



**City of Pompano Beach, Purchasing Division
1190 N.E. 3rd Avenue, Building C
Pompano Beach, Florida, 33060**

May 13, 2015

**ADDENDUM #1, Bid L-22-15
WATER TREATMENT PLANT ELECTRICAL MASTER PLAN PHASE II IMPROVEMENTS**

To Whom It May Concern,

Please review the following questions submitted by potential bidders, and answers from the City.

The deadline for acceptance of bids in the Purchasing Office, 1190 N.E. 3rd Avenue, Bldg. C, Pompano Beach, 33060, has been extended to 2:00 p.m. (local), May 27, 2015.

Q1: Will there be an allowance for permits or a contingency?

Response: Yes. A permit allowance of \$25,000 has been added as bid item 9. A contingency of \$50,000 has been added as bid item 10. Bidders must use the attached page 18 when submitting your bid. Item 7. Bid Proposal section on page 15 has been changed to state "The Proposal shall be submitted and listed according to the following Bid Items (1 through 10) for the Base Bid and Separate Bid Alternate "A" and in accordance with Bidding Instructions."

Q2: Can an Electrical Contractor be the Prime Bidder on this bid?

Response: Yes. The bid document changes listed below address this.

Page 10 Section 10.1 BID PROPOSAL; Qualifications of Bidders:

- a. Subparagraph 10.1: The word "General" is deleted, since it will be allowed for an Electrical Contractor to submit a BID as a Prime Bidder.

Page 84 SUPPLEMENTARY CONDITIONS; b, c and d below have been added

- b. The prime Bidder can be a qualified General Contractor or a qualified Electrical Contractor.
- c. If the Prime Bidder is a General Contractor, then scope of Electrical Work must be subcontracted to a qualified Electrical Contractor.
- d. If the Prime Bidder is an Electrical Contractor, then scope of non-electrical work shall be subcontracted to a qualified General Contractor.

Q3: On page C-SP-01 the key notes refer typical structural and civil notes that are not included in the bid documents, please add this information.

- a. #3 – S302 / Typ
- b. #4 – S300 / Typ
- c. #5 – C161 / Typ

Response:

For a. #3 – S302 / Typ S302 is a Typical detail, and is included on sheet T-00-T2 of the Bid Drawings.

For b. #4 – S300 / Typ S300 is a Typical detail, and is included on sheet T-00-T2 of the Bid Drawings.

For c. #5 – C161 / Typ C161 is a Typical detail, and is included on sheet T-00-T3 of the Bid Drawings.

Q4: On page S-HSP-01 the key note #7 refers to a structural detail #S304 / typ; provide this detail.

Response: Typical detail S304 is included on sheet T-00-T2 of the Bid Drawings.

Q5: On page S-HSP-01 the door schedule refers to architectural details that are not included in the bid documents, please add this information;

Response:

For a. A104 / Typ - Typical detail A104 is included on sheet T-00-T1 of the Bid Drawings.

For b. A105 / Typ - Typical detail A105 is included on sheet T-00-T1 of the Bid Drawings.

For c. A112 / Typ - Typical detail A112 is included on sheet T-00-T1 of the Bid Drawings.

For d. A120 / Typ - Typical detail A120 is included on sheet T-00-T1 of the Bid Drawings.

For e. A122 / Typ - Typical detail A120 is included on sheet T-00-T1 of the Bid Drawings.

Q6: On page S-HSP-01 the room finish schedule indicated gypsum board finish for the interior walls in room #103. What is the framing system for the GWN; wood furring, metal Z-furring or studs?

Response: Refer to Specification Section 07212-2.02-B.

Q7: On page S-DHSP-01 the exterior elevations indicate that existing fan and window openings are to be “backfilled”. Key notes #1 & #2 do not specify the type of materials for the backfill, are these opening to be infilled with masonry or metal framing in order to provide the stucco finish?

Response: See Key note 12 on sheet S-HSP-01.

Q8: On page S-HSP-01 key note #11 indicates rubber flooring in room #103; there are no specification, please provide this information. (Also noted in changes to Drawings section of this addendum.)

Response: Drawing No. “S-HSP-01”, Sheet 7 of 53:

- a. Add text at the end of Key Note “11” to read as follows: “See additional specifications on Key Note “19”.
- b. Add Key Note number “19” to read as follows: “The switchboard floor matting shall conform with ANSI/ASTM D178 standard, with dielectric strength of 30,000 volts AC, proof tested at 20,000 volts AC, flame retardant, 36 inches wide, black color with yellow borders, as manufactured by Mats Inc, Rhino, Wearwell, or equal. Provide insulating floor matting in front of the entire switchboard, in front of VFDs cabinets and wall mounted panelboards.

