

DIVISION 01
GENERAL REQUIREMENTS

SUBMITTAL PROCEDURES

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable. Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .5 Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Verify field measurements and affected adjacent Work are co-ordinated.
- .7 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .9 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
 - .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
 - .3 Allow 14 days for Contract Administrator's review of each submission.
 - .4 Adjustments made on shop drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
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SUBMITTAL PROCEDURES

- .5 Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.
 - .6 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
 - .7 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
Subcontractor.
Supplier.
Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
Fabrication.
Layout, showing dimensions, including identified field dimensions, and clearances.
Setting or erection details.
Capacities.
Performance characteristics.
Standards.
Operating weight.
Wiring diagrams.
Single line and schematic diagrams.
Relationship to adjacent work.
 - .8 After Contract Administrator's review, distribute copies.
 - .9 Submit electronic (PDF format) copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.
 - .10 Submit electronic (PDF format) copies of test reports for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .11 Submit electronic (PDF format) copies of certificates for requirements requested in specification Sections and as requested by Contract Administrator.
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SUBMITTAL PROCEDURES

- .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
- .2 Certificates must be dated after award of project contract complete with project name.

- .12 Submit 3 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.
- .13 Delete information not applicable to project.
- .14 Supplement standard information to provide details applicable to project.
- .15 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.3 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

CLOSEOUT SUBMITTALS

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 Copy will be returned with Contract Administrator's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three final copies of operating and maintenance manuals in English.
- .6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .7 Furnish evidence, if requested, for type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

1.2 FORMAT

- .1 Organize data as instructional manual.
 - .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
 - .3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.
 - .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
 - .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
 - .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
 - .7 Text: manufacturer's printed data, or typewritten data.
 - .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
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CLOSEOUT SUBMITTALS

1.3 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project; Date of submission; names.
 - .1 Addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties.
 - .2 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure.
- .6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.4 AS-BUILTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for Contract Administrator one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples. Field test records.
 - .6 Inspection certificates.
 - .7 Manufacturer's certificates.
 - .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
 - .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
 - .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
 - .5 Keep record documents and samples available for inspection by Contract Administrator.
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CLOSEOUT SUBMITTALS

1.5 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings provided by Contract Administrator.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.6 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
 - .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
 - .3 Include installed colour coded wiring diagrams.
 - .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
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CLOSEOUT SUBMITTALS

- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Additional requirements: as specified in individual specification sections.

1.7 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.8 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
-

CLOSEOUT SUBMITTALS

1.9 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.10 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to site; place and store. Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

1.11 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator.

1.12 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
 - .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Contract Administrator approval.
 - .3 Warranty management plan to include required actions and documents to assure that Contract Administrator receives warranties to which it is entitled.
 - .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
 - .5 Submit, warranty information made available during construction phase, to Contract Administrator for approval prior to each monthly pay estimate.
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CLOSEOUT SUBMITTALS

- .6 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
 - .7 Except for items put into use with Contract Administrator's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
 - .8 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .3 Procedure and status of tagging of equipment covered by extended warranties.
 - .4 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
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CLOSEOUT SUBMITTALS

- .9 Respond in a timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification will follow oral instructions. Failure to respond will be cause for the Contract Administrator to proceed with action against Contractor.

1.13 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Contract Administrator.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.Warranty period.
 - .5 Inspector's signature.
 - .6 Construction Contractor.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

DEMONSTRATION AND TRAINING

Part 1 General

1.1 DESCRIPTION

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Contract Administrator's personnel two weeks prior to date of final inspection.
- .2 Contract Administrator will provide list of personnel to receive instructions, and will co-ordinate their attendance at agreed-upon times.

1.2 QUALITY CONTROL

- .1 When specified in individual Sections require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Contract Administrator's personnel, and provide written report that demonstration and instructions have been completed.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Contract Administrator's approval. Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation.
- .2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.
 - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
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DEMONSTRATION AND TRAINING

- .4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

1.7 TIME ALLOCATED FOR INSTRUCTIONS

- .1 Allow full 8 hour day for instruction and training.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

GENERAL COMMISSIONING (CX) REQUIREMENTS

Part 1 General

1.1 SUMMARY

- .1 Acronyms:
 - .1 Cx - Commissioning.
 - .2 O&M - Operation and Maintenance.
 - .3 PI - Product Information.
 - .4 PV - Performance Verification.
 - .5 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

- .1 CX is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Effectively train O&M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

1.3 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Contract Administrator, to ensure effective performance.
 - .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.
-

GENERAL COMMISSIONING (CX) REQUIREMENTS

1.4 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Contract Administrator.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Contract Administrator.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Contract Administrator for review and approval.
 - .10 Ensure "As-Built" system schematics are available.
- .4 Inform Contract Administrator in writing of discrepancies and deficiencies on finished works.

1.5 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

1.6 COMMISSIONING DOCUMENTATION

- .1 Contract Administrator to review and approve Cx documentation.
- .2 Provide completed and approved Cx documentation to Contract Administrator.

