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PROJECT NAME: Museum of York County
Exterior Walk-In Freezer Addition
4621 Mt. Gallant Road
Rock Hill, SC 29732

SECTION

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 NOT USED

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Work restrictions.
5. Specification and drawing conventions.

1.3 PROJECT INFORMATION

A. Project Identification: Museum of York County- Outdoor Freezer Addition.

1. Project Location: 4621 Mt. Gallant Road, Rock Hill, SC 29732.

B. Owner: Culture and Heritage Museums.

1. Owner Representative: Carey Tilley, Director of Historic Facilities
2. Owner Contact: Steve Kay, Property Manager

C. Architect: DWWArchitects.

1. Architect Representative: Darrell Watts, AIA.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
1. New pad-mounted (turnkey) outdoor walk-in freezer for the Fluid Storage program. Contractor shall provide all refrigeration, plumbing, mechanical, and electrical trade work required for a “turnkey” project.
2. A new elevated concrete pad for the outdoor walk-in freezer
3. A new replacement sidewalk and a new aluminum walkway cover.
4. Minor rough and finish grading for the work.

B. Type of Contract:

1. The project will be constructed under a single prime general construction contract.

1.5 WORK BY SEPARATE CONTRACTOR

A. None.

1.6 WORK BY OWNER

A. None.

1.7 ACCESS TO SITE

A. General: Contractor shall have unlimited access to the exterior project area for construction operations during construction period and as indicated by requirements of this section. Interior electrical work (getting power to the walk-in freezer) must be coordinated with the assigned museum staff member.

B. Use of Site: Contractor shall have use of the rear existing drives and parking area or bus parking, but must not block the drive or bus parking at any time without coordinating with the museum staff. Site elements damage by construction activities shall be repaired to like new by the contractor.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. No restrictions.

B. On-Site Work Hours: Typically Monday-Friday, between 8 a.m. and 5 p.m. Exceptions may be allowed with staff coordination and approval. Some black out dates for special events may apply.

C. Existing Utility Interruptions: As required to perform the work:

1. No utility interruption shall occur during the hours the museum is open to the public (Tuesday-Saturday, 10 a.m.- 5 p.m., and Sunday 1 p.m.- 5 p.m.) Notify the Owner and utility company not less than five (5) days in advance of proposed utility interruptions. If an electrical power interruption is required, schedule the work on a Monday and/or in a manner that restores power prior to the scheduled opening for the day.
2. Obtain Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.

E. Nonsmoking Property: Smoking is not permitted on York County property.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 NOT USED

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Divisions 02 through 49 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit one consolidated pdf electronic file for consideration to the Architect. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific

features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within ten (10) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2. Substitutions during bidding period: All substitution request during the bidding phase of the project shall be substituted no less than ten (10) days prior to bid opening to be considered for approval.

B. Substitutions for Convenience: Not allowed unless otherwise indicated.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination Drawings.
3. Administrative and supervisory personnel.
4. Requests for Information (RFIs).
5. Project meetings.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Preinstallation conferences.
6. Project closeout activities.
7. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within seven days of receipt of the RFI response.

D. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1.6 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: The contractor is responsible for conducting meetings and recording significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: The architect shall schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Contractor, but no later than ten days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.

2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Critical work sequencing and long-lead items.
    c. Designation of key personnel and their duties.
    d. Lines of communications.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for RFIs.
    g. Procedures for processing Applications for Payment.
    h. Submittal procedures.
    i. Preparation of record documents.
    j. Work restrictions.
    k. Working hours.
    l. Owner's occupancy requirements.
    m. Responsibility for temporary facilities and controls.
    n. Procedures for moisture and mold control.
    o. Procedures for disruptions and shutdowns.
    p. Parking availability.
    q. Office, work, and storage areas.
    r. Security.
    s. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Progress Meetings: Conduct progress meetings at appropriate intervals, but no less than one meeting per month.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Architect, and Contractor, other subcontracts with current progress or involved in planning, coordination, or performance of future activities may be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Status of submittals.
2) Deliveries.
3) Off-site fabrication.
4) Access.
5) Site utilization.
6) Temporary facilities and controls.
7) Progress cleaning.
8) Quality and work standards.
9) Status of correction of deficient items.
10) Field observations.
11) Status of RFIs.
12) Status of proposal requests.
13) Pending changes.
14) Status of Change Orders.
15) Pending claims and disputes.
16) Documentation of information for payment requests.

4. Minutes: The contractor shall record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Special reports.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. PDF electronic file.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. Special Reports: Submit at time of unusual event.

1.5 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

C. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed.

C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule at each regularly scheduled progress meeting.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Format: Arrange the following information in a tabular format:
    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Selective electronic CAD files of the Contract Drawings can be provided by Architect for Contractor's use in preparing submittals for the architect's standard fee per sheet file and an executed CAD release form.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow ten (10) calendar days for review of each resubmittal.

D. Electronic Submittals Only: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed pdf file incorporating submittal requirements of a single Specification Section and transmittal form.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Transmittal Form for Electronic Submittals: Provide locations on form for the following information:
    a. Project name.
    b. Date.
    c. Name of Contractor.
    d. Names of subcontractor, manufacturer, and supplier.
    e. Category and type of submittal.
    f. Submittal purpose and description.
    g. Specification Section number and title.
    h. Drawing number and detail references, as appropriate.
    i. Related physical samples submitted directly.
    j. Indication of full or partial submittal.

k. Transmittal number, numbered consecutively.
l. Submittal and transmittal distribution record.
m. Remarks.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.
2. Action Submittals: Submit six paper copies of each submittal unless otherwise indicated. Architect will return four copies.
3. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Testing by recognized testing agency.
    e. Application of testing agency labels and seals.
4. For equipment, include the following in addition to the above, as applicable:
    a. Wiring diagrams showing factory-installed wiring.
    b. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
    a. PDF electronic file.
    b. Four paper copies of Product Data unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    a. Identification of products.
    b. Compliance with specified standards.
    c. Notation of dimensions established by field measurement.
    d. Relationship and attachment to adjoining construction clearly indicated.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 by 36 inches.
3. Submit Shop Drawings in the following format:
    a. PDF electronic file- Preferred.
    b. Four opaque copies of each submittal. Architect will retain two copies; remainder will be returned.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. All interior finish samples shall be obtained and organized by the General Contractor and submitted as one single package to the Architect. The architect will not accept separate, individual interior finish sample submittals.
2. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
3. Identification: Attach label on unexposed side of Samples that includes the following:
    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
    b. Final sample selections will not be made based on any means other than actual physical sampels

E. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. “Rubber Stamping” submittals (forwarding submittals to the architect w/o responsible and thorough review by the GC and/or appropriate subcontractor) is unacceptable and will be returned for resubmittal without review.

F. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply

with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

F. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, Contractor to recommend location to Architect before proceeding.
2. Notify Architect and Owner seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's and Owner’s approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

I. Steel Testing (By Owner’s consulting group)
1. All steel fabricators shall be approved under Section 1704.2.2 of IBC 2003 and shall submit documents to the engineer of record and architect of record confirming the approval.
2. All welds shall be periodically inspected, except where specified in Table 1704.3, by a certified weld inspector.
3. All connections and details shall be inspected periodically by a registered professional engineer experienced in structural engineering or a certified special inspector that is also a certified weld inspector.
4. Steel special inspections shall be conducted in accordance with Table 1704.3, “Required Verification and Inspection of Steel Construction” of IBC 2003.

J. Inspection Reports (By Owner’s consulting group)

1. Periodic inspections shall be made at 50% completion of the work being inspected ad at the completion of the work. If the work being inspected can be completed in less than 5 days, only one inspection will be required at the end of the work. All inspections shall be made before the work is covered by other trades.
2. The inspector shall write a special inspection report. This report shall state the pass/no pass condition of the work being inspected. If the work receives a no pass rating, the inspection report shall list the deficient items.
3. The special inspection report shall be sent to the architect of record and engineer of record. The architect of record shall be responsible for forwarding the special inspection reports to the Owner and building official.
4. All structural inspections shall be performed by a licensed registered engineer currently practicing structural engineering or a certified special inspector certified in the area being inspected as approved by local building authorities.
5. All geotechnical and soils inspections shall be performed by a licensed registered engineer currently practicing geotechnical engineering or a certified special inspector certified in the area being inspected as approved by local building authorities.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Only if and where quality-control services are indicated in other specification sections as the Owner's responsibility, the Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to the Contractor, and the Contract Sum will be adjusted by Change Order.
3. Owner provides for Special Inspections noted in paragraph 1.8.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Owner and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Owner and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections verifying new canopy column footings, concrete mix & compressive strength, and steel reinforcing installation required by authorities having jurisdiction as the responsibility of Owner.

1. Testing Agency will notify Owner and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services. Testing agency will notify Owner and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Owner with copy to Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and reinspect corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, security and protection facilities, and waste disposal facilities.

B. See Division 1 Section "Execution Requirements" for progress cleaning requirements.

1.2 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to owner or architect and shall be included in the contract sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces testing and inspecting agencies and personnel of authorities having jurisdiction.

1.3 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

A. Utility Transfer: None anticipated

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Owner. Provide materials suitable for use intended.

2.2 EQUIPMENT

A. Field Offices: Not required. If contractor elects to provide, unit shall be- Prefabricated, mobile units, or job-built construction with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

D. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water, drinking-water units, including paper cup supply.

1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.

E. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control in areas that are separate from facilities in use. .

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited in any occupied facility or unvented area.
2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

F. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

G. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
2. Connect temporary sewers to municipal or private system indicated as directed by sewer department officials.
3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.

1. Provide rubber hoses as necessary to serve Project site.
2. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

D. Sanitary Facilities: Provide temporary toilet. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.

E. Heating and Cooling: Not applicable.

F. Ventilation and Humidity Control: Not applicable

G. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction

period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.

1. Install electric power service underground, unless overhead service must be used.
2. Install power distribution wiring overhead and rise vertically where least exposed to damage.

H. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.

J. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities.

1. Provide an answering machine, voice-mail service or messaging service on superintendent's telephone.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
4. Prepare temporary signs to provide directional information to construction personnel and visitors.

B. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Closeout Procedures" for progress cleaning requirements.

1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

C. Common-Use Field Office: Not required. If contractor elect to use a temporary facility-Provide an insulated, weathertight, heated and air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 10 persons at Project site. Keep office clean and orderly.

D. Storage and Fabrication Facility: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services.

E. Temporary Stairs: Not applicable

F. Existing Stair Usage: Not applicable

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

D. Pest Control: Not applicable

E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide measures to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

F. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

H. Temporary Partitions: Not applicable

I. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.

    a. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Temporary Facility Changeover: Not applicable.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than store turn-over. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves the right to take possession of Project identification signs.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
5. Protect stored products from damage and liquids from freezing.
6. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with

requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

4. Manufacturers:

   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in

increased maintenance or decreased operational life or safety. Operational elements include, but are not limited to the following:

a. Primary operational systems and equipment.
b. Air or smoke barriers.
c. Fire-suppression systems.
d. Mechanical systems piping and ducts.
e. Control systems.
f. Communication systems.
g. Fire-detection and -alarm systems.
h. Electrical wiring systems.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
5. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Miscellaneous elements include, but are not limited to the following:
   a. Water, moisture or vapor barriers.
   b. Membranes and flashings.
   c. Piping, ductwork, vessels, and equipment.
   d. Noise- and vibration- control elements and systems.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Existing Utility Information: Furnish information to Owner and local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the drawings. If discrepancies are discovered, notify Architect promptly.

B. General:
1. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
2. Inform installers of lines and levels to which they must comply.
3. Check the location, level and plumb, of every major element as the Work progresses.
4. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

C. Building Lines and Levels: Locate and lay out control lines and levels for new interior construction, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels.

D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of layouts. Make the log available for reference by Architect.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of maximum percent by weight as practicable of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:

a. Concrete reinforcing steel.
b. Concrete masonry units.
c. Structural and miscellaneous steel.
d. Piping.
e. Electrical conduit.
f. Copper wiring.
g. Lighting fixtures.
h. Lamps.
i. Ballasts.

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Piping.
i. Electrical conduit.
j. Packaging: Regardless of salvage/recycle goal indicated in paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 INFORMATIONAL SUBMITTALS

A. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

B. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

A. Waste Management Company Hauling and Disposing of Waste: Experienced company, with a record of successful waste management coordination of Projects with similar requirements.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of waste generated by the Work. Use form accompanying Waste Management Plan at end of Part 3. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use form accompanying Waste Management Plan at end of Part 3. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Sale and Donation: Permitted on Project site.

B. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

D. Lighting Fixtures: Separate lamps by type and protect from breakage.

E. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

1. The following Waste Management Company recycled over 90% of the construction waste on a project in Chester for York Technical College:
   a. The Linda Construction Company, Inc.
      Tammi Tidwell
      1801-A North Tryon Street
      Charlotte, NC 28206
      704-333-7120 (Office)
      704-333-7092 (Fax)
      21*54219 (Nextel)
      704-363-0313 (Cell)
      tammitk@lindaconstruction.com
      www.lindademo.com
   b. SH Carter Development
      Steve Carter, Jr.
      PO Box 27064
      Greenville, SC 29616
      864-295-3943 (Office)
      stevejr@shcarterinc.com
   c. WCA Waste Corporation
      Darath Kruse
      40 Estes Plant Road
      Piedmont, SC 29673
      864-845-8355 (Office)
      dkrause@wcamerica.com

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

D. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

E. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Store components off the ground and protect from the weather.
3. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

B. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

C. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

D. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

E. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

a. Comply with requirements in Division 32 Section "Plants." for use of clean sawdust as organic mulch.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.

D. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

D. Key Turn-over to Owner

E. Stock finish material turn-over to Owner

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release/Occupancy: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Final Waivers of Lien from General Contractor & major Subcontractors.

D. Certified As-Built Construction Drawings turn-over to Owner

E. Provide two (2) copies of Closeout Documents in three-ring binder, organized in the order listed above

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 7 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Complete testing of systems and equipment.
3. Perform preventive maintenance on equipment used prior to Substantial Completion.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
5. Advise Owner of changeover in utilities if applicable.
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 7 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:
    a. PDF electronic file. Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete surfaces broom clean in unoccupied spaces.
i. Remove labels that are not permanent.
j. Wipe surfaces of electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
k. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
l. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
m. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
n. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Architect.
   7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manual- Electronic Copy in PDF format- provide via electronic share file and on a CD. (organize pdf file in format listed below for paper copy)

F. Manual- Paper Copy: Submit manual in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
2. Flood.

3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one pdf electronic copy and one paper copy of record Drawings as follows:

a. Final Submittal:

1) Mark-up all construction phase changes, correction, additions, deletions not indicated on the final bid set and authority-having-jurisdiction's (AHJ's) stamped field set.
2) Include each drawing sheet, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one pdf electronic copy of the Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with red-colored text. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.
3. Electronic Copy: Provide scanned set in pdf format

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as one electronic file in pdf format.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 024119 - SELECTIVE DEMOLITION

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.

1.2 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected site elements.

DEFINITIONS

B. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

C. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report that indicates the measures proposed for protecting individuals and property for environmental protection. Indicate proposed locations and construction of barriers.

B. Pre-demolition Photographs or Video: Submit before Work begins.

C. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: Hazardous materials are not anticipated to be encountered for the project. However, if the contractor suspects hazardous materials have been exposed:
   1. Do not disturb items suspected of containing hazardous.
   2. Owner will procure an assessment and testing of materials separately from a 3rd party .

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utility locations have been identified before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Notify the architect of any element removed that might have resulted in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and preconstruction videotapes.

1. Inventory and record the condition of items to be removed. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, door/frame, and other existing exterior components that are to remain or that are exposed during selective demolition operations.
4. Comply with requirements specified in Section 015000 "Temporary Facilities and Controls."

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows (not all items below may be applicable to this specific project):

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and

chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Reuse of Building Elements: Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

C. Removed and Salvaged Items:
   1. Not applicable

D. Removed and Reinstalled Items (Exposed Electrical Conduit):

   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Reference demolition drawings

END OF SECTION 024119

SECTION 03 10 00- CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Formwork for cast-in place concrete.
   2. Bracing, and anchorage.
   3. Form accessories.
   4. Form stripping.

B. Related Sections:
   1. Section 03 20 00 - Concrete Reinforcing.
   2. Section 03 30 00 - Cast-In-Place Concrete.
   3. Section 03 35 00 - Concrete Finishing
   4. Section 03 39 00 - Concrete Curing.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
   2. ACI 301 - Specifications for Structural Concrete.
   3. ACI 318 - Building Code Requirements for Structural Concrete.
   4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association:
   1. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:
   1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

D. ASTM International:
   1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
   2. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
   3. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
   4. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
   5. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
   6. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
   7. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

8. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.

1.3 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Submit formwork, accessories, shoring, and reshoring shop drawings.
   2. Indicate the following:
      a. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
      b. Means of leakage prevention for concrete exposed to view in finished construction.
      c. Sequence and timing of erection and stripping assumed compressive strength at time of stripping, height of lift and height of drop during placement.
      d. Vertical, horizontal and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.
      e. Notes to formwork erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318, Section 6.3.
      f. Procedure and schedule for removal of shores and installation and removal of reshores.

C. Product Data: Submit data on void form materials and installation requirements.

D. Design Data:
   1. Indicate design data for formwork and shoring.
   2. Indicate loads transferred to structure during process of concreting, shoring and reshoring.
   3. Include structural calculations to support design.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

B. For wood products furnished for work of this Section, comply with AF&PA.

C. Perform Work in accordance with most currently adopted standards for the Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Products storage and handling requirements.

B. Deliver void forms and installation instructions in manufacturer's packaging.

C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.7 COORDINATION

A. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Form Materials: At discretion of Contractor.

B. Lumber Forms:
1. Application: Use for edge forms and unexposed finish concrete.
2. Boards: 6 inches or 8 inches in width, ship lapped or tongue and groove, “Standard” Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.

C. Plywood Forms:
1. Application: Use for exposed finish concrete.
2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8 inch thick; APA/EWA “B-B Plyform Structural I Exterior” grade.
4. Plywood where “Smooth Finish” is required, as indicated on Drawings: APA/EWA “HD Overlay Plyform Structural I Exterior” grade, minimum of 3/4 inch thick.

2.2 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, and fixed length, free of defects, capable of leaving a cavity larger than 1 inch in concrete surface.
1. Form ties for water holding structures or below grade structures shall include an integral water stop to ensure the water tightness of the structure.
2. The cavities left in faces of concrete work by removal of form ties shall be pointed-up with non-shrink mortar.
3. The contractor shall be responsible for the design strength and spacing of the form ties.
4. Manufacturers:
a. Dayton Superior
b. Substitutions: Section 01 60 00 – Product Requirements.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:
1. Do not use anchors and hangers in exposed concrete leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.

3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.
   1. Manufacturers:
      a. Arcal Chemical Corporation Arcal-80.
      b. Industrial Synthetics Company Synthex.
      c. Nox-Crete Company Nox-Crete Form Coating.
      d. Substitutions: Section 01 60 00 – Product Requirements.

E. Exposed corners: Chamfer, wood strip type; 0.75 inch x 0.75 inch size unless otherwise noted on Contract Drawings.
   a. Substitutions: Not Permitted.

F. Bituminous Joint Filler: ASTM D1751.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

H. Expansion Joints: Provide suitable expansion joint filler material as manufactured by W.R. Meadows or equal, when required, or as shown.

I. Water Stops: Rubber, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, 6 inch wide for construction joints and 9 inches wide for expansion joints, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.
   1. Manufacturers:
      a. Horn Durajoint.
      b. Greenstreak.
      c. Substitutions: Section 01 60 00 – Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

B. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

3.2 INSTALLATION

A. Formwork - General:
   1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
   2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.

3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.

B. Forms for Smooth Finish Concrete:
1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

C. Framing, Studding and Bracing:
1. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
2. Construct beam soffits of material minimum of 2 inches thick.
3. Distribute bracing loads over base area on which bracing is erected.
4. When placed on ground, protect against undermining, settlement or accidental impact.

D. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 318.

E. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping.

F. Install chamfer strips on exposed corners of walls, beams, joists, columns, supports, etc.

G. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Do not coat forms

for concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Position recessed reglets for brick veneer masonry anchors in accordance with spacing and intervals indicated on Drawings.

E. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Install water stops continuous without displacing reinforcement. Heat seal joints watertight.

G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

I. Form Ties:
   1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
   2. Place ties at least 2 inches away from finished surface of concrete.
   3. Leave inner rods in concrete when forms are stripped.
   4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

J. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

K. Construction Joints:
   1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
   2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
   3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
   4. Arrange joints in continuous line straight, true and sharp.

L. Embedded Items:
   1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
   2. Do not embed wood or uncoated aluminum in concrete.
   3. Obtain installation and setting information for embedded items furnished under other Specification sections.

4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

M. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

N. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

O. Screed Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane is not permitted.

P. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms.
1. Do not use de-icing salts.
2. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure.
3. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Cutting ties back from the face of the wall will not be permitted.

D. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms. Wood forms shall be completely removed from all portions of the work so that no material will remain for termite infestation.

E. Under normal conditions, the time elapsing before the forms may be stripped shall be not less than that shown in the following schedule; the use of the schedule shall not relieve the Contractor from his responsibility for the safety of the structure.

1.	Slabs (Suspended not on Grade)	14 Days.
2.	Columns, Walls, and Pedestals supporting other work	7 Days.
3.	Columns, Walls, and Pedestals not supporting other work	2 Days.

F. If additional test cylinders are taken, forms for concrete work not supporting loads (loads defined as a separate additional concrete pour on top of the concrete or as the loads determined by the Design Engineer) or elevated slabs can be removed when the compressive strength of the cylinders broken reaches 2400 psi.

3.7 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 318.

B. Camber slabs and beams as shown on the drawings.

3.8 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Notify Engineer after placement of reinforcing steel in forms, a minimum of 24 hours prior to placing concrete.

C. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03 20 00- CONCRETE REINFORCING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforcing bars.
   2. Welded wire fabric.
   3. Reinforcement accessories.

B. Related Sections:
   1. Section 03 10 00 - Concrete Forming and Accessories.
   2. Section 03 30 00 - Cast-In-Place Concrete.
   3. Section 03 35 00 - Concrete Finishing
   4. Section 03 39 00 - Concrete Curing.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 318 - Building Code Requirements for Structural Concrete.
   3. ACI 530.1 – Building Code Requirements and Specification for Masonry Structures.
   4. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:
   1. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
   2. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   3. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
   4. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
   5. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   6. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
   7. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
   8. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
   9. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
   10. ASTM A1064/A1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

C. American Welding Society:
   1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:
   1. CRSI - Manual of Standard Practice.

2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

A. Section 01 33 00 –Submittal Procedures

B. Shop Drawings: Indicate bar sizes, material, yield strength, spacing, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

D. Manufacturer's Certificate: Certify products meet or exceed specifications.
1. Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

1.5 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.6 COORDINATION

A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade.

B. The steel for bars shall be made by the open hearth, basic oxygen, or electric furnace process and the bars shall be rolled from billets or ingots of properly identified heats.

C. Welded Deformed Wire Fabric shall be flat sheets only and conform to the requirements of ASTM A1064 or A1064M. Unless otherwise indicated on the Drawings, the fabric shall be 6x6-W4xW4 for 4-inch thick sidewalks and 4x4-W6xW6 for 6-inch thick paving.

D. The use of cold twisted bars will not be permitted.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel or Stainless steel type; size and shape to meet Project conditions.

D. Reinforcing Splicing Devices: Exothermic welding type shall only be used if approved by the Engineer.

E. Reinforcing Splicing Devices: Mechanical splices may be used as an alternative to lap splices and shall be used where there is insufficient space for a lap splice.
   1. All mechanical splices shall be capable of developing 135% of the bar yield strength.
   2. Manufacturers:
      a. Richmond "Dowel Bar Splice System", Bar-lock.
      b. Substitutions: Section 01 60 00 – Product Requirements.

F. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

G. Reinforcement across expansion joints shall consist of either smooth dowels or deformed bars with appropriate bond breaking material applied to one end.
   1. Manufacturers:
      a. Greenstreak "Speed Dowels" type
      b. Substitutions: Section 01 60 00 – Product Requirements.

2.3 FABRICATION

A. Fabricate concrete reinforcement in accordance with ACI 318.

B. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks, and seismic hooks as indicated on Drawings.
   1. Bend radius shall be measured to the outside face of the bar.
   2. The free end of 135° and 180° bends shall have an extension of 4 bar diameters (minimum 2.5 inches) on the free end.
   3. Hooks of 90°, 135° or 180° shall have a minimum radius of bend as shown in the following table.

Minimum bend radius for Hooks	
Bar Size	Minimum Radius (in)
3	1-1/2
4	2
5	2-1/2
6	3
7	3-1/2
8	4
9	5-3/4
10	6-1/2
11	7

C. Ties and stirrups shall be sized and spaced as detailed on the Contract Drawings and as shown in the typical details. Ties and stirrups shall be closed end with 135° hooks.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8 inch diameter continuous deformed bar or wire.

F. Weld reinforcement in accordance with AWS D1.4. “Structural Welding Code – Reinforcing Steel”.
   1. A mill test is required for each lot of bars to be welded for calculating carbon equivalent (CE). Welding techniques shall be adjusted to suit CE values and job temperatures.
   2. The correct strength, grade and size of low hydrogen electrodes shall be kept oven dry.
   3. A qualification test is required to certify all welders before beginning a project.
   4. All welding operations shall be continuously supervised. 25% of all welds shall be radiographically inspected by a firm approved by the Engineer. All costs associated with radiographic testing shall be borne by the Contractor.

G. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. All splice locations shall be reviewed and approved by the Engineer.

2.4 SHOP FINISHING

A. Galvanized Finish for Steel Bars: ASTM A767/A767M, Class II, hot dip galvanized after fabrication.

B. Epoxy Coated Finish for Steel Bars: ASTM A775/A775M.

C. Epoxy Coated Finish for Steel Wire: ASTM A884/A884M; Class A using ASTM A775/A775M.

2.5 SOURCE QUALITY CONTROL

A. Make completed reinforcement available for inspection at manufacturer’s factory prior to packaging for shipment. Notify Engineer at least seven days before inspection is allowed.

B. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
   1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
   1. Do not weld crossing reinforcement bars for assembly.

B. Do not displace or damage vapor barrier.
   1. Repair all damages to vapor barrier with additional vapor barrier material and tape.
   2. Repair material shall extend beyond the damaged material by at least 6 inches.

C. Openings.
   1. Openings 12 inches and larger through concrete walls and slabs shall have additional reinforcement placed around the opening.
   2. Reinforcement shall consist of vertical, horizontal, and diagonal bars. Bars shall be sized and placed as shown in the typical details of the Drawings.

D. Bar spacing, cover, minimum clearance, bond and anchorage shall conform to the requirements of the ACI Building Code (ACI 318, and ACI 350), and/or as indicated on the Drawings.

E. Splices and dowels shall have laps as required by ACI 318 and 350 and/or as shown in the typical details of the Drawings.
   1. All reinforcing steel shall be 100% tied. This includes splices and bars crossing each other. Reinforcing bars shall be tied 100% to insure movement of rebar does not occur when placing concrete.
   2. Splices shall occur in low stress areas.
   3. Splice lengths shall conform to code requirements relative to bar location and stress levels at the splice location.
   4. Splices in horizontal reinforcement shall be staggered.
   5. The minimum clear distance between spliced bars, except when bar clamps are specified, shall be 1-1/2 bar diameters, but in no case less than 1-inch, nor less than 1.5 times the maximum size of coarse aggregate.
   6. All other lap splices shall conform to the minimum and maximum clear distance requirements as specified above and in the applicable sections of the ACI code.

F. Wire mesh reinforcement;
   1. Shall be secured in position by spacer bars and chairs. Spacer bars shall be lapped not less than 5 inches.
   2. Precast concrete mortar blocks may be used in lieu of metal chairs for slabs on grade.
   3. Mesh shall be checked for position during placing of concrete and any displacement corrected.
   4. Mesh overlap measured between outermost cross wires of each sheet shall be 6-inches at edges unless otherwise indicated on the Drawings, and shall be securely tied at ends and overlap.

3.2 ERECTION TOLERANCES

A. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

Reinforcement Spacing	Depth Tolerance	Concrete Cover Tolerance
Greater than 8 inches	plus or minus 3/8 inch	minus 3/8 inch
Less than 8 inches	plus or minus 1/2 inch	minus 1/2 inch

B. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with ACI 318.

B. Reinforcement Inspection:
   1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
   2. Welding: Inspect welds in accordance with AWS D1.4.
   3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
   4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706/A706M.
   5. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318.
   6. Periodic Weld Inspection: Other welded connections.

3.4 REINFORCEMENT - STORAGE AND PROTECTION

A. Steel reinforcement shall be stored above the surface of the ground upon platforms, skids, or other supports, and shall be protected as far as is practicable, from mechanical injury and surface deterioration.

B. When placed in the work, it shall be free from rust, dirt, scale, paint, oil, or other foreign matter, which may reduce or destroy bond.

3.5 SOURCE OF SUPPLY AND QUALITY OF MATERIALS

A. The source of supply of all materials and equipment shall be submitted to the Engineer for review before orders are placed.

B. Suppliers of reinforcing steel, fabricated metal work and metal castings may be required to submit guarantees of conformity with the Drawings and Specifications.

C. Representative preliminary samples of the character and quality prescribed shall be submitted by the Contractor or producer for examination and tested in accordance with the methods specified below.

D. Only materials conforming to the requirements of the specifications shall be used in the work.

E. All materials proposed to be used may be inspected or tested during their preparation and use. If, after inspecting and testing and/or trial, it is found that initial sources of supply do not furnish an acceptable product in conformity with the Specifications, the Contractor shall furnish material from other sources.

F. No materials, which after approval have become unfit for use, shall be used in the work or remain on the job-site.

3.6 SAMPLES AND THE TESTING OF MATERIALS

A. Unless otherwise specified, materials tests shall be made in accordance with the standards of the American Society for Testing Materials, and by a commercial testing laboratory approved by the Engineer; reports of tests shall promptly be furnished to the Engineer.

B. Tests shall be arranged by the Contractor as directed by the Engineer. The cost of all specified inspection and testing of materials shall be paid by the Contractor whether called for in this section or other sections.

3.7 SCHEDULE OF MATERIALS AND STANDARD TESTS

A. The following materials, and the tests to which each is to be subjected, are listed below. (ASTM Standards shall be as amended to date.)
   1. Certified copies of Mill Test for all heat runs.
   2. Up to 50 thousand pounds; field inspection for rust, shape, and dimensions.
   3. 50 thousand pounds and up; independent laboratory inspection as follows;
      a. Billet Steel – ASTM A615
      b. Roll Steel – ASTM A996
      c. Cold-Drawn Steel Wire – ASTM A1064
      d. Wire Fabric – ASTM A1064 END OF SECTION

SECTION 03 30 00- CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SCOPE

A. The work described by this Section consists of furnishing all materials and equipment, and performing all labor necessary for the complete construction of all concrete work, including all work and appurtenances thereto, as shown or specified, or both.

B. Work shall include the installation of all sleeves, inserts, piping, hangers, anchors, frames, plastic liner plates, and other items to be built into the concrete work, and all other work and appurtenances specified or required, or both, for proper execution of the work.

C. All items shall be correctly positioned in form work, and must be inspected and approved by the Engineer before concrete is placed.

D. The Contractor has the option of selecting fly ash or slag cement. Once this option has been selected, the Contractor shall use the same mix throughout the project.

E. All of the concrete on this project shall be provided by a single concrete supply company with a local central batch plant.

1.2 SUMMARY

A. Section includes cast-in-place concrete for the complete construction of all concrete work.

B. Related Sections:
   1. Section 03 10 00 - Concrete Forming and Accessories.
   2. Section 03 20 00 - Concrete Reinforcing.
   3. Section 03 35 00 - Concrete Finishing.
   4. Section 03 39 00 - Concrete Curing.
   5. Section 03 60 00 – Grouting.