Q9: On page M-00-01 key note #4 appears to be mislabeled in the “E” photo; please confirm that note #3 should be note #4.

Response: Drawing No. M-00-01, Sheet 11 of 53, Photo details “C” and “E”; Revise Key note on the enclosure of pump-motor coupling to read number “4” in lieu of number “3”.

Q10: We would like to propose the following Florock products as an equal/and or performance equal to the products specified. (Also noted in changes to Specifications section of this addendum.)

System Specified: Tnemec series 241 Florock Equal System: FloroPoxo MVT

System Specified: Tnemec series: 222 Florock Equal: FloroQuartz BC

Topcoat Specified: Tnemec series 284 Florock Equal Topcoat: 4805

Response: The changes listed below to Specifications Section 09722; Seamless Flooring will allow the use of the specified Tnemec products or the substitution of Florock products.

1. Specifications Section 09722; SEAMLESS FLOORING

- a. Page 09722-1; Add paragraph 1.03 and subparagraphs A and B to read as follows:

“1.03 WARRANTY:

- A The flooring products manufacturer shall provide 1 year warranty for materials against defects and assure endurance to common flooring use in an electrical room.
- B The seamless flooring Installer shall provide a 1 year warranty against flooring defects, based on adequate level of skill for installation according to the flooring application and the manufacturer instructions”.

- b. Page 09722-1; Add paragraph 1.04 and subparagraphs A and B to read as follows:

“1.04 QUALITY ASSURANCE:

- A The flooring products manufacturer shall have a minimum of ten (10) years’ experience in the production and technical support of polymer-based floor coatings.
- B The seamless flooring Contractor and Installer personnel shall have a minimum of three (3) years’ experience in the application of polymer floor coatings and the entity shall be an authorized installer of the products manufacturer”.

- c. Page 09722-1; Paragraph 2.01-A, revise wording to read as follows: “The seamless flooring system shall consist of three products specified below:

- 1. Subparagraph 2.01-A-1, delete the subparagraph 1 wording in its entirety and add the following: “ 1 Primer: A modified polyamide epoxy penetrating primer for chemical resistance., as manufactured by TNEMEC Series 241, Florock MVT, or equal.
- 2. Subparagraph 2.01-A-2, delete the subparagraph 2 wording in its entirety and add the following: “ 2 Cove Bases: A two component, modified polyamide cured epoxy liquid and a colored quartz

broadcast aggregate , blended as mortar and applied by double broadcast to provide a 1/8 inch thickness layer, plus rolled radius cove and feather edged up vertical surfaces. Product as manufactured by TNEMEC Series 222, Florock Floroquartz BC, or equal.

3. Subparagraph 2.01-A-3, delete the subparagraph 3 wording in its entirety and add the following: “ 3 Top Coat: A modified polyamide cured epoxy glaze as manufactured by TNEMEC Series 284, Florock 4805, or equal”.
4. Add Subparagraph 2.01-A-4, to read as follows: “ 4. The existing room floor has an structural expansion joint. Treat the expansion joint at preparation of the floor base, with solids elastomeric resin, having a minimum elongation of 150 %, with suitable products manufactured by TNEMEC, Florock or equal”.
5. Add Subparagraph 2.01-A-5, to read as follows: “ 5. The flooring finish color will be selected by OWNER, upon submittal of available colors to match existing flooring finish in adjacent room”.

Review the following changes that have been made to the specifications of this bid.

1. Section 11312 SPLIT-CASE CENTRIFUGAL PUMPS of the specifications has been replaced by the Revised Section 11312 specifications that are part of this addendum.
2. Items 4 and 5 below have been added to Section 16305-1.05-A ELECTRICAL SYSTEM STUDIES-QUALITY ASSURANCE of the specifications.
 4. The engineering entity shall have a CERTIFICATE OF AUTHORIZATION, from the State of Florida, Board of Professional Engineers.
 5. The engineering entity shall provide a certificate of Professional Liability Insurance, including the insurance coverage required to perform as a subcontractor.
3. Section 09722 SEAMLESS FLOORING (See question 10 above)
 - a. Page 09722-1; Add paragraph 1.03 and subparagraphs A and B to read as follows:

“1.03 WARRANTY:

 - A The flooring products manufacturer shall provide 1 year warranty for materials against defects and assure endurance to common flooring use in an electrical room.
 - B The seamless flooring Installer shall provide a 1 year warranty against flooring defects, based on adequate level of skill for installation according to the flooring application and the manufacturer instructions”.
 - b. Page 09722-1; Add paragraph 1.04 and subparagraphs A and B to read as follows:

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polymer floor coatings and the entity shall be an authorized installer of the products manufacturer”.

