



Division of Finance and Business Operations

Procurement & Strategic Sourcing
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February 17, 2015

**Addendum #2 To
Request for Proposal
For Engineering Research Labs – Part 1: Project 090-250890**

**Minutes of the Pre-bid Conference
Dated February 10, 2015**

The Addendum must be acknowledged on your lump sum bid.

The pre-bid conference for Request for Proposal for **Engineering Research Labs – Part 1**, Project **090-250890** was held on **February 16, 2015**, at **2:00 pm** (local time) – at Detroit, MI 48202. **Kimberly Tomaszewski** reviewed the highlights of the pre-bid package, especially concerning details such as bid due dates and who vendors may contact during the live bid process. **Mark Gibbons** and **Laura Clary** from **iDesign Solutions, LLC** discussed the technical aspects of the project and bid requirements, and conducted the Q & A session.

NOTE: You must have attended a pre-bid conference in order to be eligible to bid on a particular project. Receipt of minutes or addenda without being at a pre-bid conference does not qualify your company to bid.

Numerous simple questions and answers were addressed at the pre-bid meeting. Some of the issues were as follows:

1. A bid bond is not required for bids below \$50,000. Otherwise, a bid bond (5%) will be required for the full amount of the bid.
2. Performance Bond and Material & Labor Payment Bond requirements are listed in the specifications of the job. Performance & Material & Labor Payment Bonds must be provided by the awarded Vendor with the submission of the signed contract; which will then be submitted to FP&M management for counter signature.
3. The awarded vendor must provide the required Certificate of Insurance in compliance with Section 800, article 11 of the bid specifications prior to commencement of any work.
4. Please review the insurance section carefully, there are some changes in the documents, such as the addition of professional liability insurance and changes in the amounts of required insurance for most of the categories. The Professional Liability amount for this project is set at \$500,000.00.
5. If your company has not previously done business with the University you may go to the Purchasing website at **www.purchasing.wayne.edu** and look for the "new vendor" link under "Information for Vendors" on the left. You may submit a new vendor request form and an IRS form W-9. This will register your company on our vendor list. (NOTE: this does not replace the listserv.)
6. This Project Requires the Contractor and any subcontractors to compensate all employees who come to the job site at no less than State of Michigan Prevailing Wage Rates. A Prevailing Wage Rate Schedule is included in Section 00410 of the Bid Specifications. Vendors must review these requirements to be sure they are in compliance with the requirements of the University and the State of Michigan. Contact the State of Michigan if further information on prevailing wage rate is needed at website **http://www.michigan.gov/dleg/0,1607,7-154-27673_27706---,00.html**. Vendors must post wages at the job site in compliance with the complete Prevailing Wage Rate listing provided in Bid Documents.
7. 1099 workers and subcontractors using 1099 workers are NOT acceptable
8. Certified Payroll must be provided with each of the contractor's pay applications for all workers who worked at the job site, in compliance with the State of Michigan policy. Failure to provide certified payroll will constitute breach of contract and pay applications will be returned unpaid, and remain so until satisfactory supporting documents are provided.
9. Signed waivers from all Subcontractors and suppliers must accompany Pay Applications or they will be returned for such documentation prior to approval.
10. A properly executed sworn statement is required from all tiers of contractors, and sub-contractors indicating sub-contractors and suppliers which provide services or product of \$1,000.00 or greater. Sworn statements must accompany applications for payment
11. All documents listed in the Front End Section 0410-2 "Wayne State Prevailing Wage Requirements" must accompany applications for payment. Failure to do so will result in the entire application package returned for correction.

12. A checklist of all Pay Application requirements can be found in Section 00430-1.
13. The competency and responsibility of Bidders will be considered in making the award. The Owner does not obligate himself to accept the lowest or any other bids. The Owner reserves the right to reject any and all bids and to waive any informalities in the Proposals
14. Parking on WSU campus lots and structures are \$7.00/access. Vendor must build parking into their lump sum bid. There is no parking allowed on the malls.
15. Section 300, Form of Proposal has changed very recently, review carefully and complete in its entirety to avoid disqualification.
16. The contractors **must** fill out our prequalification form. They can attach additional information if they would like but at a minimum the information requested must be filled in on our form so that we do not have to hunt to find the information.
17. Contractors who have withdrawn a bid after a University bid opening and/or refused to enter into a contract with the University upon notification of award within the last 3 years are not eligible to bid on this project.
18. Project hours of operation are 7:00am – 5:00 pm. Anything else requires advance notice and approval.
19. Prequalification meeting will be held the first business day after bid openings. Contractors must be available. The Project Manager will coordinate the meetings.
20. Prequalification meeting includes Schedule of Values from the Contractor, including a list of Contractor's subcontractors and other qualifications required by the documents.
21. An unsigned contract will be given to the successful Contractor at the conclusion of the Prequalification meeting, if all aspects of the bid are in order. The Contractor has 5 business days to return the contract to the Project Manager for University counter signature. The contractor must also submit a Performance Bond as outlined above and a Certificate of Insurance in the same 5 business day period. In the event the Contractor fails to return the documents in this 5 day period, the University reserves the right to award the contract to the next most responsive bidder.
22. An Optional second walk thru was not scheduled.
23. Permit requirements are the responsibility of the awarded contractor as listed on Section 800 Article 4. Permits and Inspections for this project must come from the State of Michigan – Bureau of Fire Services.
24. Sprinkler work is a component of this project. Shop drawings must be submitted to the state for approval.
25. Access to the Freight Elevator and the Loading Dock will be granted; however, materials must be off-loaded and vehicles must be moved to a structure or lot as vehicles cannot remain in the loading dock area or they will be ticketed.
26. A Right to Know Letter for information regarding hazardous material will be provided to the awarded contractor. Abatement is not part of this project.
27. The cleanroom in Area B is to be increased to a Class 1000. The awarded contractor will be responsible for cleanroom certification.
28. The University will carry the cost for the Siemens conduit, wiring and controls. Awarded contractor must coordinate with Siemens for this portion of the project.
29. Fume hood purchase and installation is required by the awarded contractor. Additional equipment being furnished by the owner is listed in the bid documents.
30. Shutdowns require a 7-day notice. This includes using a crane for the HVAC roof unit.
31. This project is expected to be completed Monday through Friday. Weekend hours would require approval by the Project Manager.
32. Vendor must provide their own dumpster if needed, which must be rubber or plywood padded if placed on concrete. Location and duration must be coordinated with the project manager. Dumpster must be tagged with the name of your company clearly displayed. Any lawn damage must be restored.
33. The due date for Questions has been extended. Questions are due by **February 24, 2015** at 12:00 noon.
34. The Bid Due Date has been extended. Bids are due no later than 2:00 p.m., **March 3, 2015**, at 5700 Cass Ave. Room 4200 AAB. Late Bids will not be accepted.
No public bid opening will be held.
35. **Time of Completion:** The Contract is expected to be fully executed on or about 15 calendar days after successful bidder qualification and recommendation of award. The successful bidder (Contractor) agrees to start construction **immediately after** receipt of a fully executed contract and Purchase Order, and to complete the work as follows: Substantial Completion, and State Approved Inspections (if appropriate), no later than **August 21, 2015**.
36. A copy of the sign in sheet is available for downloading from the University Purchasing Web Site at http://www.forms.purchasing.wayne.edu/Adv_bid/Adv_bid.html.
37. This is an occupied area, awarded vendor must be considerate of environment (noise, cleanliness, etc)
38. **IMPORTANT- This is an addendum which MUST be acknowledged on your bid form**

We will require two copies each of your lump sum proposals, vendor qualification questionnaire and your bid bond documents.

All questions concerning this project must be emailed to: **Kimberly Tomaszewski**, Procurement & Strategic Sourcing. Email: ac9934@wayne.edu, and copy **Cynthia Branch, Buyer**, at rfpteam1@wayne.edu.

Do not contact either FP&M or the Design Firm directly as this may result in disqualification of your proposal.

Thank you for interest shown in working with Wayne State University.

Kimberly Tomaszewski
Senior Buyer

CC: **Mark Gibbons** (Project Manager), **Cynthia Branch**, **Buyer**, Attendee list.



iDesign – Addendum No. 1

To: All Bidders

CC: Mark Gibbons, Ashley Flintoff- WSU
Laura Clary- iDesign
George Isherwood- PBA

From: Carol T Weber
iDesign Solutions, LLC
400 Water Street, Suite LL1
Rochester, MI 48307
Email: cweber@iDesign-solutions.info
Phone: 248-440-7310 ext. 3

Addendum Number: 2

Project: Engineering Research Labs – Phase II
Location : Wayne State University, Engineering Building
Project #: 090-250890-1
Date: February 17, 2015

This addendum forms part of and modifies the Construction Bid Documents dated 02-06-2015. The following revisions shall be incorporated and shall take precedence over any conflicting part of the original construction bid documents. Bidder shall acknowledge receipt in the addendum as per the bidding instructions.

Drawings Re-Issued: G-00, A2-01, A2-02, A2-03, A301, A302, A401, M002, MD201, MD401, MD402, M200, M201, M401, M402, M601, M602, M701, M801, M802, E002, ED102, ED103, E101, E202, E302, E303, E702

Drawings not re-issued: G-01, G-02

Specifications Re-Issued: Section 00 01 15, 226113, 237000, 238219, 262416, 265100A

General

Item 1. Sheet G-00 Cover Sheet and Spec Section 00 01 15 List of Drawing Sheets (Re-Issued)
A. Updated Drawing Index (Mechanical drawings)

Architectural

Item 2. Sheet G-01 and G-02 Life Safety Plan & Code Review – 2nd and 3rd Floors (**NOT RE-ISSUED**)
A. Applicable Codes: Included code: Michigan Rehabilitation Code, 2012.
B. The project documents will be sent to the State of Michigan for Mechanical, Electrical, Plumbing and Fire Bureau for review and permit. The building is equipped with an existing sprinkler system. The renovation does not make any changes to this existing system, except for those as required by code. The design does include new gas cylinder cabinets that feature an interior sprinkler head. These cabinets are required to be connected to the existing sprinkler system. Shop drawings for this work will need to be submitted to the state for review and approval as needed for permitting.



Mechanical
Electrical
Energy Management
Communication Technologies
Commissioning

ADDENDUM

Project Name: Wayne State University
Engineering Building
Engineering Research Labs
Phase 2

PBA Project Number: 2014.0386

Addendum Number: 2

Date: 2/17/15

Each Bidder's proposal shall include the work described herein.

Unless otherwise indicated, the work described herein shall comply with, and be equal in all respects to, the original Specifications and the Drawings accompanying same. Include incidental work required to properly complete the work, whether stated herein or not.

Specifications Issued: 226113, 237000, 238219, 262416, 265100A,
Drawings Issued: M002, MD201, MD401, MD402, M200, M201, M401, M402, M601, M602, M701,
M801, M802, E002, ED102, ED103, E101, E202, E302, E303, E702

Mechanical Specification Items

Item No. 1: 226113 Added stainless steel piping requirements, deleted references to natural gas.

Item No. 2: Added Specification Section 237000 – Packaged Roof Top Units.

Item No. 3: 238219 Added Trane to list of approved manufactures

Mechanical Items

Item No. 1: Refer to drawing M002 (issued):
a. Added materials for laboratory gas piping

Item No. 2: Refer to drawing MD201 (issued):
a. Revised 2nd floor plumbing demo plan and associated note.

Item No. 3: Refer to drawing MD401 (issued):
a. Revised 2nd and 3rd floor sheet metal demo plans and associated note.

2440 West Mission Lane, Ste 9
Phoenix, AZ 85021-2807
Tel: 602-314-8095
Fax: 602-943-1241

5145 Livernois, Ste. 100
Troy, MI 48098-3276
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- Item No. 4: Refer to drawing MD402 (issued):
a. Added roof demo plan.
- Item No. 5: Refer to drawing M200 (issued):
a. Revised 2nd floor plumbing plan.
- Item No. 6: Refer to drawing M201 (issued):
a. Revised 2nd and 3rd floor plumbing plan.
- Item No. 7: Refer to drawing M401 (issued):
a. Revised 3rd floor sheet metal plan.
b. Added sizes to chilled water piping
- Item No. 8: Refer to drawing M402 (issued):
a. Revised roof mechanical plan.
- Item No. 9: Refer to drawing M601 (issued):
a. Revised terminal unit details and added roof exhaust fan stack detail.
- Item No. 10: Refer to drawing M602 (issued):
a. Added details sheet.
- Item No. 11: Refer to drawing M701 (issued):
a. Revised schedules.
- Item No. 12: Refer to drawing M801 (issued):
a. Revised temperature controls general notes.
b. Added detail for Lab Gas Cabinet Alarm
- Item No. 12: Refer to drawing M802 (issued):
a. Added temperature control details.

Electrical Specification Items

- Item No. 1: Added Specification Section 262416 – Panelboards.
- Item No. 2: Refer to specification section 265100A (issued):
a. Added approved alternate manufactures to fixtures.
b. Revised “L2” to be a 2x4 fixture instead of a 2x2 fixture.

Electrical Drawing Items

- Item No. 1: Refer to drawing E002 (issued):
c. Moved panel schedules to E702.
d. Added 208V, 3 phase motor circuit sizing schedule.
- Item No. 2: Refer to drawing ED102 (issued):
a. Added demolition of emergency stop in lab 3318.
b. Indicated existing emergency stop in lab 3322.
c. Revised demolition notes as indicated.

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- d. Added demolition of FCU in lab 3335.

Item No. 3: Refer to drawing ED103 (issued):
a. Added roof demolition plan.
b. Revised demolition notes as indicated.

Item No. 4: Refer to drawing E101 (issued):
a. Lighting New Work Plan
 a. Moved lighting fixture L1 in Tissue Culture 2311.1 as indicated.
b. Power and Auxiliary Demolition Plan
 a. Added demolition of FCU as indicated.
 b. Indicated existing 480V bus in corridor as indicated.
 c. Indicated existing telecommunication devices as indicated.
 d. Added demolition note "J" to disconnects in lab 2311 as indicated.
 e. Revised demolition notes as indicated.
c. Power and Auxiliary New Work Plan
 a. Added new disconnect and starter for "FCU-7" as indicated.
 b. Revised "FCU-8" and associated disconnect and starter location as indicated.
 c. Changed existing bus voltage from 208V to 480V as indicated.
 d. Added undersink receptacle for DI water.
 e. Removed wireway and receptacles as indicated to make way for new architectural wall in Tissue Culture 2311.1.
 f. Indicated existing telecommunication devices as indicated.
 g. Added "WAP" designation to telecommunication devices as indicated.
 h. Revised general notes as indicated.
 i. Added condensate pump circuit to FCUs as indicated.

Item No. 5: Refer to drawing E202 (issued):
a. Revised "L2" to be a 2x4 fixture instead of a 2x2 fixture. Change in quantity reflects this and there is now only (1) "L2" fixture in Gowning 3322.1
b. Added single point connection and circuit to powered fan diffusers.
c. Added construction note 8 to Clean Room Support 3324 as indicated.
d. Added construction note 17 to plan as indicated.
e. Revised construction notes as indicated.
f. Indicated new P.P-D panel for reference.
g. Revised general notes as indicated.

Item No. 6: Refer to drawing E302 (issued):
a. Added new P.P-D panel as indicated.
b. Removed RTU disconnects and unit as indicated.
c. Added construction note 7 to existing emergency stop as indicated.
d. Added FCUs, starters and disconnects as indicated.
e. Added feeder runs for EF-1 and EF-2 on roof and starters as indicated.
f. Revised construction notes as indicated.
g. Added construction note 16 and 19 on plan as indicated.
h. Revised general notes as indicated.
i. Added condensate pump circuit to FCUs as indicated.
j. Added receptacles and circuits for gas cabinets as indicated.

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- Item No. 7: Refer to drawing E303 (issued):
- a. Added Roof Power and Auxiliary Systems Plan.
- Item No.8: Refer to drawing E702 (issued):
- a. Added Panel Schedules sheet.
 - b. Added new panelboard (E)P.P-A and P.P-D as indicated.
 - c. Added circuit on panelboard (E)P.P-B, (E)RPEH4, (E)RPEV3 and (R)P.P-C as indicated.

Item 3. Sheet A201 Partial 2nd & 3rd Floor Architectural Plans (Re-Issued)
Sheet A202 Partial 2nd & 3rd Floor Laboratory Equipment Plans (Re-Issued)
Sheet A203 Partial 2nd & 3rd Floor Reflected Ceiling Plans Plans (Re-Issued)
Sheet A401 Legends, Architectural Schedules and Details (Re-Issued)

- A. Added two mechanical shafts @ 3rd floor Gowning 3322.1.
- B. Revised Interior Elevation 12/A301 to reflect mechanical shafts.
- C. Revised Architectural Finish Schedule to include new FRP panels at new shafts.

Item 4. Sheet A201 Partial 2nd & 3rd Floor Architectural Plans (Re-Issued)
Sheet A202 Partial 2nd & 3rd Floor Laboratory Equipment Plans (Re-Issued)
Sheet A203 Partial 2nd & 3rd Floor Reflected Ceiling Plans Plans (Re-Issued)
Sheet A301 Partial 2nd & 3rd Floor Laboratory Equipment Plans (Re-Issued)

- A. Added gyp board & metal stud enclosure at existing pipe farm on 2nd floor between rooms Chemical Engineering LAB 3211 and Tissue Culture 3211.1.
- B. Revised Interior Elevations 23, 24 & 28/A302 to reflect pipe enclosure and laboratory equipment (casework) modifications to suit.

Item 5. Sheet A203 Partial 2nd & 3rd Floor Reflected Ceiling Plans Plans (Re-Issued)

- A. Revised lighting and HVAC diffusers @ ceilings per mechanical and electrical modifications.
- B. Added note to re-work existing ceiling grid @ Clean Room 3322.2 as required to suit new mechanical grilles.

Electrical: SEE ATTACHED

Mechanical: SEE ATTACHED

END of ADDENDUM No. 1

DRAWING LIST

Sheet Number

Sheet Title

GENERAL

G-00	Cover Sheet
G-01	Life Safety Plan and Code Review – Second Floor
G-02	Life Safety Plan and Code Review – Third Floor

ARCHITECTURAL DRAWINGS

A100	Partial 2 nd Floor Demo Plan
A101	Partial 3 rd Floor Demo Plan
A201	Partial 2 nd & 3 rd Floor Architectural Plans
A202	Partial 2 nd & 3 rd Floor Laboratory Equipment Plans
A203	Partial 2 nd & 3 rd Floor Reflected Ceiling Plans
A301	Interior Elevations (Area 'A' and 'B')
A302	Interior Elevations (Area 'C')
A401	Legends, Architectural Schedules and Details
A402	Laboratory Schedules and Details

MECHANICAL DRAWINGS

M-001	Mechanical Standards and Drawing Index
M-002	Plumbing Insulation and Materials
M-003	HVAC Insulation and Materials
MD-201	Partial Second and Third Floor Plumbing Demolition Plans
MD-301	Partial Second and Third Floor HVAC Demolition Plans
MD-401	Partial Second and Third Floor Sheet Metal Demolition Plans
MD-402	Roof Mechanical Demolition Plan
M-200	Partial First Floor Plumbing Plans
M-201	Partial Second and Third Floor Plumbing Plans
M-301	Partial Second and Third Floor HVAC Piping Plans
M-401	Partial Second and Third Floor Sheet Metal Plans
M-402	Roof Mechanical Plan
M-601	Mechanical Details and Diagrams
M-602	Mechanical Details and Diagrams
M-701	Mechanical Schedules
M-801	Temperature Controls
M-802	Mechanical Details and Diagrams

ELECTRICAL DRAWINGS

E-001	Electrical Standards and Drawing Index
E-002	Electrical Standard Schedules and Panel Schedules
ED-102	Third Floor Electrical Demolition Plan
ED-103	Roof Electrical Demolition Plan
E-101	Second Floor Electrical Plans
E-202	Third Floor Lighting Plan
E-302	Third Floor Power and Auxiliary Systems Plan
E-303	Roof power and Auxiliary Systems Plan
E-701	Electrical Details
E-702	Panel Schedules

END OF DRAWING LIST

SECTION 22 61 13
LABORATORY AIR, GAS, AND VACUUM PIPING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 11 Section "Laboratory Fume Hoods" for laboratory fume hood outlets requiring laboratory air or vacuum service.
 - 2. Division 12 Section "Metal Laboratory Casework" for metal casework and outlets requiring laboratory air or vacuum service.
 - 3. Division 20 Section "Mechanical General Requirements."
 - 4. Division 20 Section "Basic Mechanical Materials and Methods."

5. Division 20 Section "Meters and Gages" for thermometers and pressure gages.
6. Division 22 Section "Laboratory Air and Vacuum Equipment" for laboratory air and vacuum equipment and related accessories.
7. Division 20 Section "Valves."

1.2 SUMMARY

- A. This Section includes piping for laboratory gases and related specialties.

1. Laboratory Gases:

- a. Compressed-air.
- b. Hydrogen
- c. Methane
- d. Ammonia
- e. Oxygen
- f. Vacuum

1.3 DEFINITIONS

- A. PTFE: Polytetrafluoroethylene plastic.
- B. TFE: Tetrafluoroethylene plastic.
- C. CGA: Compressed Gas Association.
- D. BAS: Building Automation System.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide laboratory gas and vacuum piping systems that comply with NFPA 99, Level 4 requirements for materials and installation.
- B. Components and installation shall be capable of withstanding the following minimum pressure, unless otherwise indicated:
1. Laboratory Gas Piping: 125 psig.
 2. Laboratory Vacuum Piping: 15 psig.

1.5 SYSTEMS DESCRIPTIONS

- A. Laboratory Gases And Vacuum Piping Systems: Use tubing, fittings, and joining methods according to the following applications:

1. Interior and Underslab Laboratory Gases Pressure Piping: Use Type K, hard copper tubing, wrought copper pressure fittings, and brazed joints.
 2. Interior and Underslab Laboratory Vacuum: Use Type L, hard copper tubing, wrought copper pressure fittings, and soldered joints.
 3. Interior Liquid Nitrogen Piping: Use factory pre-insulated piping system.
- B. Drawings indicate valve types to be used for laboratory air and vacuum piping. If specific valve types are not indicated, the following requirements apply:
1. Shutoff Valves NPS 3 and Smaller: Copper-alloy ball valve.
 2. Shutoff Valves NPS 4 and Larger: Stainless-steel ball valve.
 3. Check Valves NPS 3 and Smaller: Bronze.
 4. Check Valves NPS 4 and Larger: Cast iron.
 5. Zone Valves: With copper-tube extensions and gage.

1.6 SUBMITTALS

- A. Product Data: For the following:
1. Laboratory gas and vacuum tubing and fittings.
 2. Laboratory gas and vacuum valves and valve boxes.
 3. Alarm system components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Coordination Drawings: For laboratory gas and vacuum systems. Include relationship to other services that serve same work area.
- D. Brazing Certificates: As required by ASME Boiler and Pressure Vessel Code, Section IX, or AWS B2.2.
- E. Piping Material Certification: Signed by Installer certifying that laboratory gas and vacuum piping materials comply with NFPA 99 requirements.
- F. Qualification Data: For testing agency.
- G. Field quality-control test reports.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 51, Oxygen-fuel Gas System for Welding, Cutting, and Allied Processes.
- E. Comply with NFPA 54, "National Fuel Gas Code."
- F. Comply with NFPA 70, "National Electrical Code."
- G. Comply with NFPA 99, "Health Care Facilities," for materials and installation.
- H. Comply with UL 544, "Medical and Dental Equipment," for laboratory gas and vacuum specialties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBES, AND FITTINGS

- A. Copper Tube: ASTM B 819, Type K or L, seamless, drawn-temper, medical gas tube that has been factory cleaned, purged, and sealed for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.
 - 1. Fittings: Factory cleaned, purged, and bagged for oxygen service according to ASTM B 819 or field cleaned, purged, and bagged as specified in "Preparation" Article in Part 3.
 - a. Copper Pressure Fittings: ASME B16.22, wrought-copper solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
 - b. Cast-Copper-Alloy Flanges: ASME B16.24, Class 300.
 - c. Copper Unions: ASME B16.22 or MSS SP-123.
- B. Flexible Pipe Connectors: Corrugated-bronze inner tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Cleaning: Factory cleaned, purged, and sealed or bagged for oxygen service according to ASTM B 819 or field cleaned, purged, and sealed or bagged as specified in "Preparation" Article in Part 3.
 - 2. Working-Pressure Rating: 200 psig minimum.

3. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
4. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
5. Manufacturers:
 - a. ANAMET Inc.
 - b. Flex-Hose Co., Inc.
 - c. Flexicraft Industries.
 - d. Hyspan Precision Products, Inc.
 - e. Metraflex, Inc.

2.3 LABORATORY GRADE STAINLESS-STEEL TUBE AND FITTINGS:

- A. Tubing: ASTM A 269, Type 316L, seamless tubing up to size NPS 2, electric resistance welded tubing for sizes NPS 3 and NPS 4.
 1. Minimum Nominal Wall Thickness: 0.035 inch.
 2. Internal Surface: Electro-polished.
 3. Cleaning: Purged with filtered nitrogen and factory sealed.
 4. Manufacturer:
 - a. HOKE Incorporated; Gyroluk.
 - b. Parker Hannifin Corp.; Tube Fittings Division.
 - c. Swagelok Company.
 - d. Tylok International, Inc.
- B. Fittings: ASTM A 276 Type 316 stainless steel gaugeable tube fittings consisting of front and back ferrules, and two-piece fitting body.
 1. Cleaning: Factory cleaned and packaged, suitable for oxygen service.
 2. Manufacturers:
 - a. HOKE Incorporated; Gyroluk.
 - b. Parker Hannifin Corp.; Tube Fittings Division.
 - c. Swagelok Company.
 - d. Tylok International, Inc.

2.4 FACTORY PRE-INSULATED PIPING SYSTEM

- A. Copper Tubing: ASTM B88, Type K, hard drawn.
 1. Fittings: ANSI B16.18 cast bronze or ANSI B16.22 wrought copper.
 2. Joints: AWS A5.8, BCuP silver braze.
- B. Factory Preparation: Factory clean all piping, valves, fittings and other components of system. Systems shall be thoroughly clean of oil, grease, and other readily oxidizable materials as if for oxygen service. After cleaning, particular care shall be exercised in the storage and handling of such material. Such material shall be temporarily capped or

plugged to prevent recontamination before final assembly. Just prior to final assembly, such material shall be examined internally for contamination and shall be recleaned if necessary.

- C. Insulation: Three inch thickness, rigid 90 to 95 percent closed cell polyurethane with 1.9 to 2.1 pounds per cubic foot density and a coefficient of thermal conductivity of 0.14 BTU/(Hr.)(Sq.Ft.)(F/in) at 73 degrees F. Jacket shall be PVC with a minimum thickness of .060 inch.
- D. Minimum System Pressure Rating: 125 psig
- E. Isolation Valves: Globe valves.
- F. Manufacturers:
 - 1. Insul-Tek.
 - 2. Rovanco.
 - 3. Thermacor.

2.5 JOINING MATERIALS

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.
- B. Brazing Filler Metals: AWS A5.8, BCuP series alloys. Flux is prohibited unless used with bronze fittings.
- C. Threaded-Joint Tape: PTFE.
- D. Gasket Material: ASME B16.21, nonmetallic, flat, asbestos free, and suitable for service.

2.6 VALVES

- A. Valves, General: Refer to Division 20 Section "Valves."
- B. Copper-Alloy Ball Valves: Factory cleaned for oxygen service and bagged. MSS SP-110, 3-piece-body, full-port ball valve rated for 300-psig minimum working pressure; with chrome-plated brass ball, PTFE or TFE seats, blowout-proof stem, threaded or solder-joint ends, and locking-type handle designed for quarter turn between opened and closed positions.
 - 1. Manufacturers:
 - a. Allied Healthcare Products, Inc.; Chemetron Div.
 - b. Amico Corporation.
 - c. Beacon Medaes.
 - d. Conbraco Industries, Inc., Apollo Ball Valves.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Squire-Cogswell/Aeros Instruments.

- C. Bronze Check Valves: Straight-through-pattern, spring-loaded ball check valve; designed for 300-psig minimum working pressure.
 - D. Forged Steel Check Valves: Class 800, forged steel body, stainless steel trim, swing check valve, with socket weld ends.
 - E. Natural Gas Valves, NPS 3 and Smaller: Bronze or brass body with AGA or CSA stamp, UL listed or FM approved for service, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 125-psig minimum pressure rating.
 - 1. Manufacturers:
 - a. Conbraco Industries, Inc.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Watts Industries, Inc.; Water Products Div.
 - 2. Tamperproof Feature: Include design for locking.
 - F. Safety Valves: Bronze body with settings to match system requirements.
 - 1. Pressure Relief Valves: ASME construction, poppet type.
 - 2. Vacuum Relief Valves: Specialty manufacturer's option.
 - G. Pressure Regulators: Bronze body and trim; spring-loaded, diaphragm-operated, relieving type; manual pressure-setting adjustment; rated for 250-psig minimum inlet pressure; and capable of controlling delivered air pressure within 0.5 psig for each 10-psig inlet pressure.
 - H. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, 200-psig minimum working-pressure rating, and capable of automatic discharge of collected condensate.
- 2.7 MASTER GAS SHUT OFF VALVE AND VALVE BOX
- A. Manufacturers:
 - 1. BeaconMedaes.
 - 2. Metcraft Industries Inc.; A606 Master Gas Valve Box.
 - 3. Squire-Cogswell/Aeros Instruments Inc.; Healthcair.
 - B. Master Gas Shut-Off Valve Box: Formed steel, stainless steel, or formed or extruded aluminum for recessed or surface mounting as indicated on the drawings, in sizes to permit manual operation of valves, with holes for piping and anchors.
 - 1. Interior Finish: Factory-applied white enamel.
 - 2. Cover Plate: Aluminum or extruded-anodized aluminum or stainless steel with NAAMM AMP 503, No. 4 finish.

3. Hinged, key locking door with continuous stainless piano type hinge. Door labeled "MASTER GAS VALVE."
4. Valve-Box Windows: Clear or tinted transparent plastic.

C. Master gas shut off valve: Natural gas valve as specified in this Section.

D. Provide union ahead of valve within box.

E. Exposed gas piping located within master gas valve box shall be painted yellow. Refer to Division 20 Section "Mechanical Identification" and Division 09.

2.8 LABORATORY PRESSURE REGULATORS

A. Pressure regulators shall be compact design, die cast aluminum body, balanced poppet design, locking adjustment knob, with convoluted diaphragm. Regulators for nitrogen system shall have 0-60 psi gauge. Regulators for compressed air shall have 0-125 psi gauge.

B. Manufacturer:

1. Coil Hose Pneumatics 26R3.

2.9 TEST GAS

A. Description: Oil-free dry nitrogen complying with CGA P-9, for purging and testing of piping.

2.10 IDENTIFICATION

A. Refer to Division 20 Section "Mechanical Identification" for identification of piping, valves, gages, alarms, and specialties.

PART 3 - EXECUTION

3.1 PREPARATION

A. Interruption of Existing Laboratory Air and Vacuum Services: Do not interrupt laboratory air and vacuum services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary laboratory air and vacuum services according to requirements indicated:

1. Notify owner not less than two days in advance of proposed interruption of laboratory air services.
2. Do not proceed with interruption of laboratory air services without owner's written permission.

B. Cleaning of Piping: If factory-cleaned and -capped laboratory air and vacuum piping is not available or if precleaned piping must be recleaned because of exposure, perform the following procedures:

1. Clean laboratory air and vacuum tubes and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."
2. Wash laboratory air and vacuum piping and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.
 - a. Scrub to ensure complete cleaning.
 - b. Rinse with clean, hot water to remove cleaning solution.

3.2 PIPING SYSTEM INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Install thermometers and pressure gages according to Division 20 Section "Meters and Gages."
- C. Install flexible pipe connector at each connection to laboratory air and vacuum equipment.
- D. Purge laboratory gas and vacuum piping, using oil-free dry nitrogen, after installing piping but before connecting to gages.
- E. Install underslab laboratory air, gas, and vacuum piping in protective conduit fabricated with PVC pipe and fittings.

3.3 VALVE INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping and valve installation.
- B. Install shutoff valve at each connection to and from laboratory air and vacuum specialties and equipment.
- C. Install check valves to maintain correct direction of fluid flow to and from laboratory air and vacuum specialties and equipment.
- D. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
- E. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.
 1. Pressure System Valves: Install pressure gage downstream from valve.
 2. Suction System Valves: Install vacuum gage upstream from valve.
- F. Install pressure safety and vacuum relief valves where recommended by specialty manufacturers.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Brazed Joints: Use silver- or copper-phosphorus-composition filler metal and comply with CDA's "Copper Tube Handbook," Section VII, "Brazed Joints"; or AWS D10.13, "Recommended Practices for the Brazing of Copper Pipe and Tubing for Medical Gas Systems."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 20 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable, roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 20 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install supports and anchors according to Division 20 Section "Hangers and Supports," with spacing according to NFPA 99.
- F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/4: 60 inches with 3/8-inch rod.
 - 2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
 - 3. NPS 3/4: 84 inches with 3/8-inch rod.
 - 4. NPS 1: 96 inches with 3/8-inch rod.
 - 5. NPS 1-1/4: 108 inches with 3/8-inch rod.
 - 6. NPS 1-1/2: 10 feet with 3/8-inch rod.
 - 7. NPS 2: 11 feet with 3/8-inch rod.
 - 8. NPS 2-1/2: 13 feet with 1/2-inch rod.
 - 9. NPS 3: 14 feet with 1/2-inch rod.
 - 10. NPS 3-1/2: 15 feet with 1/2-inch rod.
 - 11. NPS 4: 16 feet with 1/2-inch rod.

12. NPS 5: 18 feet with 1/2-inch rod.
13. NPS 6 NPS: 20 feet with 5/8-inch rod.
14. NPS 8: 23 feet with 3/4-inch rod.

- G. Install supports for vertical copper tubing every 10 feet.
- H. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
 5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to specialties and equipment to allow service and maintenance.
- C. Specialty and Equipment Flanged Connections: Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube.
- D. Ground specialties and equipment according to Division 26 Section "Grounding and Bonding."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.7 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for laboratory air and vacuum piping systems. Refer to Division 20 Section "Mechanical Identification" for labeling and identification materials.
- B. Captions and Color-Coding: Comply with ASME (ANSI) A13.1 unless otherwise indicated.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- C. Perform the following field tests and inspections and prepare test reports:

1. Inspect, test, and certify completed laboratory gas and vacuum systems according to requirements specified. Inspect, test, and certify each piping system, including specialties, alarm system, safety devices, and source equipment.
2. Provide oil-free dry nitrogen, materials, and equipment required for testing.
3. Laboratory Gas Piping Testing: Owner to witness all tests. 72 hour written notice required. Use oil-free dry nitrogen, unless otherwise indicated, and perform procedures and tests as indicated. Include the following:
 - a. Piping Integrity Tests:
 - 1) Blow Down: Clear piping before connecting service connections or outlets.
 - 2) Initial Pressure Tests: Subject each piping section to test pressure of 1.5 times system working pressure, but not less than 150 psig, before attaching system components, after installing station outlets with test caps (if supplied) in place, and before concealing piping system. Maintain test until joints are examined for leaks by means of soapy water. Repair leaks with new materials and retest systems.
 - 3) Purge Tests: Perform heavy intermittent purging of piping and full-flow purging of service connections.
 - b. Verification and Final Testing: Activate systems with compressed air at normal operating pressure.
 - 1) Standing-Pressure Tests: Install assembled system components after testing individual systems as specified above. Subject systems to 24-hour standing-pressure test. Verify that pressure differences comply with required calibration. Repair leaks with new materials and retest systems.
 - 2) Pressure Relief Valve Tests: Verify proper valve operation.
 - 3) Cross-Connection Tests: Activate only compressed-air system. Verify that air flows from each laboratory air outlet and does not flow from vacuum inlets. Repeat cross-connection test for laboratory vacuum system.
 - 4) Secondary Equipment Tests: Verify operation of equipment if available.
 - 5) Labeling: Verify correct labeling.
4. Laboratory Vacuum Piping Testing: Use oil-free dry nitrogen, unless otherwise indicated, and perform procedures and tests as indicated. Include the following:
 - a. Blow Down: Clear piping before connecting service connections or inlets.
 - b. Pressure Tests: Subject each piping section to test pressure of 15 psig for 24 hours. Verify that pressure drop does not exceed 5 psig. Repair leaks with new materials and retest systems.
 - c. Cross-Connection Tests: Perform as part of laboratory air piping testing.
 - d. Labeling: Verify correct labeling.
5. Test and adjust controls and safeties.

D. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

1. Inspections performed.
2. Procedures, materials, and gases used.
3. Test methods used.
4. Results of tests.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain laboratory air and vacuum alarm system. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 22 61 13

**SECTION 237000
PACKAGED ROOFTOP UNITS**

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 GENERAL DESCRIPTION

- A. This section includes the design, controls and installation requirements for packaged rooftop units.

1.3 QUALITY ASSURANCE

- A. Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.
- B. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- C. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- D. Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.
- E. Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
- F. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.
- G. Unit shall be approved for use in and outside High Velocity Hurricane Zones (HVHZ) by the Florida Building Code (FL# 15031), when using the required steel rooftop curb and attachment methods.

Maximum allowable lateral wind pressure is +100psf/-100psf. Maximum allowable uplift is +50psf/-50psf. Positive and negative required design pressures calculated for use with this system shall be determined by others on a job specific basis, in accordance with the governing code. Site specific pressures shall be less than or equal to the listed positive or negative allowable lateral wind design pressure and allowable uplift values for the product.

1.4 SUBMITTALS

- A. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics and connection requirements. Installation, Operation, and Maintenance manual with startup requirements shall be provided.
- B. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Unit shall be shipped with doors screwed shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.
- B. Follow Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
- C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation, and Maintenance manual.

1.6 WARRANTY

- A. Manufacturer shall provide a limited "parts only" warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Products shall be provided by the following manufacturers:
 - 1. AAON
 - 2. McQuay.

3. Substitute equipment may be considered for approval that includes at a minimum:
 - a. R-410A refrigerant
 - b. Variable capacity compressor with 10-100% capacity control
 - c. Direct drive supply fans
 - d. Double wall cabinet construction
 - e. Insulation with a minimum R-value of 13
 - f. Stainless steel drain pans
 - g. Hinged access doors with lockable handles
 - h. All other provisions of the specifications must be satisfactorily addressed

2.2 ROOFTOP UNITS

A. General Description

1. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, reheat coil, gas heaters, and unit controls.
2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
4. Unit components shall be labeled, including refrigeration system components and electrical and controls components.
5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
6. Installation, Operation, and Maintenance manual shall be supplied within the unit.
7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, cooling coils, reheat coil, heaters, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit shall include lifting lugs on the top of the unit.

C. Electrical

1. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
2. Unit shall be provided with a factory installed and factory wired 115V, 13 amp GFI outlet disconnect switch in the unit control panel.
3. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

D. Supply Fans

1. Unit shall include direct drive, unhooded, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

E. Cooling Coils

1. Evaporator Coils

- a. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
- b. Coils shall have interlaced circuitry and shall be 6 row high capacity.
- c. Coils shall be hydrogen or helium leak tested.
- d. Coils shall be furnished with factory installed expansion valves.

F. Refrigeration System

1. Unit shall be factory charged with R-410A refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.
7. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.
8. Unit shall include a variable capacity scroll compressor on all refrigeration circuits which shall be capable of modulation from 10-100% of its capacity.
9. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Modulation range shall be 30-100%
10. Each refrigeration circuit shall be equipped with a liquid line sight glass.

G. Condensers

1. Air-Cooled Condenser

- a. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
- b. Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes or coils shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design of copper tube coils shall be sine wave rippled.
- c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
- d. Coils shall be hydrogen or helium leak tested.
- e. Condenser fans shall be VFD driven variable speed for condenser head pressure control. Factory provided and factory programmed VFDs shall continuously modulate the fan air flow to maintain head pressure at acceptable levels. Cooling operation shall be allowed down to 35°F with adjustable compressor lockouts.

H. Gas Heating

1. Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty, from the date of original equipment shipment from the factory.
2. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.
3. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
4. Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.