1.3 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 305 - Hot Weather Concreting.
   3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
   4. ACI 308.1 - Standard Specification for Curing Concrete.
   5. ACI 318 - Building Code Requirements for Structural Concrete.
   6. ACI 350 - Building Code Requirements for Environmental Engineering Concrete Structures.

B. ASTM International:
   1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   2. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

3. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
6. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)
7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
8. ASTM C150/C150M - Standard Specification for Portland Cement.
9. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete.
10. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C191 - Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
12. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
13. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
14. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete.
15. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
16. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements.
17. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
18. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
19. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
20. ASTM C845/C845M - Standard Specification for Expansive Hydraulic Cement.
21. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars.
22. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
23. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
24. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
25. ASTM C1157/C1157M - Standard Performance Specification for Hydraulic Cement.
26. ASTM C1218/C1218M - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
27. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
28. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures

B. Concrete Supplier Qualifications:
   1. Submit qualifications on the proposed concrete supply company. The concrete supply company shall be in good standing with the Owner.

2. The Owner and Engineer shall review and approve the Contractor's proposed concrete supplier selection.
3. The concrete supplier shall be ACI certified.
4. The Contractor shall provide additional qualifications from the concrete supply company if required by the Owner or Engineer.

C. Product Data: Submit data on:
1. Admixtures
2. Cement
3. Fly Ash
4. Aggregate
5. Other concrete materials

D. Design Data:
1. Submit concrete mix design for each concrete strength, type, and class.
2. Submit separate mix designs when admixtures are required for the following:
a. Hot and cold weather concrete work.
b. Air entrained concrete work.
3. Identify mix ingredients and proportions, including admixtures, and the volume in cubic feet of each ingredient in a cubic yard of concrete.
4. Identify chloride content of admixtures and whether or not chloride was added during manufacture.
5. Include in the submittal, a list of all the materials proposed for use in the concrete.
a. For each material, show the specific gravity, the total weight of material to be used in a cubic yard of concrete, and the volume of each material to be used in a cubic yard of concrete.

E. Samples: Submit two 24 inch long samples of expansion joint and control joint.

F. Laboratory Test Reports:
1. Submit laboratory test reports for concrete materials and mix design.

G. Cylinder Break Reports:
1. Submit proposed test cylinder break report form from the concrete testing lab.

H. Concrete Batch and Delivery Tickets:
1. Submit examples of concrete batch tickets and concrete delivery tickets that are proposed for use.

I. Concrete batched on the project will not be allowed.

1.5 QUALITY ASSURANCE

A. Imperfect and damaged work shall be satisfactorily removed; new work and materials, which are in accordance with the requirements of the Drawings and Construction Specifications, shall be furnished and installed at no additional expense to the Owner.

B. Removal of concrete work and installation of subsequent work and materials shall be accomplished in a manner which will not impair the strength of the structure.

C. Perform Work in accordance with ACI 318 and ACI 350.

D. Conform to ACI 305 when concreting during hot weather.

E. Conform to ACI 306.1 when concreting during cold weather.

F. Acquire cement and aggregate from one source for Work.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 33 00 – Shop Drawings, Product Data and Samples: Environmental conditions affecting products on site.

1.7 COORDINATION

A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement:
   1. Cement shall satisfy the requirements of ASTM C150, as amended to date. Cement for normal Class “A”, “B”, and “C” concrete shall be Type I.

B. Slag Cement:
   1. Slag cement, if used, shall be Grade 120 and satisfy the requirements of ASTM C989 and ACI 233R, both as amended to date.

C. Coarse Aggregates:
   1. Coarse Aggregates shall be washed gravel or crushed stone consisting of hard, strong, durable, and uncoated particles; and shall contain neither vegetable matter nor soft, friable, thin, and elongated particles in quantities considered deleterious by the Engineer. Coarse aggregates shall satisfy the requirements of ASTM C33, as amended to date, and have gradation as follows:

      Coarse Aggregate Gradation:

Sieve Size	Percent Passing, by Weight
1-1/2” Sieve	100
1” Sieve	95 to 100
½” Sieve	25 to 60
No. 4 Sieve	0 to 10
No. 8 Sieve	0 to 5

D. Fine Aggregates:
   1. Fine aggregate shall be natural sand consisting of hard, strong, durable, and uncoated particles having a fineness modulus of not less than 2.30 nor more than 3.10; variation in fineness modulus shall be limited to +0.20 from the average of all tests. Aggregate shall satisfy the requirements of ASTM C33, as amended to date, and have gradation as follows:

      Fine Aggregate Gradation:

Sieve Size	Percent Passing, by Weight
3/8” Sieve	100
No. 4 Sieve	95 to 100
No. 8 Sieve	80 to 100
No. 16 Sieve	50 to 85
No. 30 Sieve	25 to 60
No. 50 Sieve	5 to 30
No. 100 Sieve	0 to 10

E. Fly Ash
   1. Fly ash, if used, shall satisfy the requirements of ASTM C618 Class F, as amended to date, except that the loss-on-ignition shall be no more than 6%.

F. Water
   1. Water shall be fresh, clean, and free of injurious amounts of oil, acid, alkali and organic materials.
   2. Water shall not contain more than 1,000 parts per million of chlorides calculated as Cl, nor more than 1,000 milligrams per liter of sulfates calculated as SO_4.

2.2 ADMIXTURES

A. Manufacturers:
   1. Master Builders
   2. Substitutions: Section 01 60 00 – Product Requirements.

B. Air Entrainment: ASTM C260.
   1. The air entrainment agent shall be BASF MasterAIR “AE-90”.
   2. The agent shall be added in such amounts that not less than 4% or more than 6% of air by volume is entrained in the concrete as it enters the forms.

C. Water Reducing: ASTM C494/C494M – Type A or D.
   1. The water-reducing admixture shall be BASF “Pozzolith”.
   2. To be added in accordance with the admixture manufacturer’s printed instructions.

D. Retarding: ASTM C494/C494M – Type B or D

E. Accelerating: ASTM C494/C494M – Type C.
   1. Accelerating admixtures are not permitted.

F. Water Reducing and Accelerating: ASTM C494/C494M – Type E
   1. Type E admixtures are not permitted.

G. Water Reducing, High Range: ASTM C494/C494M – Type F.
   1. Type F admixtures are not permitted.

H. Water Reducing, High Range and Retarding: ASTM C494/C494M – Type G.
   1. Type G admixtures are not permitted.

I. Plasticizing: ASTM C1017/C1017M Type I, plasticizing.
   1. The use of super plasticizer is not permitted for any water retaining structure.

J. Chlorides:

1. The use of calcium chloride as an admixture is prohibited.
2. Admixtures shall not contain chloride ions in excess of 0.25% by weight of the admixture.

2.3 CONCRETE MIX

A. General
1. Concrete shall be composed of cement, slag cement (if required), fly ash (if required), admixtures (if required), fine aggregate, coarse aggregate, and water proportioned and mixed to produce a plastic workable mix in accordance with the requirements of this Section, and shall be suitable for the specific conditions of placement.
2. The Contractor shall select the source of the concrete aggregates which he proposes to use in the work, and shall furnish suitable samples of those aggregates to the testing laboratory for testing and preparation of design mix.
3. The mix shall be submitted not more than 60 days nor less than 30 days in advance of the time of proposed use.

B. Pump Concrete
1. Pumped concrete is allowed for this project, and may be necessary in some cases where concrete is heavily reinforced or inaccessible. If a special design mix for pumped concrete is required, it shall be submitted for approval.
2. The Engineer shall review the pumping equipment and methods.

C. Lightweight Concrete
1. Lightweight concrete shall have a compressive strength of not less than 3,500 psi and shall be used as shown on the Contract Drawings.
2. The mix shall incorporate the use of lightweight coarse aggregate and standard weight sands.
3. Lightweight concrete shall have maximum 28-day air-dry unit weight of 115 pounds per cubic foot.