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 2. Subparagraph 2.01-A-2, delete the subparagraph 2 wording in its entirety and add the following: “ 2 Cove Bases: A two component, modified polyamide cured epoxy liquid and a colored quartz broadcast aggregate , blended as mortar and applied by double broadcast to provide a 1/8 inch thickness layer, plus rolled radius cove and feather edged up vertical surfaces. Product as manufactured by TNEMEC Series 222, Florock Floroquartz BC, or equal.
 3. Subparagraph 2.01-A-3, delete the subparagraph 3 wording in its entirety and add the following: “ 3 Top Coat: A modified polyamide cured epoxy glaze as manufactured by TNEMEC Series 284, Florock 4805, or equal”.
 4. Add Subparagraph 2.01-A-4, to read as follows: “ 4. The existing room floor has an structural expansion joint. Treat the expansion joint at preparation of the floor base, with solids elastomeric resin, having a minimum elongation of 150 %, with suitable products manufactured by TNEMEC, Florock or equal”.
 5. Add Subparagraph 2.01-A-5, to read as follows: “ 5. The flooring finish color will be selected by OWNER, upon submittal of available colors to match existing flooring finish in adjacent room”.

Review the following changes that have been made to the Drawings of this bid.

1. Drawing No. “S-HSP-01”, Sheet 7 of 53: (See question 8 above)
 - a. Add text at the end of Key Note “11” to read as follows: “See additional specifications on Key Note “19”.
 - b. Add Key Note number “19” to read as follows: “The switchboard floor matting shall conform with ANSI/ASTM D178 standard, with dielectric strength of 30,000 volts AC, proof tested at 20,000 volts AC, flame retardant, 36 inches wide, black color with yellow borders, as manufactured by Mats Inc, Rhino, Wearwell, or equal. Provide insulating floor matting in front of the entire switchboard, in front of VFDs cabinets and wall mounted panelboards.
2. Drawing No. “M-00-01”, Sheet 11 of 53:
 - a. Photo details “C” and “E; Revise Key note on the enclosure of pump-motor coupling to read number “4” in lieu of number “3”.
3. HVAC ductwork items for mitigation of existing conflicts between the ductwork and conduits. (See sketches H-HSP-02 (A) and H-HSP-02 (B) last 2 pages of this addendum.)
 - a. Drawing No. “H-HSP-02”, Sheet 10 of 53: Ductwork Extension Plan.

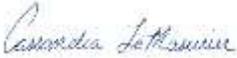
- i. Modify existing HVAC ductwork in the VFD Room as shown in attached sketch "H-HSP-02 (A)" and per additional key notes No. 6 through No. 9.
- ii. Add call-out for detail "B", as shown in attached sketch "H-HSP-02 (A)".
- iii. Add detail "B" shown in attached sketch "H-HSP-02 (B)".
- iv. Add Key Notes number "6" through Number "9", to read as shown in sketch "H-HSP-02 (A)".

Addendum #1 is posted on the City's website: <http://www.pompanobeachfl.gov>. Acknowledge receipt of this Addendum in the area provided on page 14 of the bid.

The deadline for acceptance of bids in the Purchasing Office, 1190 N.E. 3rd Avenue, Bldg. C, Pompano Beach, 33060, is **2:00 p.m. (local), May 27, 2015.**

The remainder of the solicitation is unchanged at this time.

Sincerely,



Cassandra LeMasurier, Purchasing Supervisor

cc: website
file

- a) Acceptance Testing of All New Electrical Equipment and Wiring at the Membrane Building and Public Works Administration Building.

Bid Item 6, Lump Sum: \$ _____

Bid Item 7:

Construction of upgrades under Phase 2 Electrical Master Plan Improvements, as specified including all necessary work for the following elements:

- a) Contractor shall provide field technical labor for attending site meetings with Owner’s Electrical Department, Engineer and/or Engineering Entity for coordination and discussion of Contractor’s approach, work schedule and timely submittal of all necessary electrical system field data, for the Engineer and/or Engineering Entity to perform the electrical system studies required in technical specifications section 16305.
- b) Contractor shall provide field technical labor, tools, reading equipment, personnel protective means and methods, for work requirements specified in part 1.06-A and part 3.01-A of technical specifications section 16305, including but not limited to review record drawings, gather pertinent field data, take photographs of electrical equipment rooms with equipment layout and detail photographs of electrical equipment, gather accurate data of existing and new Protective Device (breaker and fuses) containing manufacturer Name, Equipment Model Number, Electrical Equipment Ratings, Existing Protective Settings. Also, determine cable/wiring Insulation, Verify Wire Sizes and Measure Wire lengths, and submit clear, organized and thorough documentation to the engineering entity in responsible charge of performing the electrical system studies, according to the requirements specified in technical specifications section 16305.