1.7 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.
-

GENERAL COMMISSIONING (CX) REQUIREMENTS

1.8 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days notice prior to commencement.
- .2 Contract Administrator representative to witness of start-up and testing.

1.9 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Contract Administrator.
 - .3 Obtain written approval of test results and documentation from Contract Administrator before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Contract Administrator.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.10 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
 - .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
 - .3 Correct deficiencies and obtain approval from Contract Administrator after distinct phases have been completed and before commencing next phase.
-

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .4 Document required tests on approved PV forms.

1.11 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Contract Administrator for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Contract Administrator to repeat start-up at any time.

1.12 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Contract Administrator for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.13 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.14 START OF COMMISSIONING

- .1 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.
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GENERAL COMMISSIONING (CX) REQUIREMENTS

1.15 INSTRUMENTS / EQUIPMENT

- .1 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.16 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under accepted simulated operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.17 WITNESSING COMMISSIONING

- .1 Contract Administrator representative to witness activities and verify results.

1.18 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Contract Administrator within 5 days of test and with Cx report.

1.19 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Contract Administrator for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Contract Administrator's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Contract Administrator deems Contractor's request for second verification was premature.
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GENERAL COMMISSIONING (CX) REQUIREMENTS

1.20 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Contract Administrator.
- .2 Report problems, faults or defects affecting Cx to Contract Administrator in writing. Stop Cx until problems are rectified. Proceed with written approval from Contract Administrator.

1.21 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Contract Administrator.

1.22 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.23 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.24 OCCUPANCY

- .1 Cooperate fully with Contract Administrator during stages of acceptance and occupancy of facility.

1.25 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Contract Administrator.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.26 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10 of specified values.
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GENERAL COMMISSIONING (CX) REQUIREMENTS

- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

1.27 CONTRACT ADMINISTRATOR'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Contract Administrator will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

AIR HANDLING UNIT			
AHU NUMBER	AHU-4	SPEC REFERENCE	23 73 11
AREA SERVED			
LOCATION			
AIR UNIT DATA	Specified	Shop Drawings	Installed
MANUFACTURER			
MODEL NUMBER			
CAPACITY L/S (CFM)			
STATIC PRESSURE KPA (IN.)			
FAN TYPE (Supply)			
FAN TYPE (Return)			
COMMENTS:			

Contractor			
Name (Print)			
Signature		Date	

AIR HANDLING UNIT							
AIR UNIT NUMBER		AHU-4		SPEC REFERENCE		23 73 11	
<u>Supply Fan</u>							
FAN MANUFACTURER				DRAWING REF.			
FAN MODEL NUMBER				LOCATION			
FAN SERIAL NUMBER				FAN TYPE			
MOTOR MANUFACTURER				MODEL			
MOTOR SERIAL NUMBER				FRAME			
Volts/Phase		HP/KW		RPM		Amps	
Panel No		Fuse Rating		Type			
Thermal Protection							
AIR UNIT DATA		Design		Measured		Remarks	
Air Flow L/S (CFM)							
Outlet Velocity m/s (FPM)							
Ext. Static Pressure Pa (IN)							
Fan RPM							
Fan BHP							
Voltage		A-B					
		A-C					
		B-C					
Amperage		A-B					
		A-C					
		B-C					
COMMENTS:							

Contractor			
Name (Print)			
Signature		Date	

AIR HANDLING UNIT							
AIR UNIT NUMBER		AHU-4		SPEC REFERENCE		23 73 11	
<u>Return Fan</u>							
FAN MANUFACTURER			DRAWING REF.				
FAN MODEL NUMBER			LOCATION				
FAN SERIAL NUMBER			FAN TYPE				
MOTOR MANUFACTURER			MODEL				
MOTOR SERIAL NUMBER			FRAME				
Volts/Phase		HP/KW		RPM		Amps	
Panel No		Fuse Rating			Type		
Thermal Protection							
AIR UNIT DATA		Design		Measured		Remarks	
Air Flow L/S (CFM)							
Outlet Velocity m/s (FPM)							
Ext. Static Pressure Pa (IN)							
Fan RPM							
Fan BHP							
Voltage		A-B					
		A-C					
		B-C					
Amperage		A-B					
		A-C					
		B-C					
COMMENTS:							

Contractor			
Name (Print)			
Signature		Date	

AIR HANDLING UNIT			
AHU NUMBER	AHU-3	SPEC REFERENCE	23 73 11
AREA SERVED			
LOCATION			
AIR UNIT DATA	Specified	Shop Drawings	Installed
MANUFACTURER			
MODEL NUMBER			
CAPACITY L/S (CFM)			
STATIC PRESSURE KPA (IN.)			
FAN TYPE (Supply)			
FAN TYPE (Return)			
COMMENTS:			