D. Class "A" Concrete
1. Class "A" concrete shall have 28-day compressive strength of not less than 3,500 psi, and shall have normal setting characteristics.
2. Class "A" concrete shall be used for reinforced concrete work, and for unreinforced footings not thicker than 8-inches.

E. Class "B" Concrete
1. Class "B" concrete shall have 28-day compressive strength of not less than 3,000 psi, and shall have normal setting characteristics.
2. Class “B” concrete shall be used for blocking, gravity type walls, pipe encasement, and unreinforced footings and slabs thicker than 8-inches.

F. Class “C” Concrete
1. Class “C” concrete shall have a compressive strength of not less than 1,500 psi, and shall have normal setting characteristics.
2. Class “C” shall be used for concrete sub-foundations, and concrete backfill where required.

G. Design Mix

1. Design mix for each classification of concrete to be used in the work shall be prepared and tested by an independent commercial testing laboratory approved by the Owner and/or Engineer for the testing of materials.
2. The Contractor has the option of selecting a fly ash or slag cement concrete mix. Once this option has been selected, the Contractor shall use the same mix throughout the project.
3. The design mix shall be prepared using samples of cement, slag cement (if required), fly ash (if required), admixture (if required), and the aggregates to be used in the work.
4. Not fewer than three (3) cylinders shall be made from the design mix for each classification of concrete; one (1) cylinder shall be tested at 7 days, and two (2) shall be tested at 28 days. Cylinders shall be made and tested in accordance with ASTM C31 and C39.
5. If an existing design mix that was recently prepared using the same source of proposed materials is demonstrated to conform to this specification, the Engineer may approve its use in the work.

H. Proportioning

1. Proportioning of materials shall be accomplished in a manner that will produce a workable mixture having a slump within the required limits, and having minimum water content.
2. The exact proportion of materials to be used in concrete shall be as determined by the Laboratory Design Mix, and as directed by the Engineer.
3. The Contractor shall furnish the equipment necessary to positively determine and control actual amounts of materials entering into the concrete.
4. The proportions of materials used in the mix shall be changed whenever, in the opinion of the Engineer, a change is necessary to obtain the required strength, and the desired density for uniformity and workability. In structures intended to be watertight, good workability will be considered to be of primary importance.
5. All materials shall be measured by weight, except for water, which may be measured by volume.
    a. One (1) gallon of water to weigh 8.33 pounds.
    b. One (1) bag of Portland cement shall be considered to weigh 94 pounds.
6. Each cubic yard of concrete shall contain not less than the following quantities of cement and fly ash:

Cement (Non Slag):

Concrete Class	Portland Cement	Fly Ash
A-1	470 pounds (5 bags)	100 pounds
B-1	376 pounds (4 bags)	100 pounds
C-1	376 pounds (4 bags)	None Required

Slag Cement:

Concrete Class	Portland Cement	Slag
A-S	424 pounds (5 bags)	141 pounds
B-S	376 pounds (4 bags)	100 pounds
C-S	376 pounds (4 bags)	None Required

Lightweight Concrete:

Concrete Class	Portland Cement	Fly Ash
LWC	480 pounds (5 bags)	190 pounds

7. In calculating the total water content of mixes, the amount of water borne on the surface of the aggregate particles shall be included. The amount of water to be used in the mix shall, in all cases, be the least amount necessary to produce a plastic mix having the required strength and the desired density, uniformity, workability, and characteristics within the required slump limits. The intent of the specifications is to produce a maximum water cement ratio for Class "A" concrete of 0.49 or less.

Maximum Water Addition:

Component	Water
Portland Cement – Class A	5.6 gallons/bag cement/CY
Portland Cement – Class B	7.7 gallons/bag cement/CY
Fly Ash	5.5 gallons/100 lbs fly ash/CY
Slag	5.5 gallons/bag cement/CY

8. The total volume of aggregates to be used in each cubic yard of concrete, and the proportion of fine aggregate to coarse aggregate, shall be that necessary to produce a dense mixture having the required workability, as determined by the Laboratory Design Mix, and as directed by the Engineer.

I. Admixtures:
   1. Admixture may be added to Class "A" and Class "B" concrete if the Engineer allows its addition.
   2. The use of admixtures is solely at the discretion of the Engineer and all such admixtures shall be submitted to the Engineer for review and approval.
   3. A standard dispenser shall be used to introduce the admixture into the mix. The Contractor shall provide for the services of the admixture manufacturer's representative in order to install and establish the operation of the dispenser.

J. Slump Limits:
   1. The slump of concrete to be placed in formed work such as columns, slabs, beams, piers and walls shall be not less than 4 inches, or more than 6 inches.
   2. The Slump of concrete to be placed in slabs on earth and rock shall be not less than 1 inch, or more than 4 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 CONCRETE PRE-CONSTRUCTION MEETING

A. A concrete pre-construction meeting shall be held a minimum of seven (7) days prior to the placement of any concrete.

B. Attendance:
   1. The following persons are required to attend the meeting:
      a. Owner
      b. Contractor
      c. Engineer
      d. Concrete Supplier
      e. Testing Lab Representative

C. Submittals
   1. A minimum of seven (7) days prior to the meeting, the following submittals shall be made.
      a. Proposed Design Mix
      b. Proposed Test Cylinder Break Report
      c. Proposed Concrete Batch Ticket Report Form
      d. Proposed Concrete Loading/Delivery Ticket Form

3.3 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush For roughening concrete give the ICR profile needed (CSP-2, CSP-3…) and applying bonding agent at vertical construction joints, and grout at horizontal construction joints. Remove laitance, coatings, and unsound materials.

B. Bonding:
   1. Before placing new concrete work on, and against, concrete work which has recently set, the surfaces of recently set concrete work shall be thoroughly roughened and made free from all foreign matter and laitance, the forms placed and tightened, and the surfaces of that concrete slushed with grout.
   2. New concrete shall be placed before grout has attained its initial set.
   3. Bonding work shall be accomplished in a manner that will ensure complete bonding.
   4. Two (2) inches to four (4) inches of grout shall be applied to all horizontal construction joints.

C. Time:
   1. When concrete is loaded onto a truck at the central mix plant, the time that the loading occurs shall be stamped on the load/batch ticket.
   2. If the elapsed time between the time stamped on the load/batch ticket and discharge of the concrete from the truck exceeds 60 minutes, the inspector may require that the truck and contents of the truck be removed from the project.

3. If the elapsed time between the time stamped on the load/batch ticket and discharge of the concrete from the truck exceeds 90 minutes, the truck shall be rejected and the concrete will be deemed unacceptable for use in this project.
4. This rejected truck shall leave the site and all concrete contents from the truck shall be removed prior to batching another load in this truck.

D. Accumulated water and debris shall be removed from excavations and from formwork into which concrete is to be placed.
   1. Flow of water into those places shall be diverted into side drains or sumps and be removed without disturbing newly placed concrete.

E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout unless otherwise shown on the Drawings.

F. Remove debris and ice from formwork, reinforcement, and concrete substrates.

G. Forms, unless lined, shall be thoroughly wetted with water before concrete is placed so as to tighten joints and prevent leakage of the mix.

H. Concrete Floor Surfaces and Slabs:
   1. Before constructing concrete slabs on earth, all piping that will be under these slabs shall be successfully tested.
   2. The sub-grade shall provide solid bearing, and shall be brought to a true and even plane.
   3. All pipes, except perforated pipe shall be encased in concrete.
   4. Provide a continuous membrane of polyethylene plastic film under all slabs on grade.
   5. Provide compacted crushed stone under all slabs on grade.

3.4 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Notify testing laboratory and Engineer minimum 24 hours prior to commencement of operations.

C. Before concrete is placed, the depth and character of the foundations, the adequacy of forms and false-work, and the placing of steel and appurtenant work shall be inspected, and must be accepted by the Engineer.
   1. That acceptance, however, shall not relieve the Contractor from the responsibility to produce the finished work.

D. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.

E. Ensure conduits and pipes embedded in concrete follow ACI 318-6.3**:**
   1. Conduits and pipes made of aluminum shall be effectively coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.
   2. Conduits, pipes, and their fittings embedded within a column shall not displace more than 4-percent of the area of cross section.
   3. Conduits, pipes, and their fittings, shall not be larger in outside dimension that 1/3 the overall thickness of slab, wall, or beam in which they are embedded.
   4. Conduits, pipes, and their fittings shall not be spaced closer than 3 diameters or widths on center.