- I. Natural gas furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. 292.5 MBH and 390 MBH gas heating assemblies shall be capable of operating at any firing rate between 100% and 10% of their rated capacity.

J. Filters

1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the cooling coil.
2. Unit shall include 4 inch thick, pleated panel filters with an ASHRAE efficiency of 85% and a MERV rating of 13, upstream of the cooling coil. Unit shall also include 2 inch thick, pleated panel pre filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the 4 inch standard filters.
3. Unit shall include a clogged filter switch.

K. Controls

1. Factory Installed and Factory Provided Controller

- a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand-alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
- b. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
- c. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
- d. Makeup Air Controller
 - 1) Unit shall modulate cooling with constant airflow to meet ventilation outside air loads. Cooling capacity shall modulate based on supply air temperature.
 - 2) With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet outside air humidity loads and prevent supply air temperature swings and overcooling of the space.
 - 3) Unit shall modulate heating with constant airflow to meet ventilation outside air loads. Heating capacity shall modulate based on supply air temperature.
- e. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network. [WattMaster Orion Controls System]

L. Accessories

- 1. Unit shall be provided with a safety shutdown terminal block for field installation of a smoke detector which shuts off the unit's control circuit.

2.3 CURBS

- A. Curbs shall to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.
- B. Knockdown curb (with duct support rails) shall be factory furnished for field assembly.
- C. Solid bottom curb shall be factory assembled and fully lined with 1 inch neoprene coated fiberglass insulation and include a wood nailer strip. (Curb shall be adjustable up to 3/4 inch per foot to allow for sloped roof applications.)

PART 3 - EXECUTION

3.1 INSTALLATION, OPERATION, AND MAINTENANCE

- A. Installation, Operation, and Maintenance manual shall be supplied with the unit.
- B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.
- C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION 23 70 00

**SECTION 23 82 19
 FAN-COIL UNITS**

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 20 Section "Mechanical General Requirements."
 - 2. Division 20 Section "Basic Mechanical Materials and Methods."

1.2 DEFINITIONS

- A. BAS: Building automation system.
- B. IAQ: Indoor air quality.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension components.
 - 2. Structural members to which fan-coil units will be attached.
 - 3. Method of attaching hangers to building structure.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - 6. Perimeter moldings for exposed or partially exposed cabinets.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For fan-coil units to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 COORDINATION

- A. Coordinate layout and installation of fan-coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

- B. Coordinate size and location of wall sleeves for outdoor-air intake.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fan-Coil-Unit Filters: Furnish spare filter for each filter installed.
 - 2. Fan Belts: Furnish one set of spare fan belts for each unit installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 BLOWER COIL UNITS

- A. Manufacturers:
 - 1. Carrier; a United Technologies Company.
 - 2. Daikin Applied; a member of Daikin Industries, Ltd.
 - 3. Enviro-Tec, Johnson Controls, Inc.
 - 4. Magic Aire; div. of United Electric Company L.P.
 - 5. Trane
- B. Description: Factory-packaged and -tested units rated according to AHRI 440, ASHRAE 33, and UL 1995.
- C. Coil Section Insulation: Minimum 1/2-inch thick dual-density coated glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 - 1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
- D. Drain Pans: Stainless steel. Fabricate pans and drain connections to comply with ASHRAE 62.1. Include factory-installed float switch to detect high condensate water level and disable fan operation.

- E. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panels.
- F. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.
 - 1. Return-Air Plenum: Sheet metal plenum finished to match the chassis.
 - 2. Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.
- G. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - 1. Washable Foam: 70 percent arrestance and 3 MERV.
- H. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.
- I. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.
- J. Belt-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the cabinet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.
- K. Motors: Comply with requirements in Division 20 Section "Motors."
- L. Control devices and operational sequence are specified in Division 23 Sections "Temperature Controls" and indicated on "Sequence of Operation" on the Drawings.
- M. Electrical Connection: Factory wire motors and controls for a single electrical connection.
- N. Capacities and Characteristics: Refer to schedule on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil-unit installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fan-coil units level and plumb.
- B. Install fan-coil units to comply with NFPA 90A.
- C. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Division 20 Section "Mechanical Vibration Controls."
- D. Verify locations of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above finished floor.
- E. Install new filters in each fan-coil unit within two weeks after Substantial Completion.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
 - 1. Install piping adjacent to machine to allow service and maintenance.
 - 2. Connect condensate drain to indirect waste.
 - a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.
- B. Connect refrigerant tubing to components. Install tubing to allow access to unit. Evacuate and charge with refrigerant in accordance with manufacturer's instructions.
- C. Water Piping: Unless otherwise indicated:
 - 1. Install union or flange and isolation valve on supply-water connection.
 - 2. Install union or flange and calibrated balancing valve or PICCV as indicated on the Drawings on return-water connection.
 - 3. Hydronic specialties are specified in Division 23 Section "Hydronic Piping."
- D. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Division 23 Section "Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.
- E. Ground equipment according to Division 26 Section "Grounding and Bonding."
- F. Connect wiring according to Division 26 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan-coil units.

END OF SECTION 23 82 19

**SECTION 262416
PANELBOARDS**

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
1. Distribution panelboards.
 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.

- C. GFEP: Ground-fault equipment protection.
- D. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, surge protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Related Submittals:
 - 1. Provide overcurrent device coordination study to demonstrate proper overcurrent device ratings, adjustments, and settings.
- C. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- D. Field quality-control test reports including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner no fewer than seven days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Owner's written permission.

1.7 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products. (provide U of M lugs)
 - b. General Electric Co.; Electrical Distribution & Protection Div.
 - c. Siemens Industries, Inc.
 - d. Square D.

2.2 MANUFACTURED UNITS

- A. Enclosures: Mounting as noted on panel schedules. NEMA PB 1, Type 1.
 - 1. Cabinet Front: Flush or surface cabinet as noted on the Drawings.
 - a. Siemens/Eaton – Figure 4 hinge to box w/piano hinge.
 - b. GE – FGB (front hinge to box).
 - c. Square D – Continuous piano hinge trim.
 - 2. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

3. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
 - B. Phase and Ground Buses:
 1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
 - C. Conductor Connectors: Suitable for use with conductor material.
 1. Main and Neutral Lugs: Mechanical type.
 2. Ground Lugs and Bus Configured Terminators: Compression type.
 3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - D. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
 - E. Surge Protective Devices: Where indicated, provide manufactured units with direct bus connected type as specified in Division 26 Section "Surge Protective Devices."
- 2.3 PANELBOARD SHORT-CIRCUIT RATING
- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.
- 2.4 DISTRIBUTION PANELBOARDS
- A. Main bus bars, neutral and ground, shall be copper and sized in accordance with U.L. Standards to limit temperature rise on any current carrying part to the maximums as indicated in UL67.
 - B. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.
 - C. Main Overcurrent Protective Devices: Circuit breaker.
 - D. Branch Overcurrent Protective Devices:
 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
 3. Fused switches.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Main bus bars, neutral and ground, shall be copper and sized in accordance with U.L. Standards to limit temperature rise on any current carrying part to the maximums as indicated in UL67.
- B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 3, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
 - a. Circuit Breakers 250A and Larger: Magnetic trip element with front-mounted, field-adjustable trip setting with restricted access cover.
 - 2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 - 3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 4. AFCI Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Shunt Trip: 120-V trip coil energized from separate circuit.
 - 4. Do not use tandem circuit breakers.
 - 5. Provide lock on devices for circuit breakers when called out on panel schedules with "LOD" designation.
 - 6. Provide type GFEP circuit breakers for all self-regulating heating (snow melting and heat trace) cables branch circuits and where noted on panel schedules with "GFEP" designation
 - 7. Provide GFCI circuit breaker when called out on panel schedules with "GFCI" designation.
 - 8. Provide Arc-Fault Circuit Interrupters where indicated on panel schedule with "AFCI" designation.
 - 9. Provide shunt trip breakers when called out on panel schedules with "STB" designation.
 - 10. Provide smart controllable circuit breakers when called out on panel schedules with "SMT" designation.

- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- D. Fuses are specified in Division 26 Section "Fuses."

2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads or created by retrofitting. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Coordinate final directory room names and numbers with Owner.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters. Perform electrical tests on all breakers and switches 200A and above or that constitute a component of an emergency distribution system. Main circuit breakers in branch circuit panelboards 225A and below are not required to be tested.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
 - 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

2. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

E. Testing and Certification (Isolation Power Panels)

1. Provide manufacturer's engineer or technician for final testing of Isolated Power Panel and the related system as follows.
 - a. Simulate faults at each receptacle to ascertain correct function of the L.I.M.
 - b. Check the calibration of the L.I.M. meter and record readings.
 - c. Record and date all data in permanent log book.
 - d. Certify that the system is properly installed and in correct working order.
 - e. Turn over to the hospital maintenance department a set of test equipment consisting of a ground integrity tester, current leakage tester, and plug in the L.I.M. tester.

3.5 CLEANING

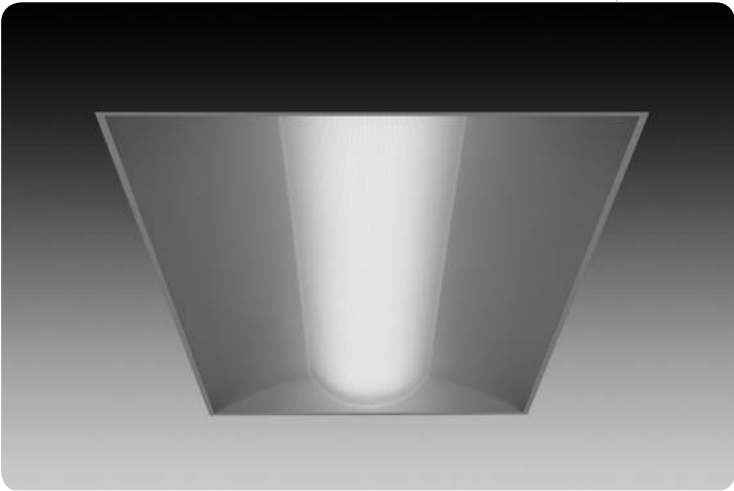
- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

L1,L1E



amica™ 2x4



features

Architectural recessed LED luminaire.

