

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 00 10 – General Instructions.
- .2 Shop drawings to show and include:
 - .1 Mounting arrangements and connections.
 - .2 Operating and maintenance clearances.
 - .3 Wiring and controls diagrams.
 - .4 Capacities.
 - .5 Detailed drawings of bases, supports, and anchor bolts.
 - .6 Acoustical sound power data, where applicable.
 - .7 Points of operation on performance curves.
 - .8 Manufacturer to certify current model production.
 - .9 Certification of compliance to applicable codes.
- .3 Shop drawings shall be specific to the project and identified with the name of the project, date of submission, name of the Departmental Representative and equipment identification code as indicated on the drawings and specifications. Catalogue cuts will not be accepted.
- .4 Review of shop drawings by the Departmental Representative is a general review to reduce the risk of errors in the manufacturing process. It does not relieve the contractor from its responsibilities to provide an installation that is compliant with the drawings and specifications.
- .5 Shop drawings shall be submitted in English.
- .6 Insert the copy of the shop drawings stamped as reviewed by the Departmental Representative in the Operations and Maintenance manuals.
- .7 Provide a list of Identifications legends for piping and valves.
- .8 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 00 10 – General Instructions.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Site records:
 - .1 Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Use different colour waterproof ink for each service.
 - .3 Make available for reference purposes and inspection.

- .4 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed as-built drawings with Operating and Maintenance Manuals.
- .5 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 INTERFERENCE DRAWINGS

- .1 General Requirements:
 - .1 Interference drawings, also called coordination and integration drawings, are required in all cases where interference between the various trades render such drawings necessary.
 - .2 The interference drawings must clearly and precisely show all relevant work done by the concerned section or these done by others.
- .2 Description:
 - .1 Interference drawings consist of dimensioned and scaled drawings showing location of equipment, ducts, piping, valves and other accessories with all necessary sections and details. Drawings shall be complete with dimensions of piping and ducts, location of sleeves, openings, anchors and supports, including their location relative to structural and architectural works and other mechanical and electrical works.
- .3 Preparation:
 - .1 Each trade shall be responsible for the information provided on the interference drawings for its own works.
 - .2 Division 23 - Heating, Ventilating & Air Conditioning (HVAC) shall be responsible for the coordination of interference drawings for all mechanical and electrical sub-contractors. These sections shall supply all the data, drawings and diagrams required for this coordination.
 - .3 All drawings with no exception shall be coordinated by the General Contractor with the collaboration of all mechanical and electrical sections, including structural and architectural elements.
 - .4 All interference drawings for a given area shall be submitted all at once for review.
- .4 Collaboration:
 - .1 A close collaboration is required between the various mechanical and electrical trades to determine the location of their works and to avoid any possible interference.

- .5 Distribution of interference drawings:
 - .1 Submit to the Departmental Representative, for information, two copies approved by the contractor and signed by all parties involved.
 - .2 Drawings to be corrected and resubmit if required.
- .6 Responsibility:
 - .1 Each section shall be solely responsible for the exact location and dimensioning of openings, holes and sleeves, location of equipment, piping and ductwork, whether the structural, architectural or engineering drawings bear dimensions or not.
 - .2 No compensation will be given in the event of changes to works rendered necessary for purposes of coordination or integration of the various electrical and mechanical systems.
 - .3 Notwithstanding the responsibility for coordination and integration, the works shall not be executed prior approval of the interference drawings. Each section shall do over, at its own cost, all works not in accordance with the interference drawings and will be given no compensation based on a misinterpretation of the scope. Such misinterpretations shall not relieve the concerned section from its responsibilities and obligations to turn over systems that are complete, properly tested, ready to operate and fully integrated.
 - .4 Existing works: interference drawings shall take into account existing or future mechanical, electrical, structural and architectural works.
- .7 Interference drawings are required:
 - .1 For the location of sleeves, openings and holes to be provided in walls, floors, beams and columns.
 - .2 For all works related to automatic sprinklers and fire protection.
 - .3 For all ventilation and air-conditioning works.
 - .4 Where indicated in specifications.
 - .5 The present clause is not restrictive; additional interference drawings may be required where they are deemed necessary.
- .8 Original interference drawings: Provide the owner with the original interference drawings, in Revit model and PDF version, on DVD at the commissioning stage.

1.4 OPERATION AND MAINTENANCE MANUALS

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 00 10 – General Instructions.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection and prior to any scheduled training.
- .3 Bind data in vinyl hard cover 3 "D" ring type loose leaf binders for 212 x 275 mm size paper. Binders must not exceed 75 mm thick or be more than 2/3 full.
- .4 Enclose title sheet labelled "Operation Data and Maintenance Manual," project name, date and list of contents. Project name must appear on binder face and spine.
- .5 Include one complete set of final shop drawings (bound separately) indicating corrections and changes made during fabrication and installation.

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- .6 Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.
 - .7 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .8 Maintenance data to include:
 - .1 Servicing, maintenance, and operation instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .3 Lubrication products and schedules.
 - .4 Trouble shooting procedures.
 - .5 Adjustment techniques.
 - .6 Operational checks.
 - .7 Suppliers' names, addresses and telephone numbers and components supplied by suppliers must be included. Identify components by description and manufacturer's part number.
 - .9 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .10 Guarantees showing:
 - .1 Name and address of projects.
 - .2 Guarantee commencement date (date of Interim Certificate of Completion).
 - .3 Duration of guarantee.
 - .4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
 - .5 Signature and seal of Guarantor.
 - .11 Spare parts: list recommended spares parts and materials to be maintained on site to ensure optimum efficiency. List special tools appropriate to unique application. Parts and tools detailed must be identified as to manufacturer, manufacturer part number and supplier.

- .12 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for verification. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .13 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

1.5 AS-BUILT DRAWINGS

- .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
- .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows:
 - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
- .3 Submit to Departmental Representative for approval and make corrections as directed.
- .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
- .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .6 Submit copies of as-built drawings for inclusion in final TAB report.

1.6 LETTERS OF CONFORMANCE

- .1 At the end of the works, every subcontractor has to submit to the Departmental Representative the certificate of compliance which provides evidence that all the works were executed according to drawings and specifications and according to the current applicable codes and standards.

1.7 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 00 10 – General Instructions as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One head gasket set for each heat exchanger.
 - .4 One glass for each gauge glass.
 - .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

1.9 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions.

Part 2 Products**2.1 NOT USED**

- .1 Not Used.

Part 3 Execution**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.4 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Chillers, and heat exchangers.
 - .2 Pumps.
 - .3 Air handlers and fans.
 - .4 Glycol make-up and chemical feed systems.
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION