachment are complete. For equipment stored onsite over 4 weeks, interim service report will document that manufacturer's long-term storage procedures have been incorporated and equipment has not been damaged, nor coatings deteriorated.

Final service report is to be completed when equipment can be started, electrical amperage and voltage draw measured, cold and hot alignments performed, vibration testing and monitoring performed and the equipment is found to be in compliance with Manufacturer's operating parameters and the requirements of the individual equipment specifications.

PROJECT: _____

Report Status:

Initial Service Report completed and submitted on _____

Interim Service Report completed and submitted on _____

Final Service Report completed and submitted on _____

Commencement of Warranty _____

I Description

- A. Equipment Name and Identification: _____
- B. Serial Number: _____
- C. Specification Section Number: _____
- D. Manufacturer: _____
- E. Representative: _____
- F. Type of Service: Initial _____ Interim _____ Final _____

II General Review

- A. The above referenced equipment/material/supplies have been inspected, checked, and adjusted. Yes _____ No _____

Summary:

- B. The above referenced equipment/material/supplies were placed upon properly prepared or suitable substrate. N/A _____ Yes _____ No _____

Summary:

- C. The above referenced equipment/material/supplies are free from any undue stress imposed by any connected piping, anchor bolts or any other load.
N/A _____ Yes _____ No _____

Summary:

- D. The above referenced equipment/material/supplies have operated under design conditions. N/A _____ Yes _____ No _____

Summary:

- E. The above referenced equipment/material/supplies have been installed in accordance with the manufacturer's recommendations and the Procurement Documents, require no corrective work, and are hereby approved.

Yes _____ No _____

Summary:

- F. The above referenced equipment/material/supplies are acceptable to the manufacturer as installed providing the following corrective action(s) are performed:

1. _____
2. _____
3. _____
4. _____
5. _____

III

Inspection Checklist

Item	Acceptable (Yes/No)	Readings/Comments
Bearings (1)		
Belts (tension reading)		
Lubrication Levels		
Vibration (1) (mils/sec)		
Starting Amps		
Full Load Amps		
Volts		
Rotation		
Seal Water Flow		
Seal Water Pressure (psi)		
Alignment (1)		
Anchor Bolts		
Grout		
(1) Inspection or testing reports must be attached.		

IV O&M Manuals

- A. The O&M manual as presented contains all information required for proper operation, maintenance, and instruction of this system.

N/A _____ Yes _____ No _____

Summary:

V Preventive Maintenance

- A. The preventive maintenance summary outlined in the O&M manual is acceptable for operation of the system throughout the warranty period.

N/A _____ Yes _____ No _____

Summary:

VI Operator Training/Classroom Instruction

- A. Training and instruction have been performed in accordance with the requirements of the Procurement Documents. N/A _____ Yes _____ No _____

- B. Final Training/Classroom Instruction Completed on: _____

Summary:

VII Remarks

VIII Certification

I hereby certify, that I, _____, am a duly authorized representative of the manufacturer, that I am empowered by the manufacturer to inspect, approve, and operate his equipment, and that I am authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as modified herein. I also certify that all information contained herein is true and accurate.

By: _____

(Authorized Representative)

For: _____

Date: _____

IX Acknowledgments

By: _____

For: _____

(Contractor)

Date: _____

By: _____

For: _____

(Contracting Officer)

Date: _____