Sweeping curves and classic lines
compliment architecture.

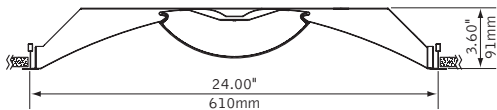
Amica's center ribbed diffuser masks
LED brightness and image to create even
illumination.

Amica features a shallow 3.6" housing depth
which flies under the radar of most plenum
obstructions.

lens detail



dimensional data



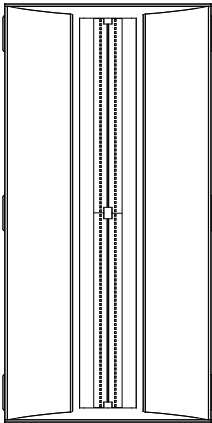
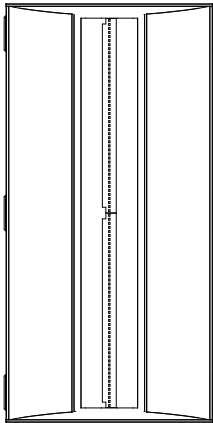
led options



Standard Output (LL1)
Medium Output (LL2)



High Output (LL3)

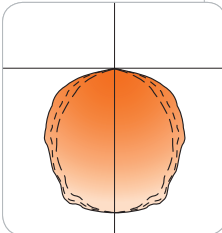


APPROVED ALTERNATE MANUFACTURERS:
1. COOPER "CLASS R2X" SERIES
2. DAY-BRITE "ARIOSO RECESSED LED" SERIES

performance

High Output (LL3)
Delivered lumens: 6243lm
Total system watts: 62.9W

Photometric performance is measured
in accordance with IESNA LM-79.



Visit focalpointlights.com for
complete photometric data.

september 2013 A

L1,L1E

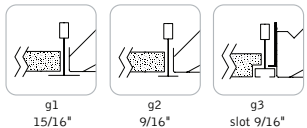
fixture:

project:

mounting information

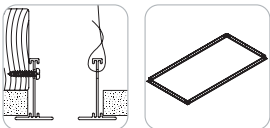
grid

for lay-in grid, specify G1, G2 or G3.



drywall frame kit

specify "DF" Drywall Frame Kit for drywall ceiling conditions.



Use tie-wire or screws to secure frame kit.

cut out dimensions:
2': Min: 24.25"
Max: 24.563"
4': Min: 48.25"
Max: 48.563"

specifications

led system

Proprietary linear LED module incorporates premium LEDs on a robust platform to achieve excellent thermal management. LEDs are placed to promote a uniform appearance. Available in 3000K, 3500K or 4000K with CRI>80. 0-10V dimming driver standard. LED modules and drivers are replaceable from below.

construction

One piece 20 Ga. steel reflector and housing.
Side access 20 Ga. steel ballast compartment.
Earthquake brackets supplied as standard.

Weight: 25 lbs

optic

20 Ga. steel reflectors finished in matte satin white powder coat.
.095" thick frosted white acrylic lamp diffusers with linear micro-prism pattern.

electrical

Standard 120-277V driver includes 0-10V analog dimming. Power factor > .9.
Optional EcoSystem™ or forward phase dimming drivers from Lutron available.

LED System	Color Temp	Tested System Watts	Delivered Lumens
Standard output	3500K	44.8	4197
Medium output	3500K	66.3	5760
High output	3500K	62.9	6243

*Lumen output may vary +/- 5%. *LL3 output with Lutron drivers reduced by approx. 6%

*Actual wattage may vary +/- 5%

emergency battery

Bodine BSL310-CAN.
Emergency output—10 watts for 90 minutes.

labels

UL and cUL listed.

finish

Polyester powder coat applied over a 5-stage pre-treatment.
Optional Matte Satin White with anti-microbial coating provides 99.99% protection against a broad spectrum of micro-organisms.

Lifetime and warranty

LED system rated for 50,000 hours at 70% lumen output (L70). Rated life and lumen output based on maximum ambient temperature of 25°C. 5 year limited warranty.

ordering

luminaire series	FAML
Amica LED	FAML
nominal size	24
2' x 4'	24
shielding	ACR
Radial Acrylic Diffuser	ACR
led system	
Standard Output	LL1
Medium Output	LL2
High Output	LL3
color temperature	
3000K	L30
3500K	L35
4000K	L40
driver	
0-10V Dimming	LD1
Lutron® A-Series - EcoSystem™	L3D
Lutron A-Series - Forward Phase (120 only)	LTE
voltage	
120 Volt	120
277 Volt	277
mounting	
15/16" Grid	G1
9/16" Grid	G2
9/16" Slot Tee	G3
factory options	
Air Return (Overall height for luminaire with Air Return is 4.26")	AR
Chicago Plenum	CP
Drywall Frame Kit (Cut out dimensions: Min: 24.25"/Max: 24.563" Min: 48.25"/Max 48.563")	DF
Flex Whip*	FW
Emergency Battery Pack with Integral Test Switch	EM
finish	
Matte Satin White	WH
Matte Satin White with Anti-Microbial Coating	WHA

FOR L1E FIXTURE INDICATED ON DRAWINGS

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* for more information see Reference section.

SIMPLESEAL™

CSEDI SERIES – LED – INSET DOOR

PRODUCT FEATURES:

- » High-output, high-CRI LED lamp sources for accurate color rendition and lighting performance
- » Diffused high-efficiency lens for reduced glare
- » Recessed ceiling mount; grid or flange - 1'x4', 2'x2', 2'x4'
- » Suitable for universal installation into 1.0" and 1.5" grid or flange (drywall) ceilings
- » One piece inset doorframe, secured to housing with aircraft cables.

SPECIFICATIONS

HOUSING: 20-gauge CRS. Hole-free, one-piece, seam-welded construction. Integral aluminum heat sink for thermal dissipation. 18-gauge housing flange with mitered and welded corners. White TGIC polyester powder coat finish – 5-step pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%.

DOORFRAME: 18-gauge CRS. One-piece inset-style construction with welded corners. Gloss white TGIC polyester powder coat finish with 5-stage pre-treatment. Doorframe secured to housing with stainless steel aircraft cables and captive, flush-mounted Phillips-head fasteners. Closed-cell silicone gasket seals doorframe to housing.

OPTICS: Symmetric optic includes diffused, impact-resistant acrylic lens.

ELECTRICAL: Available 3500K, 4000K and 5000K color temperatures. 120-277VAC, 50/60Hz electrical input with serviceable high power factor electronic, constant-current driver (<20% THD, >0.95 PF). Standard 0-10V dimming with 3-100% range.

INSTALLATION: Non-IC recessed ceiling mounting into grid and flange application types. Flange installation utilizes included adjustable swing-out mounting brackets. Grid installation suitable for 1" and 1.5" T-bar ceilings. Universal installation into grid or flange (drywall) ceiling applications. See Options for continuous row mounting and install frames.

PHOTOMETRICS: Photometry tested to the IESNA LM-79-08 standard. For additional photometric data, please go to www.kenall.com

WARRANTY: Limited five (5) year warranty.

LISTINGS: Luminaire is certified to UL standards by Intertek Testing Laboratories for Wet Location. Certified IP65 per IEC 60598. NSF2 Splash/Non-Food Zone. CCEA Approved. Meets FED-STD-209E/Class 100 (ISO 5) Cleanrooms. Optional compliance to MIL-STD 461F - Airforce/Navy fixed.



L2,L2E



PROJECT INFORMATION

Job Name _____
Fixture Type _____
Catalog Number _____
Approved by _____

APPROVED ALTERNATE MANUFACTURERS:
1. KERZON "TL" SERIES

ORDERING INFORMATION (Ex: CSEDI-24-67L40K-DCC-DV-2F-2H-SYM)

Model	Size	Lamp Type	Driver	Voltage	Doorframe	Housing	Optics	Options
CSEDI			DCC	DV			SYM	
Size	Lamp Type		2'x4'			Housing Options		
14 1'x4'	1'x4'		45L35K 45 Watt 3500K LED (82 CRI)			2H 20-Ga CRS (STD)		
22 2'x2'	45L40K 45 Watt 4000K LED (82 CRI)		45L40K 45 Watt 4000K LED (82 CRI)			5H 20-Ga Type 304 SS		
24 2'x4'	45L50K 45 Watt 5000K LED (82 CRI)		45L50K 45 Watt 5000K LED (82 CRI)			PAH .050" Painted Aluminum		
	67L35K 67 Watt 3500K LED (82 CRI)		67L35K 67 Watt 3500K LED (82 CRI)			Optics		
	67L40K 67 Watt 4000K LED (82 CRI)		67L40K 67 Watt 4000K LED (82 CRI)			SYM Symmetric, Diffused DR Acrylic		
	67L50K 67 Watt 5000K LED (82 CRI)		67L50K 67 Watt 5000K LED (82 CRI)			Options		
	90L35K 90 Watt 3500K LED (82 CRI)		90L35K 90 Watt 3500K LED (82 CRI)			LEL Emergency Battery Pack (not available with DV Voltage option)		
	90L40K 90 Watt 4000K LED (82 CRI)		90L40K 90 Watt 4000K LED (82 CRI)			TUVV 10KV/KA Surge Protection per IEEE/ANSI C62.41 Cat. A		
	90L50K 90 Watt 5000K LED (82 CRI)		90L50K 90 Watt 5000K LED (82 CRI)			FS Fuse & Holder		
	2'x2'		135L35K 135 Watt 3500K LED (82 CRI)			RF Radio Frequency Filter (MIL-STD 461F Compliance)		
	45L35K 45 Watt 3500K LED (82 CRI)		135L40K 135 Watt 4000K LED (82 CRI)			RM† Continuous Row Mounting		
	45L40K 45 Watt 4000K LED (82 CRI)		135L50K 135 Watt 5000K LED (82 CRI)			* Add .375" to ceiling cut out dimensions		
	45L50K 45 Watt 5000K LED (82 CRI)		180L35K 180 Watt 3500K LED (82 CRI)			† Only available when installed in drywall ceilings (flange mount)		
	67L35K 67 Watt 3500K LED (82 CRI)		180L40K 180 Watt 4000K LED (82 CRI)			• Voltage specific		
	67L40K 67 Watt 4000K LED (82 CRI)		180L50K 180 Watt 5000K LED (82 CRI)					
	67L50K 67 Watt 5000K LED (82 CRI)		Driver Type					
	90L35K 90 Watt 3500K LED (82 CRI)		DCC Dimming Constant Current					
	90L40K 90 Watt 4000K LED (82 CRI)		Voltage					
	90L50K 90 Watt 5000K LED (82 CRI)		DV 120/277VAC, 50/60Hz					
			120 120VAC					
			277 277VAC					
			347 347VAC					
			Doorframe Options					
			5F 20-Ga Type 304 SS Brushed					
			2F 18-Ga CRS (STD)					
			AF Anodized Aluminum					
			PAF Painted Fabricated Aluminum					