5. Conduits, pipes, and their fittings shall not significantly impair the strength of the construction as determined by the design engineer.
6. No liquid, gas, or vapor shall be placed in embedded pipes until concrete has attained its design strength.
7. In slabs, piping shall be placed between the top and bottom reinforcement.
8. Concrete cover for conduits, pipes, and their fittings shall not be less than 1-1/2-in.
9. Conduits, pipes, and their fittings shall be so fabricated and installed that cutting, bending, or displacement of reinforcement from its proper location will not be required.

F. Install construction joint devices in coordination with floor slab pattern placement sequence.
   1. Set top to required elevations.
   2. Secure to resist movement by wet concrete.

G. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.

H. Install joint covers in longest practical length, when adjacent construction activity is complete.

I. Transporting From Mixer:
   1. Concrete shall be transported from the mixer to the point of deposit by a pump, a crane handled bottom dump concrete bucket, with concrete buggies, or with wheelbarrows.
   2. Runways for buggies and wheelbarrows, if used, shall not be supported by formwork.
   3. Concrete shall be conveyed in a manner that will not disturb forms.
   4. In the event the quality of the concrete as it reaches the form, and the method and placing thereof, in the opinion of the Engineer, is not satisfactory, the Contractor shall change his method of operation so as to place concrete in a manner suitable to the Engineer.

J. Concrete shall be placed in a manner which will prevent the possibility of segregating aggregates, displacing reinforcing, and coating and splattering the reinforcing steel which is in place.
   1. Troughs, pipes, hoppers, chutes, and canvas tremies shall be arranged and used in a manner that will ensure that the concrete is placed in the manner specified.
   2. The maximum distance between the end of the concrete hopper, chute, tremie, pump hose, etc. shall not exceed five (5) feet above the fresh concrete.

K. The placing of concrete within formwork shall be regulated in a manner that will ensure that the pressure within the formwork caused thereby shall not exceed the design pressure of the formwork.

L. Concrete shall be placed in continuous horizontal layers, the thickness of which, in general, shall not exceed 12 inches.

M. Care shall be used to fill each part of the forms; concrete shall be deposited to as near final position as possible. After the concrete has taken its initial set, care shall be used to avoid jarring the formwork, and placing strain and vibration on the ends of projecting reinforcing bars.

N. When placing concrete, each batch and each layer shall be placed following the preceding batch or layer so closely that there will be no "cold joints" in the work.

O. If concrete must be dropped more than five (5) feet, it shall be deposited through a tremie.

P. Consolidating Concrete:

1. Concrete, when placed, shall be compacted with mechanical, internal vibrating equipment supplemented with hand spading with a slicing rod.
2. Vibrating shall not be used to transport concrete within forms. Vibrating equipment shall maintain an impulse rate of not less than 5,000 impulses per minute, when submerged in concrete.
3. Not less than one (1) spare vibrator shall be maintained on the job site as a relief.
4. The duration of vibration shall be limited to that time necessary to satisfactorily consolidate the concrete without causing objectionable segregation.
5. The vibrator shall not be inserted into lower layers that have begun to set.

Q. Thin Section Work:
1. Thin section work shall be thoroughly worked with a steel rod; faces shall be shaped and mortar flushed to the surface of the form.
2. Small diameter holes shall be drilled in formwork beneath large wall sleeves and inserts to prevent the entrapment of air beneath those sleeves and inserts when concrete is placed.

R. The placement of concrete within units of the work between construction joints, once begun, shall continue without interruption so that the unit will be monolithic in construction.

S. Concrete shall be placed and compacted in a manner that will form a dense, compact, impervious structure having smooth faces on exposed surfaces. Sections of concrete work found to be porous, plastered, or otherwise defective, in the opinion of the Engineer shall be removed and replaced in whole, or in part, as directed by the Engineer, at no additional expense to the Owner.

T. Concrete shall be placed in daylight. Placing of concrete in a portion of the work shall not be started if that portion of the work cannot be completed during daylight, unless an adequate lighting system is provided.

U. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.5 PLACEMENT IN COLD WEATHER

A. Concrete shall not be placed when the atmospheric temperature is below 35ºF or the temperature of the concrete is below 55ºF.

B. Methods for obtaining proper concrete temperature for mixing and placing concrete are listed under Cold Weather Concreting in ACI 306.

C. If, after placing concrete, the atmospheric temperature becomes lower than 35ºF, the Contractor shall enclose, heat, and protect the concrete in a manner which will keep the air surrounding the fresh concrete at a temperature above 45ºF for a period of 6 days after concrete is placed.

D. The Contractor shall assume all risk connected with the cold weather placing and protecting of concrete and, should that concrete be unsatisfactory, it shall be rejected and replaced at no additional cost to the Owner.

3.6 PLACEMENT IN HOT WEATHER:

A. When the ambient temperature is 90ºF or above, special precautions shall be taken during mixing, placing, and curing.

B. At times when the temperature exceeds 90ºF, the Engineer may require that placement of the concrete be at night or during early morning hours.

C. In no case should the temperature of the concrete, when placed, be above 90ºF.

D. Methods of lowering concrete temperature are listed under Hot Weather Concreting in ACI 305R.

E. Attention shall be given to coordinating the dispatching of trucks with the rate of placement to avoid delays in delivery.

F. When elapsed time from batching to placement is so long as to result in significant increases in mixing water demand, or in slump loss, mixing in the trucks should be delayed until only sufficient time remains to accomplish mixing before the concrete is placed.

G. On truck arrival at the job site, addition of water is allowed to achieve specified slump but shall not exceed that shown on the batch ticket. The forms and reinforcing steel should be cooled to a temperature of not more than 90ºF by spraying with fog nozzles.

H. The concrete shall be cured with water.

3.7 WATERTIGHTNESS

A. All concrete structures for holding and transporting water, and pits below ground level, shall be watertight:
   1. A drop in the water level of more than 1/4 inches within 24 hours will not be permitted when water holding structures are filled.

B. All exposed surfaces of water-holding structures, and interiors of pits below ground water level, shall be free from visible damp spots and seepage before acceptance.

3.8 FLOOR SLOPE:

A. In areas with floor drains, maintain floor elevation at walls, pitch surfaces uniformly to drains at ¼ inch per foot nominal unless otherwise indicated on the Contract Drawings.

3.9 TESTING

A. The Contractor shall arrange and pay for all concrete testing services on the referenced project.

B. Tests for Concrete Materials:
   1. Fine aggregate shall satisfy the requirements of ASTM C33, as amended to date. Coarse aggregate shall satisfy the requirements of ASTM C33, as amended to date.
   2. Cement shall have normal setting characteristics and satisfy the requirements of ASTM C150 for Type I cement, as amended to date (Cement which has been stored for more than four months after being tested shall be re-tested before use).
   3. Slag Cement shall be Grade 120 and shall satisfy the requirements of ASTM C989 and ACI 233R as amended to date.
   4. Fly Ash, if required, shall satisfy the requirements of ASTM C618 Class F, as amended to date, except loss-on-ignition shall be not more than 6%.

C. Testing During Construction

1. A representative of an independent testing lab shall be on site to make test cylinders for concrete, slump test, air entrainment, and concrete temperature all of which shall be included on the report for the cylinder broken, along with the truck number and date of test. The truck and load number shall be used to coordinate the test cylinder with the load sampled.
2. When the proportioning and mixing is accomplished at the central mix plant, a laboratory representative shall be present to observe, confirm and report the proportioning and mixing of Class "A" concrete, except as may be otherwise approved by the Engineer.
3. Concrete cylinders for testing purposes shall be made in accordance with the procedure described in ASTM C31, as amended to date.
4. Slump tests shall be made with an accurately made sheet iron test cone, and in accordance with the procedure described in ASTM C143, as amended to date.
5. Air content shall be determined according to the appropriate ASTM specification as amended to date:

Type of Cement	ASTM Specification	Method
Non Slag Cement	C 173	Volumetric
	C 138	Gravimetric
	C 231	Pressure
Slag Cement	C 173	Volumetric
Lightweight	C 173	Volumetric

6. Compression tests shall be made at the age of 7 days and 28 days by the testing laboratory in accordance with the procedure described in ASTM C39, as amended to date, and as required by the Engineer.
7. After beginning work, the number of tests shall be as listed in the following table, but shall be not less than one for each type of concrete for each pour. Each test shall consist of at least four cylinders; two to be properly stored at the site; and two for laboratory control, one each to be broken at 7 days and one each at 28 days.