Bid Item 7, Lump Sum: \$ _____

Bid Item 8: Indemnification **Bid Item 8, Lump Sum:** \$ 10.00

Bid Item 9: Permit Fee Allowance **Bid Item 9, Lump Sum:** \$ 25,000.00

Bid Item 10: Contingency (only to be used at the City’s discretion for unforeseen circumstances) **Bid Item 10, Lump Sum:** \$ 50,000.00

BASE BID GRAND TOTAL:

(Including Lump Sum of Bid Items 1 through 10 above) \$ _____

BID ALTERNATE A

Provide a separate lump sum price, to be added to the BASE BID price at the option of the City, containing all engineering and related technical expertise services from an independent and qualified engineering entity, perform and deliver a comprehensive electrical system study for the entire Water Treatment Plant, including but not limited to analysis of existing power distribution system at the Lime Softening plant, the existing power distribution system at the Membrane Filter plant, existing electrical equipment at the Public Works Administration Building (located adjacent to the Water Treatment Plant) plus additional new electrical system in the Electrical

REVISED SECTION 11312
SPLIT-CASE CENTRIFUGAL PUMPS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Two new electric motors, new pump-motor couplings and related auxiliary devices for existing split-case centrifugal pumps supplying backwash water to the filters.

- B. Related sections:
 - 1. The Contract Documents are complementary, what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. Section 16222 – Low voltage Electric Motors

1.02 REFERENCES

- A. American Bearing Manufacturers' Association (ABMA):
 - 1. 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. 11 - Load Ratings and Fatigue Life for Roller Bearings.

- B. American Society of Mechanical Engineers (ASME):
 - 1. B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 250.
 - 2. B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.

- C. ASTM International (ASTM):
 - 1. A 48 - Standard Specification for Gray Iron Castings.
 - 2. A 108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - 3. A 276 - Standard Specification for Stainless Steel Bars and Shapes.
 - 4. A 283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - 5. A 582 - Standard Specification for Free-Machining Stainless Steel Bars.
 - 6. B 505 - Standard Specification for Copper Alloy Continuous Castings.
 - 7. B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
 - 8. E 10 - Standard Test Method for Brinell Hardness of Metallic Materials.

- D. Hydraulic Institute (HI):
 - 1. 1.1-1.2 - Rotodynamic (Centrifugal) Pumps for Nomenclature and Definitions.
 - 2. 1.3 - Rotodynamic (Centrifugal) Pumps for Design and Application.
 - 3. 9.1-9.5 - Pumps - General Guidelines for Types, Definitions, Application, Sound Measurement and Decontamination.
 - 4. 9.6.4 - Rotodynamic Pumps for Vibration Analysis and Allowable Values.
 - 5. 14.6 – Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.

- E. NSF International (NSF):

1. Standard 61 – Drinking Water System Components - Health Effects.

1.03 DEFINITIONS

- A. NEMA:
 1. Type 4X enclosure in accordance with NEMA 250.
- B. Pump head (total dynamic head, TDH), flow capacity, pump efficiency, net-positive suction head available (NPSHa), and net-positive suction head required (NPSHr): As defined in HI 1.1-1.2, 1.3, 9.1-9.5, 9.6.4, and 14.6 and as modified in the Specifications.
- C. Suction head: Gauge pressure available at pump intake flange or bell in feet of fluid above atmospheric; average when using multiple suction pressure taps, regardless of variation in individual taps.
- D. Allowable Operating Region (AOR): The region over which the service life of the pump is not seriously compromised by hydraulic loads, vibration, or flow separation where the pump's vibration, noise, and cavitation are within acceptable limits.

1.04 SYSTEM DESCRIPTION

- A. Existing split-case centrifugal pumps for the backwash of existing filters. The existing pump's motor base and supports shall be modified to accommodate new motor arrangements as scheduled with couplings, base plates, guards, supports, anchor bolts, and other items as specified and as required for a complete and operational system.
- B. Design requirements:
 1. Motor characteristics: As specified in the Pump Schedule.

1.05 SUBMITTALS

- A. Motors as specified in Section 16222.
- B. New coupling for existing pump and new motor and guard product data
- C. Structural details for pump-motor supports:
 1. Shop drawings drawn to scale with structural calculations of pump-motor foundation anchored to existing floor.
 2. New steel frame of pump-motor supports
 3. Materials of anchors bolts and related hardware
- D. Qualifications of the Contractor responsible for installation of new electric motors with existing pumps.
- E. Test results of required pump-motor functional test and required vibration testing.