FOR L2E FIXTURE INDICATED
ON DRAWINGS

**PROVIDE AMBER LIGHT
FILTER ON FIXTURE LENS**



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SIMPLESEAL™

L2,L2E

CSEDI SERIES – TECHNICAL DATA

PERFORMANCE		Initial Delivered Lumens				
Model	Lamp Type	@ 25°C	Efficacy (lm/W)	Input Power (W)	Drive Current (mA)	Estd. L70 LED Life (Hrs)
CSEDI14	45L35K	4388	88	50	94	80,000
	45L40K	4678	94	50	94	80,000
	45L50K	4865	97	50	94	80,000
	67L35K	6290	85	74	66	80,000
	67L40K	6706	91	74	66	80,000
	67L50K	6974	95	74	66	80,000
	90L35K	8510	86	99	94	60,000
	90L40K	9072	92	99	94	60,000
	90L50K	9435	95	99	94	60,000
CSEDI22	45L35K	4358	87	50	94	80,000
	45L40K	4647	93	50	94	80,000
	45L50K	4833	97	50	94	80,000
	67L35K	6247	84	74	66	80,000
	67L40K	6660	90	74	66	80,000
	67L50K	6927	93	74	66	80,000
	90L35K	9042	97	99	94	60,000
	90L40K	9640	104	99	94	60,000
	90L50K	10026	108	99	94	60,000
CSEDI24	45L35K	4799	99	48	94	80,000
	45L40K	5116	106	48	94	80,000
	45L50K	5321	110	48	94	80,000
	67L35K	6949	94	74	66	80,000
	67L40K	7408	100	74	66	80,000
	67L50K	7704	104	74	66	80,000
	90L35K	8839	91	98	94	60,000
	90L40K	9423	97	98	94	60,000
	90L50K	9800	100	98	94	60,000
	135L35K	14127	105	148	94	60,000
	135L40K	15061	112	148	94	60,000
	135L50K	15663	116	148	94	60,000
	180L35K	20226	112	199	94	60,000
	180L40K	21563	120	199	94	60,000
	180L50K	22426	125	199	94	60,000

Displayed information is for selected luminaires only. Additional wattages and color temperatures are also available. Visit www.kenall.com for additional information.



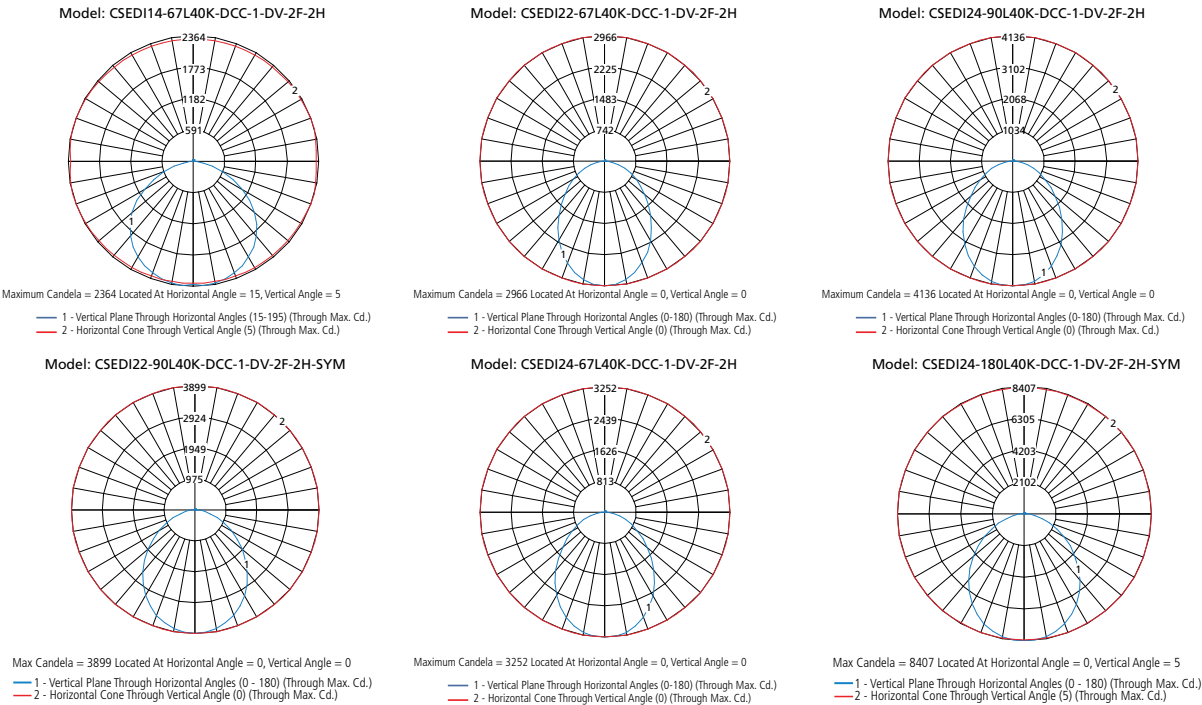
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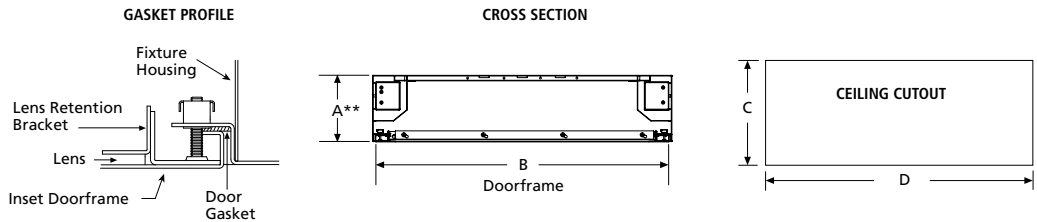
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L2,L2E

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CSEDI SERIES – TECHNICAL DATA
PERFORMANCE



DIMENSIONAL DATA



DIMENSIONAL DATA (IN INCHES)

	A	B	C	D
1x4	4.20	11.75 x 47.75	10.85	46.85
2x2	4.20	23.75 x 23.75	22.85	22.85
2x4	4.20	23.75 x 47.75	22.85	46.85

* Add .375" to ceiling cut out dimensions when IF Option is specified
** Height is 8.691" with LEL option



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CSEDI SERIES – LED – INSET DOOR

- » High-output, high-CRI LED lamp sources for accurate color rendition and lighting performance
- » Diffused high-efficiency lens for reduced glare
- » Recessed ceiling mount; grid or flange - 1'x4', 2'x2', 2'x4'
- » Suitable for universal installation into 1.0" and 1.5" grid or flange (drywall) ceilings
- » One piece inset doorframe, secured to housing with aircraft cables.

HOUSING: 20-gauge CRS. Hole-free, one-piece, seam-welded construction. Integral aluminum heat sink for thermal dissipation. 18-gauge housing flange with mitered and welded corners. White TGIC polyester powder coat finish – 5-step pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%.

OPTICS: Symmetric optic includes diffused, impact-resistant acrylic lens.

INSTALLATION: Non-IC recessed ceiling mounting into grid and flange application types. Flange installation utilizes included adjustable swing-out mounting brackets. Grid installation suitable for 1" and 1.5" T-bar ceilings. Universal installation into grid or flange (drywall) ceiling applications. See Options for continuous row mounting and install frames.

WARRANTY: Limited five (5) year warranty

APPROVED ALTERNATE MANUFACTURERS:
 1. KERZON "TL" SERIES



Model	Size	Lamp Type	Driver	Voltage	Doorframe	Housing	Optics	Options
CSEDI			DCC	DV			SYM	
Size		Lamp Type		2'x4'		Housing Options		
14	1'x4'	1'x4'		45L35K	45 Watt 3500K LED (82 CRI)	2H	20-Ga CRS (STD)	
22	2'x2'	45L40K	45 Watt 4000K LED (82 CRI)	45L40K	45 Watt 4000K LED (82 CRI)	5H	20-Ga Type 304 SS	
24	2'x4'	45L50K	45 Watt 5000K LED (82 CRI)	45L50K	45 Watt 5000K LED (82 CRI)	PAH	.050" Painted Aluminum	
		67L35K	67 Watt 3500K LED (82 CRI)	67L35K	67 Watt 3500K LED (82 CRI)			Optics
		67L35K	67 Watt 3500K LED (82 CRI)	67L40K	67 Watt 4000K LED (82 CRI)	SYM	Symmetric, Diffused DR Acrylic	
		67L40K	67 Watt 4000K LED (82 CRI)	67L50K	67 Watt 5000K LED (82 CRI)			Options
		67L50K	67 Watt 5000K LED (82 CRI)	90L35K	90 Watt 3500K LED (82 CRI)			LEL Emergency Battery Pack (not available with DV Voltage or
		90L35K	90 Watt 3500K LED (82 CRI)	90L40K	90 Watt 4000K LED (82 CRI)	TUV†	TUV/K/A Surge Protection per IEEE/ANSI C67-41 Cat. A	
		90L40K	90 Watt 4000K LED (82 CRI)	90L50K	90 Watt 5000K LED (82 CRI)	FS	Fuse & Holder	
		90L50K	90 Watt 5000K LED (82 CRI)	135L35K	135 Watt 3500K LED (82 CRI)	HJ	J Sealed Wireway	
				135L40K	135 Watt 4000K LED (82 CRI)	IF*†	Install Frame	
		2'x2'		135L50K	135 Watt 5000K LED (82 CRI)	RF*	Radio Frequency Filter (MIL-STD 461F Compliance)	
		45L35K	45 Watt 3500K LED (82 CRI)	180L35K	180 Watt 3500K LED (82 CRI)	RM†	Continuous Row Mounting	
		45L40K	45 Watt 4000K LED (82 CRI)	180L40K	180 Watt 4000K LED (82 CRI)			* Add .375" to ceiling cut out dimensions
		45L50K	45 Watt 5000K LED (82 CRI)	180L50K	180 Watt 5000K LED (82 CRI)			† Only available when installed in drywall ceilings (flange mount)
		67L35K	67 Watt 3500K LED (82 CRI)					• Voltage specific
		67L40K	67 Watt 4000K LED (82 CRI)					
		67L50K	67 Watt 5000K LED (82 CRI)					
		90L35K	90 Watt 3500K LED (82 CRI)					
		90L40K	90 Watt 4000K LED (82 CRI)					
		90L50K	90 Watt 5000K LED (82 CRI)					
				Driver Type				
				DCC	Dimming Constant Current			
				Voltage				
				DV	120/277VAC, 50/60Hz			
				120	120VAC			
				277	277VAC			
				347	347VAC			
				Doorframe Options				
				5F	20-Ga Type 304 SS Brushed			
				2F	18-Ga CRS (STD)			
				AF	Anodized Aluminum			
				PAF	Painted Fabricated Aluminum			



