

~~~~~ **PROJECT NOTE** ~~~~~

AOR/EOR IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE AOR/EOR.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE "AOR PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ALL DIVISION 00 AND DIVISION 01 SECTIONS ARE TO BE REVIEWED BY THE DESIGN MANAGER/CONSTRUCTION MANAGER FOR THE PROJECT. AOR/EOR TO COORDINATE ACCORDINGLY.

~~~ **END OF PROJECT NOTE** ~~~

SECTION 01 79 00
DEMONSTRATION, TRAINING AND COMMISSIONING

~~~~~ **PROJECT NOTE** ~~~~~

THIS SECTION RELATES TO STANDARD DEMONSTRATION OF SYSTEMS AND OPERATION INTENDED FOR SCHOOL PERSONNEL. RETAIN OPTION [CxA] FOR PROJECTS THAT REQUIRE COMMISSIONING

~~~ **END OF PROJECT NOTE** ~~~

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Board personnel in operation, maintenance, care, cleaning, maintenance, and repair of:
 - 1. Items specified in individual product Sections.
 - 2. Products and systems identified in Part 2

1.02 REFERENCES

- A. ASHRAE Guideline 0-2005 - The Commissioning Process 2005, with Errata (2011) .
- B. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process 2007, with Errata (2012).

1.03 SUBMITTALS

~~~~~ **PROJECT NOTE** ~~~~~

RETAIN OPTION [CxA] FOR PROJECTS THAT REQUIRE COMMISSIONING

~~~ **END OF PROJECT NOTE** ~~~

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- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Draft Training Session Matrix: Board will designate personnel to be trained; tailor training to needs and skill-level of attendees. Matrix shall be used to confirm scheduling of all required training sessions with the designated personnel.
 - 1. Submit not less than four weeks prior to Preliminary Acceptance.
 - 2. Revise and resubmit until acceptable.
 - 3. Provide an overall schedule showing all training sessions.
 - a. Coordinate instruction schedule with the Board's operations and schedule through the Board's Representative. Adjust schedule as required to minimize disrupting the Board's operations and to ensure attendance by designated personnel.
 - 4. Include at least the following for each training session:
 - a. Identification.
 - b. Proposed date, time, and duration.
 - c. Description of products and/or systems to be covered.
 - d. Name of firm and person conducting training; include qualifications.
 - e. Intended audience, such as job description.
 - f. Objectives of training and suggested methods of ensuring adequate training.
 - g. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - h. Media to be used, such a slides, hand-outs, etc.
 - i. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Coordinate content of training sessions with content of emergency, operation, and maintenance manuals.
 - 2. Include applicable portion of O&M manuals.
 - 3. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 4. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Sign-off sheets: Submit copies of proposed sign-off sheets for each training session not less than 10 days prior to the scheduled training. Sign-off sheets are to include the following information:
 - 1. Name of training session
 - 2. Date of training
 - 3. Beginning/Ending time
 - 4. Detailed, itemized summary listing all areas of training for that session.
 - 5. Listing of hand-out materials distributed at the session.
 - 6. Signature lines for Trainer, Contractor, and Board's Personnel being trained.
 - a. Signature by Board's personnel evidences training received only to the extent listed on the sign-off sheet summary.
- E. Video Recordings: Submit digital video recording of each demonstration and training session for Board's subsequent use.
 - 1. Format: DVD Disc. Provide three (3) copies.
 - 2. Label each disc and container with session identification and date.

1.04 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 - 2. Where applicable, training is to be provided by a factory-authorized service representative experienced in the operation and maintenance procedures and training of the specified product/system..