1.06 QUALITY ASSURANCE

- A. Manufacturer of existing pumps to furnish and coordinate the use of existing pump, new motor, and pump components as specified and scheduled and to provide written installation and checkout requirements.

- B. The Contractor responsible for installation of new motors coupled with existing pumps shall have prior experience in water or wastewater treatment plant projects, including installation of similar size pumps and motors driven by variable frequency drives in five other projects. Submit qualifications of the Contractor for review during submittals for the new motors.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store new equipment in adequate, clean indoor space until equipment is ready for field installation.

1.08 SEQUENCING AND SCHEDULING

- A. Coordinate work with restrictions as specified in Section 01140.

1.09 WARRANTY

- A. Provide one year warranty for all new equipment and related work.

1.10 MAINTENANCE

- A. Provide the following spare parts:
 - 1. Motor bearing set of each type, packaged for long term storage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Existing filter backwash pumps manufacturer:
 - 1. Fairbanks Morse, Series K2C4949
 - 2. Existing electric motor frames are shown on the mechanical drawings.

2.02 SUPPORTS, PEDESTALS, AND BASEPLATES

- A. Provide new base supports for new motors as necessary for alignment of new motor with existing pump.
- B. Materials: ASTM A 283 steel, hot-dip galvanized after fabrication and coated as specified in Section 09940.
- C. Pump and driver support strength: Able to withstand minimum 1.5 times maximum imposed operating loads or imposed loads, whichever is greater.
- D. Configuration: Allow easy access to stuffing boxes, bearing frames, and couplings.
- E. Horizontal mount: Structural base plate and support for motor shall resist torsional loads and meet vibration criteria as specified in paragraph 3.03
- F. Anchor bolts: As specified in Section 05120.

2.03 COUPLINGS

- A. Types: Flexible coupling as recommended by the manufacturer of existing pump.

- B. Flexible coupling life: Infinite at up to 0.30-degree misalignment angle total or per disk for disk type at maximum operating loads.
- C. Design coupling to withstand a minimum of 1.5 times the maximum operating torque and other imposed loads.

2.04 EQUIPMENT GUARDS

- A. Provide equipment safety guards for new coupling between motor and pump.

2.05 DRIVERS

- A. Horsepower:
 - 1. As scheduled.
- B. Motors: Provide motors as specified in Section 16222 and as specified in this Section:
 - 1. Revolutions per minute: As scheduled.
 - 2. Enclosure: As scheduled.
 - 3. Electrical characteristics: As scheduled.
 - 4. Efficiency, service factor, insulation, and other motor characteristics: As specified in Section 16222.
 - 5. Motor accessories: As specified in Section 16222 and in this Section.
 - 6. Coordinate motors with the variable frequency drive manufacturer to ensure compatibility between the motor and variable frequency drive.

2.06 FINISHES

- A. Prepare surfaces and apply protective finishes as specified in Section 09960.

2.07 PUMP SCHEDULE

Tag Numbers	P-BW-301 P-BW-302
Service	Backwash Pumps (Existing)
Quantity	2
Manufacturer	Fairbanks Morse
Serial Numbers	No. 1: K2C4949 No. 2: Unknown
Maximum Noise, dBA at 3 feet	85
Torsional Analysis	Not Required
Minimum Pumped Fluid Temperature, degrees Fahrenheit	50
Normal Pumped Fluid Temperature, degrees Fahrenheit	65
Maximum Pumped Fluid Temperature, degrees Fahrenheit	80
Pump and Driver Mounting	Horizontal

Tag Numbers	P-BW-301 P-BW-302
Speed Control	Variable Frequency Drive
Maximum Pump rpm	1200
Minimum Pump rpm	440
Flow, gpm	7,200 gpm
Minimum Efficiency, Percent	70
Pump Casing	Cast Iron
Driver Type	Motor
Drive Arrangement	Horizontal
Minimum Horsepower	150
Maximum Speed, rpm	1200
Inverter Duty Rated	Yes
Motor Voltage/Phases/Hertz	460/3/60
Enclosure Type	TEFC

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install new electric motor and related pump products in accordance with manufacturer's instructions.
- B. Only one backwash water pump can be taken out of service at a time. Work shall be performed so that the new motor and coupling are installed and tested on the first pump prior to beginning work on the second pump.

3.02 MANUFACTURER'S FIELD SERVICES

- A. Require existing pump manufacturer local representative to inspect system before initial start-up and certify that system has been correctly installed and prepared for start-up as specified in this Section.