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CSEDI 14 22 24-010515

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CSEDI SERIES – TECHNICAL DATA

PERFORMANCE		Initial Delivered Lumens				
Model	Lamp Type	@ 25°C	Efficacy (lm/W)	Input Power (W)	Drive Current (mA)	Estd. L70 LED Life (Hrs)
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	180L40K	21563	120	199	94	60,000
	180L50K	22426	125	199	94	60,000

Displayed information is for selected luminaires only. Additional wattages and color temperatures are also available.
Visit www.kenall.com for additional information.



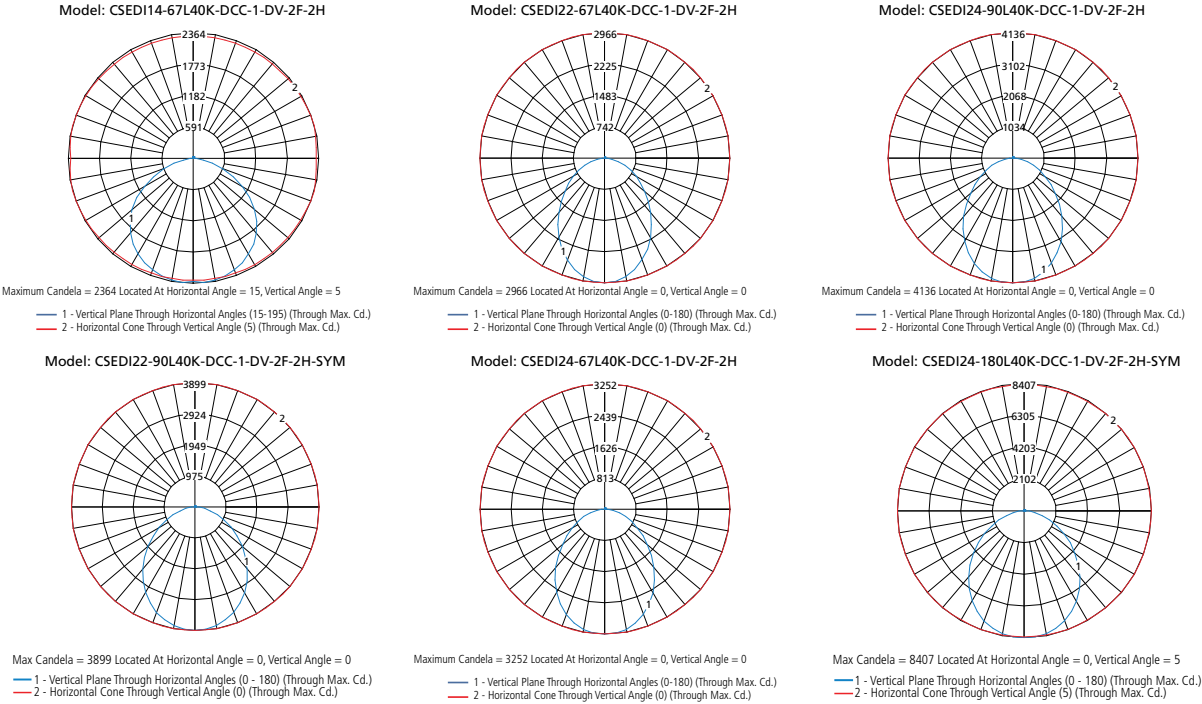
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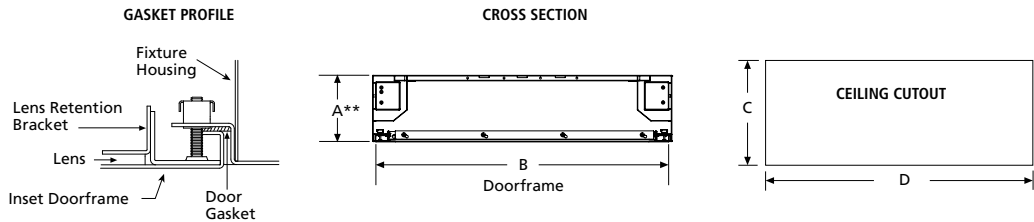
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L3,L3E

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CSEDI SERIES – TECHNICAL DATA
PERFORMANCE



DIMENSIONAL DATA



DIMENSIONAL DATA (IN INCHES)

	A	B	C	D
1x4	4.20	11.75 x 47.75	10.85	46.85
2x2	4.20	23.75 x 23.75	22.85	22.85
2x4	4.20	23.75 x 47.75	22.85	46.85

* Add .375" to ceiling cut out dimensions when IF Option is specified

** Height is 8.691" with LEL option



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CSEDI_14_22_24-010515



FEATURES & SPECIFICATIONS

INTENDED USE — Ideal for applications requiring attractive, thin-profile, die-cast aluminum signage.

CONSTRUCTION — Die-cast aluminum housing, thin profile. Clear lacquer, brushed aluminum inhibits fingerprints and other surface contaminants. Also available with white finish.

Universal directional chevron knockouts are completely concealed and easily removed.

Letters are 6" high with 3/4" stroke, with 100 ft. viewing distance rating, based upon UL924 standards.

OPTICS — The typical life of the exit LED lamp is 10 years.

Low energy consumption: one watt (120/277V).

ELECTRICAL — Dual-voltage input capability 120 or 277 VAC. Emergency models are provided with test switch, status indicator and a battery that automatically recharges when normal power is restored.

Battery: Emergency model provided with sealed, maintenance-free, nickel-cadmium battery that delivers 90 minutes of emergency power.

INSTALLATION — Universal mounting (top, end or back). Mounting knockouts and hole plugs are easily removed. Die-cast aluminum canopy is provided.

LISTINGS — UL Listed standard. Damp location listing 32°F to 122°F (0°C to 50°C) standard. Meets UL 924, NFPA 101 (current Life Safety Code), NFPA 70-NEC and OSHA illumination standards.

WARRANTY — 5-year limited warranty. Complete warranty terms located at www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Actual performance may differ as a result of end-user environment and application.

Note: Specifications subject to change without notice.

Catalog Number
Notes
Type <input checked="" type="checkbox"/>

Signature

Thin Die-Cast Aluminum Exit



TLE

LED Lamps



APPROVED ALTERNATE MANUFACTURERS:
1. CHLORIDE "55L" SERIES
2. ISOLITE "TL" SERIES

ORDERING INFORMATION All configurations of this product are considered "standard" and have short lead times. **Example:** TLE 1 R EL N

Family	Housing color	Number of faces	Letter color	Options
TLE	(blank) Brushed aluminum W White	1 Single face 2 Double face	R Red G Green	(blank) AC only; 120/277V EL N 120/277 VAC input with nickel-cadmium battery back-up

Accessories: Order as separate catalog number.	
ELA WG1	Back-mount wireguard ¹
ELA WGEXT	Top-mount wireguard ¹
ELA WGEXE	End-mount wireguard ¹

Notes
1 See spec sheet [ELA-WG](#).

TLE Thin Die-Cast Aluminum Exit



SPECIFICATIONS

ELECTRICAL

Primary Circuit				
Type	Typical LED life	Supply voltage	Input watts	Max. amps
Red LED, AC only	10 years	120	1	0.1
		277	1	0.1
Green LED, AC only	10 years	120	1	0.1
		277	1	0.1
Red LED, emergency	10 years	120	1	0.1
		277	1	0.1
Green LED, emergency	10 years	120	1	0.1
		277	1	0.1

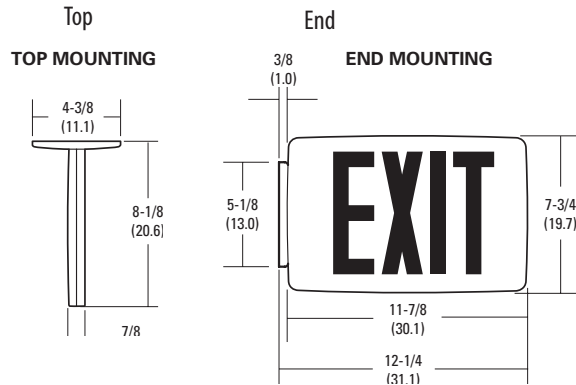
BATTERY (included with EL N option)		
Sealed Nickel-Cadmium		
Shelf life ²	Maintenance ³	Optimum temperature ⁴
3 years	None	32° - 122°F (0° - 50°C)

Notes

- Based on continuous operation. The typical life of the exit LED lamp is 10 years.
- At 77°F (25°C).
- All life safety equipment, including emergency lighting path of egress, must be maintained, serviced and tested in accordance with all National Fire Protection Association and local codes. Failure to perform the required maintenance, service or testing could jeopardize the safety of occupants and will void all warranties.
- Optimum ambient temperature range where unit will provide capacity for 90 minutes. Higher and lower temperatures affect life and capacity. Consult factory for detailed information.

MOUNTING

All dimensions are inches (centimeters).
 Shipping weight: 3 lbs. (1.3 kgs.).



Backplate

BACK MOUNTING