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RETAIN SUBPARAGRAPH BELOW FOR COMMISSIONING PROJECTS

~~~ **END OF PROJECT NOTE** ~~~~

- B. Contractor shall comply with all commissioning training requirements in ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1 for HVAC&R Systems.

PART 2 PRODUCTS

~~~~~ **PROJECT NOTE** ~~~~~

EDIT LIST BELOW, INCLUDING INDIVIDUAL SYSTEMS AND EQUIPMENT, TO SUIT PROJECT. REMOVE ALL BRACKETS.

~~~ **END OF PROJECT NOTE** ~~~~

2.01 INSTRUCTION MODULES

- A. Motorized doors, including [overhead coiling doors] [overhead coiling grilles] [and] [automatic entrance doors].
- B. Equipment, including [stage equipment] [projection screens] [loading dock equipment] [waste compactors] [food-service equipment] [residential appliances] [and] [laboratory fume hoods] .
- C. Fire-protection systems, including [fire alarm] [fire pumps] [and] [fire-extinguishing systems].
- D. Intrusion detection systems.
- E. Conveying systems, including [elevators] [wheelchair lifts] [escalators] [and] [cranes].
- F. Medical equipment, including medical gas equipment and piping.
- G. Laboratory equipment, including laboratory [air] [and] [vacuum] equipment and piping.
- H. Heat generation, including [boilers] [feedwater equipment] [pumps] [steam distribution piping] [and] [water distribution piping].
- I. Refrigeration systems, including [chillers] [cooling towers] [condensers] [pumps] [and] [distribution piping].
- J. HVAC systems, including [air-handling equipment] [air distribution systems] [and] [terminal equipment and devices].
- K. HVAC instrumentation and controls.
- L. Electrical service and distribution, including [transformers] [switchboards] [panelboards] [uninterruptible power supplies] [and] [motor controls].
- M. Packaged engine generators, including transfer switches.

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- N. Lighting equipment and controls.
- O. Communication systems, including [intercommunication] [surveillance] [clocks and programming] [voice and data] [and] [television] equipment.
- P. [Insert other systems and equipment.]
- Q. Systems requiring training per commissioning guidelines:

~~~~~ **PROJECT NOTE** ~~~~~

AOR/EOR EDIT BELOW PER PROJECT SPECIFIC COMMISSIONING REQUIREMENTS.  
ADD/DELETE LINE ITEMS THAT ARE APPLICABLE TO THE PROJECT.

~~~ **END OF PROJECT NOTE** ~~~

- 1. Division 22 - Plumbing
 - a. Domestic Hot Water System and Controls
 - b. Circulation Pumps
 - c. Booster Pump
 - d. Temperature Mixing Valves
 - e. Elevator Pit Sump Pumps
 - f. Rainwater Collection and Treatment Systems
- 2. Division 23 – Heating, Ventilating and Air Conditioning
 - a. Heating Hot Water System
 - b. Chilled Water System
 - c. Air Handling Units
 - d. Rooftop Units
 - e. Variable Volume Terminal Units
 - f. Fan Coil Units
 - g. Radiant Panels
 - h. Unit Heaters / Cabinet Unit Heaters
 - i. Variable Frequency Drives
 - j. Expansion and Buffer Tanks, Air Separators
 - k. Water Treatment
 - l. Piping and Insulation
 - m. Ductwork and Sound Attenuation
 - n. Refrigeration Systems
 - o. General Exhaust Fans
 - p. Kitchen Exhaust Fans
 - q. Ductless Split Systems
 - r. Building Automation System
- 3. Division 26 - Electrical
 - a. Interior Lighting and Controls
 - b. Exterior Lighting and Controls
 - c. Renewable Energy Systems
 - d. Air Quality Monitors
 - e. Educational Dashboards

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2.02 INSTRUCTION CONTENT

- A. Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
 5. Adjustments: Include the following:
 - a. Alignments.

- b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Board.
- B. Demonstration may be combined with Board personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Board will provide classroom and seating at no cost to Contractor.
 - 1. Contractor to set up instructional equipment at instruction location.
- C. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- D. Provide instruction at mutually agreed on times as approved in the training schedule matrix. For equipment that requires seasonal operation, provide similar instruction at start of each season.

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- E. Create and provide training video. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module video, record each chart containing learning objective and lesson outline.
- F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.
- G. At the conclusion of each training module obtain sign-offs using the approved sign-off sheets. Executed sign-off sheets are to be submitted as part of the closeout documentation evidencing compliance with training requirements.
- H. Collect used and leftover educational materials and return to Board. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

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