3.03 FIELD QUALITY CONTROL AND TESTING

- A. Witnessing: All field-testing shall be witnessed by the ENGINEER. Provide advance notice of field testing, at least 7 days prior to field testing.
- B. Submit Tests Plans.

1. Indicate test start time and duration, equipment to be tested, other equipment involved or required; temporary facilities required, number and skill or trade of personnel involved; safety issues and planned safety contingencies; anticipated effect on Owner's existing equipment and other information relevant to the test.
2. Provide locations of all instruments to be used for testing. Provide calibration records for all instrumentation.

C. Performance Tests

1. Level 1 Tests:
 - a. Level 1 General Equipment Test:
 - 1) For equipment, operate, rotate, or otherwise functionally test for 15 minutes minimum after components reach normal operating temperatures.
 - 2) Confirm that equipment is properly assembled, equipment moves or rotates in the proper direction, shafting, drive elements and bearings are installed and lubricated in accordance with proper tolerances, and that no unusual power consumption, lubrication temperatures, bearing temperatures, or other conditions are observed.
 - b. Level 1 Pump Performance Test:
 - 1) Demonstrate adequate performance over the entire speed range and through the range of flows required for the filter backwash operation without exceedance of the Level 1 testing criteria.
 - 2) Record measured flow, suction pressure, discharge pressure, and make observations on bearing temperatures and noise levels.

D. Vibration Test:

1. Definitions:
 - a. Peak-to-peak displacement: The root mean squared average of the peak-to-peak displacement multiplied by the square root of 2.
 - b. Peak velocity: The root mean squared average of the peak velocity multiplied by the square root of 2.
 - c. Peak acceleration: The root mean squared average of the peak acceleration multiplied by the square root of 2.
 - d. High frequency enveloping: A process to extract very low amplitude time domain signals associated with impact or impulse events such as bearing or gear tooth defects and display them in a frequency spectrum of acceleration versus frequency.
 - 1) Manufacturers: One of the following or equal:
 - a) Rockwell Automation, Entek Group, "Spike Energy" analysis.
 - b) CSI, "PeakVue."
 - e. High speed equipment: Equipment and equipment components operating at or above 600 revolutions per minute.
2. Vibration instrumentation requirements:
 - a. Analyzers: Use digital type analyzers or data collectors with anti-aliasing filter, 12 bit A/D converter, fast fourier transform circuitry, phase measurement capability, time wave form data storage, high frequency enveloping capabilities, 35 frequency ranges from 21 to 1,500,000 cycles per minute, adjustable fast fourier transform resolution from 400 to 6,400 lines, storage for up to one hundred 3,200 line frequency spectra, RS232C data output port, circuitry for integration of acceleration data to velocity or double integration to displacement.

- 1) Manufacturers: One of the following or equal:
 - a) Entek-IRD, Division of Rockwell Automation, Enpac 1200 with applicable data analysis software or Entek Model 838 analyzer with built in printer.
 - b) Computational Systems Inc., (CSI) Division of Emerson Electric, Model 2120A, Data Collector/analyzer with applicable analysis software.
- b. Analyzer settings:
 - 1) Units: English, inches/second, mils, and gravitational forces.
 - 2) Fast fourier transform lines: Most equipment 1,600 minimum; for motors, enough lines as required to distinguish motor current frequencies from rotational frequencies, use 3,200 lines for motors with a nominal speed of 3,600 revolutions per minute; 3,200 lines minimum for High Frequency Enveloping; 1,600 lines minimum for low speed equipment.
 - 3) Sample averages: 4 minimum
 - 4) Maximum frequency (Fmax): 40 times rotational frequency for rolling element bearings, 10 times rotational frequency for sleeve bearings.
 - 5) Amplitude range: Auto select but full scale not more than twice the acceptance criteria or the highest peak, whichever is lower.
 - 6) Fast fourier transform windowing: Hanning Window.
 - 7) High pass filter: Minus 3 dB at 120 cycles per minute for high speed equipment. Minus 3 dB at 21 cycles per minute for low speed equipment.
3. Vibration acceptance criteria:
 - a. Testing of rotating mechanical equipment: Tests are to be performed by an experienced, factory trained, and authorized vibration analysis expert.
 - b. Vibration displacement limits: Unless otherwise specified, equipment operating at speeds 600 revolutions per minute or less is not to exhibit unfiltered readings in excess of following:

Operating Speed (revolutions per minute)	Unfiltered (Overall) Peak-to-Peak Amplitude (mils)
	All Rotating Equipment
0 - 300	6.5
301 - 600	4.5
Note: For all equipment, axial shaft displacements not to exceed 50 percent of the maximum radial shaft displacements shown in the table relative to the casing.	