Contractor			
Name (Print)			
Signature		Date	

AIR HANDLING UNIT							
AIR UNIT NUMBER		AHU-3		SPEC REFERENCE		23 73 11	
<u>Supply Fan</u>							
FAN MANUFACTURER			DRAWING REF.				
FAN MODEL NUMBER			LOCATION				
FAN SERIAL NUMBER			FAN TYPE				
MOTOR MANUFACTURER			MODEL				
MOTOR SERIAL NUMBER			FRAME				
Volts/Phase		HP/KW		RPM		Amps	
Panel No			Fuse Rating		Type		
Thermal Protection							
AIR UNIT DATA		Design		Measured		Remarks	
Air Flow L/S (CFM)							
Outlet Velocity m/s (FPM)							
Ext. Static Pressure Pa (IN)							
Fan RPM							
Fan BHP							
Voltage		A-B					
		A-C					
		B-C					
Amperage		A-B					
		A-C					
		B-C					
COMMENTS:							

Contractor			
Name (Print)			
Signature		Date	

AIR HANDLING UNIT							
AIR UNIT NUMBER		AHU-3		SPEC REFERENCE		23 73 11	
<u>Return Fan</u>							
FAN MANUFACTURER				DRAWING REF.			
FAN MODEL NUMBER				LOCATION			
FAN SERIAL NUMBER				FAN TYPE			
MOTOR MANUFACTURER				MODEL			
MOTOR SERIAL NUMBER				FRAME			
Volts/Phase		HP/KW		RPM		Amps	
Panel No		Fuse Rating		Type			
Thermal Protection							
AIR UNIT DATA		Design		Measured		Remarks	
Air Flow L/S (CFM)							
Outlet Velocity m/s (FPM)							
Ext. Static Pressure Pa (IN)							
Fan RPM							
Fan BHP							
Voltage		A-B					
		A-C					
		B-C					
Amperage		A-B					
		A-C					
		B-C					
COMMENTS:							

Contractor			
Name (Print)			
Signature		Date	

CIRCULATING PUMP			
PUMP NUMBER	PU-1	SPEC REFERENCE	23 21 23
SYSTEM SERVED			
LOCATION			
PUMP DATA	Specified	Shop Drawings	Installed
MANUFACTURER			
LIQUID			
MODEL NUMBER			
SIZE (suction x discharge)			
CAPACITY L/S (GPM)			
HEAD PRESSURE KPA (PSI)			
TYPE			
RPM			
BHP			
MOTOR KW (HP)			
IMPELLER SIZE			
VOLTS/PHASE			
AMPS			
COMMENTS: _____			

Contractor			
Name (Print)			
Signature		Date	

CIRCULATING PUMP					
PUMP NUMBER		PU-1		SPEC REFERENCE	23 21 23
MOTOR MANUFACTURER			MODEL		
Volts/Phase		HP/KW		RMP	
Amps		Panel No		Fuse Rating	
Thermal Protection					
MOTOR DATA		Design		Measured	
Motor RPM					
Voltage		A-B			
		A-C			
		B-C			
Amperage		A-B			
		A-C			
		B-C			
PUMP DATA					
Flow L/S (GPM)					
Head kPa (Feet)					
Efficiency					
Pump RPM					
Outlet Velocity m/s (FPM)					
COMMENTS: _____					

Contractor			
Name (Print)			
Signature		Date	

CIRCULATING PUMP			
PUMP NUMBER	PU-2	SPEC REFERENCE	23 21 23
SYSTEM SERVED			
LOCATION			
PUMP DATA	Specified	Shop Drawings	Installed
MANUFACTURER			
LIQUID			
MODEL NUMBER			
SIZE (suction x discharge)			
CAPACITY L/S (GPM)			
HEAD PRESSURE KPA (PSI)			
TYPE			
RPM			
BHP			
MOTOR KW (HP)			
IMPELLER SIZE			
VOLTS/PHASE			
AMPS			
COMMENTS: _____			

Contractor			
Name (Print)			
Signature		Date	

CIRCULATING PUMP			
PUMP NUMBER	PU-2	SPEC REFERENCE	23 21 23
MOTOR MANUFACTURER		MODEL	
Volts/Phase	HP/KW	RMP	
Amps	Panel No	Fuse Rating	
Thermal Protection			
MOTOR DATA	Design	Measured	Remarks
Motor RPM			
Voltage	A-B		
	A-C		
	B-C		
Amperage	A-B		
	A-C		
	B-C		
PUMP DATA			
Flow L/S (GPM)			
Head kPa (Feet)			
Efficiency			
Pump RPM			
Outlet Velocity m/s (FPM)			
COMMENTS: _____			

Contractor			
Name (Print)			
Signature		Date	

UNIT HEATER			
UNIT HEATER NUMBER		LOCATION	
SPEC REFERENCE		FLUID	
MANUFACTURER		DWG. REF	
	Design	Measured	Remarks
Size mm (inches)			
Air Flow L/S (CFM)			
Water Flow L/S (GPM)			
Amperage			
EAT °C (°F)			
LAT °C (°F)			
EWT °C (°F)			
LWT °C (°F)			
Heating Capacity			
COMMENTS: _____			

Contractor			
Name (Print)			
Signature		Date	