- c. Vibration velocity limits: Unless otherwise specified, equipment operating at speeds greater than 600 revolutions per minute is not to exceed the following peak velocity limits:

Item	Unfiltered Overall Limit (inches per second)	Any Filtered Peak Limit (inches per second)
Horizontal Centrifugal Pumps	0.18 (Input BHP 25 or less)	0.14 (Input BHP 25 or less)
	0.22 (Input BHP more than 25 but less than 100)	0.18 (Input BHP more than 25 but less than 100)
	0.25 (Input BHP 100 or more)	0.20 (Input BHP 100 or more)
	0.33 (Input BHP 125 or more)	0.24
Motors	See Applicable Motor Specification	

4. Testing Levels:
 - a. Level 1 Vibration Test:
 - 1) Test requirement:
 - a) Measure filtered vibration spectra versus frequency in 3 perpendicular planes at each normally accessible bearing housing on the driven equipment, any gears and on the driver; 1 plane of measurement to be parallel to the axis of rotation of the component.
 - b) Vibration spectra versus frequency shall be in accordance with Vibration Acceptance Criteria.
 - 2) Equipment operating condition: Test at specified maximum speed.
5. Vibration testing results presentation:
 - a. Provide equipment drawing with location and orientation of measurement points indicated.
 - b. For each vibration measurement take and include appropriate data on equipment operating conditions at the time vibration data is taken; for pumps, compressors, and blowers record suction pressure, discharge pressure, and flow.
 - c. When Vibration Spectra Data required:
 - 1) Plot peak vibration velocity versus frequency in cycles per minute.
 - 2) Label plots showing actual shaft or part rotation frequency, bearing inner and outer race ball pass frequencies, gear mesh frequencies and relevant equipment excitation frequencies on the plot; label probable cause of vibration peaks whether in excess of specification limits or not.
 - 3) Label plots with equipment identification and operating conditions such as tag number, capacity, pressure, driver horsepower, and point of vibration measurement.
 - 4) Plot motor spectra on a log amplitude scale versus frequency.
 - d. Provide name of manufacturer and model number of the vibration instrumentation used, including analyzer and accelerometer used together with mounting type.

E. Drivers Tests:

1. Test motors as specified in Section 16222.
2. Test variable frequency drives (VFDs) as specified in the equipment section 16264.

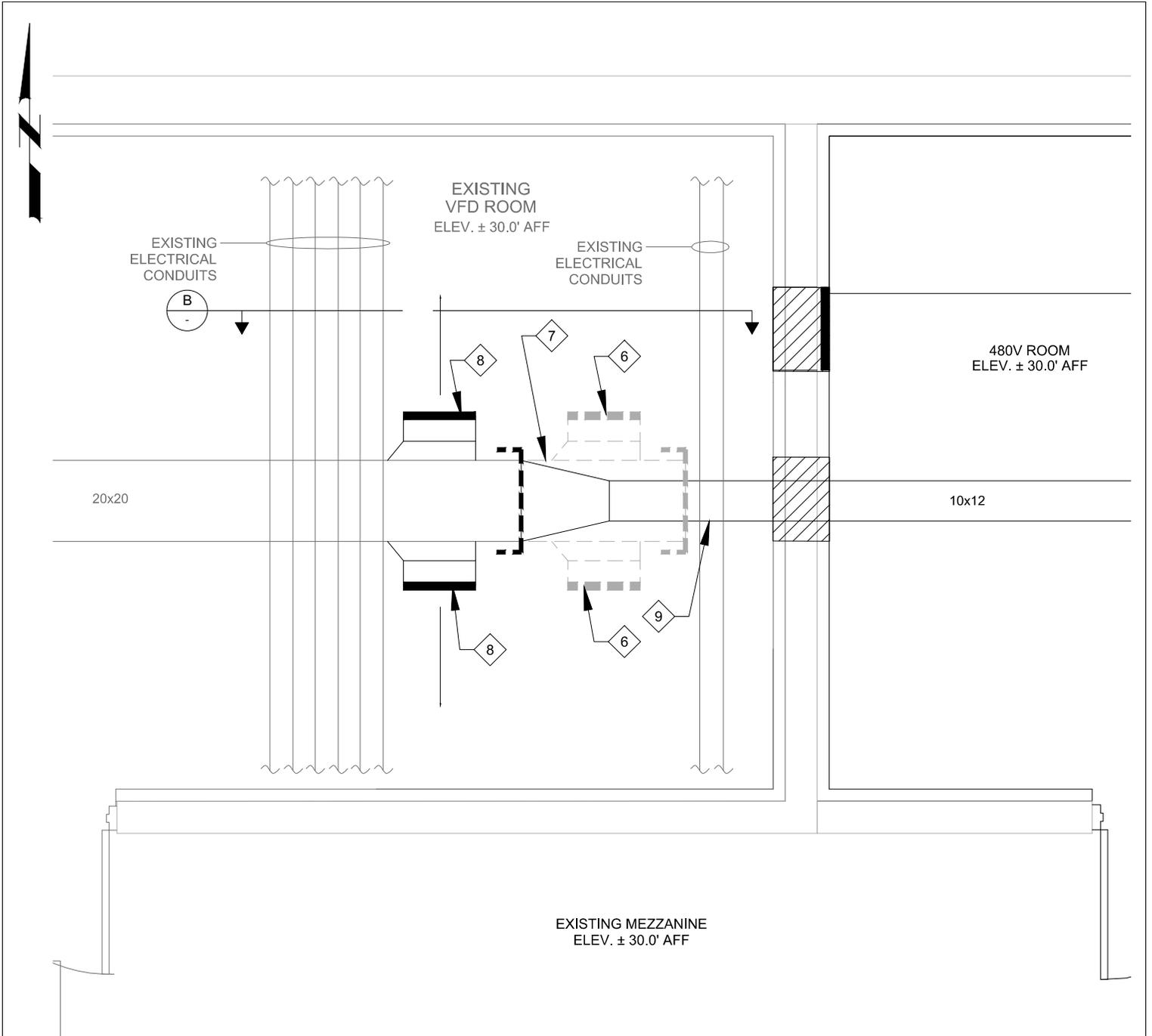
F. Noise Requirements and Control:

1. Perform noise tests in conjunction with vibration test analysis.
2. Make measurements in relation to reference pressure of 0.0002 microbar.
3. Make measurements of emitted noise levels on sound level meter meeting or exceeding ANSI S1.4, Type II.
4. Set sound level meter to slow response.
5. Unless otherwise specified, maximum free field noise level not to exceed 85 dBA measured as sound pressure level at 3 feet from the equipment.
 - a. Equipment operation: Measurements are to be obtained with equipment installed and operating within capacity ranges specified and without duplicate equipment running.
 - b. Additional criteria:
 - 1) No narrow band spectral vibration amplitude components, whether sub-rotational, higher harmonic, or synchronous multiple of running speed, are to exceed 40 percent of synchronous vibration amplitude component without manufacturer's detailed verification of origin and ultimate effect of such excitation.
 - 2) For motors, the following shall be cause for rejection:
 - a) Stator eccentricity evidenced by a spectral peak at 2 times electrical line frequency that are more than 40 percent of the peak at rotational frequency.
 - b) Rotor eccentricity evidenced by a spectral peak at 2 times electrical line frequency with spectra side bands at the pole pass frequency around the 2 times line frequency peak.
 - c) Other rotor problems evidenced by pole pass frequency side bands around operating speed harmonic peaks or 2 times line frequency side bands around rotor bar pass frequency or around 2 times the rotor bar pass frequency.
 - d) Phasing problems evidenced by 1/3 line frequency side band spectral peaks around the 2 times electrical line frequency peak.
 - e) The presence of peaks in a High Frequency Enveloping spectra plot corresponding to bearing, gear or motor rotor bar frequencies or harmonics of these frequencies shall be cause for rejection of the equipment; since inadequate lubrication of some equipment may be a cause of these peaks, lubrication shall be checked, corrected as necessary and the high frequency envelope analysis repeated.

END OF SECTION

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Sketch H-HSP-02 (A)



KEY NOTES:

- 6** MODIFY DUCTWORK TO RELOCATE EXISTING AIR OUTLETS
- 7** CUT PORTION OF EXISTING DUCTWORK.
- 8** NEW LOCATION OF AIR OUTLETS TO ALLOW SPACE FOR REDUCTION OF DUCTWORK AND ROUTING OF NEW DUCTWORK ABOVE EXISTING CONDUITS
- 9** ROUTE NEW A/C DUCTWORK ABOVE EXISTING ELECTRICAL CONDUIT

Sketch H-HSP-02 (B)



B A/C DUCTWORK (PHOTO)

SCALE: NTS
FILE:

KEY NOTES:

- 6** MODIFY DUCTWORK TO RELOCATE EXISTING AIR OUTLETS
- 7** CUT PORTION OF EXISTING DUCTWORK.
- 9** ROUTE NEW A/C DUCTWORK ABOVE EXISTING ELECTRICAL CONDUIT