Total Cubic Yards Concrete Placed	Minimum Number of Tests
0 to 100	One Each Pour
100 to 1,000	One Each 250 CY
1,000 to 2,000	One Each 350 CY
2,000 and Over	One Each 500 CY

8. If Contractor desires to strip forms early, additional cylinders shall be taken to determine strength of concrete at the desired time of form removal.

3.10 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.11 CLEANING

A. Upon completion of the work, all forms, equipment, protective covering and rubbish resulting there from shall be removed from the premises.

B. Finished concrete surfaces shall be left in a condition satisfactory to the Engineer.

END OF SECTION

SECTION 03 35 00- CONCRETE FINISHING

PART 1 GENERAL

1.1 SCOPE

A. The work described by this Section consists of furnishing all materials and equipment, and performing all labor necessary to finish the concrete, including all work and appurtenances thereto, as shown or specified, or both.

B. Work shall include any type of finish as required by these Specifications or as shown on the Contract Drawings.

1.2 SUMMARY

A. Section includes finishing all cast-in-place concrete on the project.

B. Related Sections:
   1. Section 03 10 00 - Concrete Forming and Accessories.
   2. Section 03 20 00 - Concrete Reinforcing.
   3. Section 03 30 00 - Cast-In-Place Concrete.
   4. Section 03 39 00 - Concrete Curing.

1.3 REFERENCES

A. American Concrete Institute

B. ASTM International

1.4 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on;
   1. Floor Hardener.

1.5 QUALITY ASSURANCE

A. Imperfect and damaged work shall be satisfactorily removed; new work and materials, which are in accordance with the requirements of the Drawings and Construction Specifications, shall be furnished and installed at no additional expense to the Owner.

B. Removal of concrete finishing work and installation of subsequent work and materials shall be accomplished in a manner which will not impair the strength of the structure.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 33 00 – Shop Drawings, Product Data and Samples: Environmental conditions affecting products on site.

B. Properly store all materials according to the manufacturer’s recommendations. These recommendations shall be submitted with the shop drawings.

1.7 COORDINATION

A. Coordinate finishing of concrete with other concrete work and other trades.

B. The Contractor shall propose, during the initial project schedule submittal, alternate concrete finishing methods for the Owner and Engineer to review and accept; only if the Contractor's formwork methods conflict with finishing/rubbing the concrete surfaces.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare surfaces to receive finishing by completely removing all exposed snap tie ends and any she bolts or formwork supports. Remove any and all laitance, coatings, and unsound materials.

3.2 CONCRETE FINISHING

A. Exterior concrete surfaces shall be finished to levels not shallower than 12 inches below finish grade levels; other concrete surfaces exposed-to-view, shall be finished.

B. Concrete not exposed to view shall have rough edges tooled off and shall be pointed and spot finished to fill any irregularities.

C. Depressions resulting from removal of form ties, and all other holes and rough places, shall be thoroughly wetted with water and pointed with non-shrink sand cement mortar.
    1. Pointing and surface repair shall commence immediately after forms are removed.

D. All imperfect concrete shall be removed to dense solid concrete and repairs made as directed by the Engineer.

E. Concrete Rubbing:
    1. Rubbing of finished surfaces shall begin immediately after pointed surfaces and surface repairs have set sufficiently to allow rubbing to commence.
    2. Chamfered surfaces shall be rubbed only once, and this shall not be done during the first rubbing.
    3. The surface of the curing, moist, concrete shall be kept wet with water and rubbed with a medium coarse carborundum stone or equal abrasive, bringing a paste to the surface.
    4. The rubbing shall continue until all form marks and projections are removed and a smooth, dense surface having no pits or irregularities is produced.
    5. The material that has been ground to a paste in the process shall be carefully and uniformly spread over the entire surface and allowed to rest.
    6. The entire concrete surface shall be kept moist during rubbing to assure adequate curing.
    7. The first rub shall be applied at the time specified herein.
    8. If the Contractor postpones the finishing beyond this time or has insufficient labor to keep it up to date, the Owner will order him to stop any other work until the progress of finishing is satisfactory.

9. The final rub may be given to the structure no earlier than 24 hours after the first rub, and it shall be done with a fine carborundum stone or equal abrasive leaving a smoothly textured surface, uniform in color.
10. The final rub shall be accomplished prior to the application of any Protective Surface Treatment which the Drawings or Specifications may require.
11. "White washing" of the finished areas by the use of separately mixed grout or paste on the rubbing stone or spread on the surface to be rubbed will not be allowed.
12. All areas of structures disfigured by drip from concrete placement or from the rubbing process shall be thoroughly cleaned and blended into the surrounding surfaces.

F. Floating:
1. All floors, walks, platforms, stairs, and other slab work shall have a wood float finish.
2. After screeding to the required grade while the concrete is still green, but has hardened sufficiently to bear the finisher's weight, the concrete surface shall be floated with a wood float to a true and even plane, have no visible coarse aggregate, and shall be sufficiently rough (broom finish) to prevent slipping.

G. Floor Hardener:
1. Floor hardener shall be applied on all slabs.
2. Floor hardener shall be applied in strict accordance with the hardener manufacturer's printed instructions.

3.3 ACCEPTABLE RUBBED FINISH

A. After the forms are removed on the first concrete pour, the Contractor shall rub a section of concrete. The Owner and Engineer shall observe/inspect this test section. This test section, once it has been accepted by the Owner and Engineer, shall become the acceptable rubbed concrete standard. All remaining concrete rubbed on this project shall be similar to this standard.

B. All concrete surfaces to be rubbed shall be done by experienced personnel and shall be done such that all rubbed surfaces look similar and are aesthetically pleasing.

C. The Owner shall be the final determination if rubbed surfaces are acceptable.

D. Any rubbed surfaces found to be defective or inconsistent with the rubbed standard shall be removed and reworked until acceptable to the Owner.

3.4 CLEANING

A. Upon completion of work, all forms, equipment, protective covering and rubbish resulting there from shall be removed from the premises.

B. Finished concrete surfaces shall be left in a condition satisfactory to the Owner and Engineer.

END OF SECTION

SECTION 03 39 00- CONCRETE CURING

PART 1 GENERAL

1.1 SCOPE

A. The work described by this Section consists of furnishing all materials and equipment, and performing all labor necessary for curing cast-in-place concrete.

B. Related Sections:
   1. Section 03 10 00 - Concrete Forming and Accessories.
   2. Section 03 20 00 - Concrete Reinforcing.
   3. Section 03 30 00 - Cast-In-Place Concrete.
   4. Section 03 35 00 - Concrete Finishing.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.

B. ASTM International:
   1. ASTM C156 - Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete.
   2. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   3. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Provide data sheets and complete submittals on all types of curing compounds proposed for use on the Project.

B. Provide written certification that the curing compounds meet or exceed the requirements set forth in ASTM C309.

C. Provide written certification that the cure and seal compounds meet or exceed the requirements set forth in ASTM C1315.

1.4 QUALITY ASSURANCE

A. Imperfect and damaged work shall be satisfactorily removed; new work and materials, which are in accordance with the requirements of the Drawings and Construction Specifications, shall be furnished and installed at no additional expense to the Owner.

B. Removal of any subsequent work and materials (after application of curing compounds) not compatible with the curing compounds used or residue remaining from curing compounds and re-installation of subsequent work and materials shall be accomplished in a manner which will not impair the strength of the structure and shall be performed at no additional costs to the Owner.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 33 00 – Shop Drawings, Product Data and Samples: Environmental conditions affecting products on site.

B. Store compounds as recommended by manufacturer.

C. Protect concrete and curing compound applied to concrete as required by compound manufacturer.

1.6 COORDINATION

A. Coordinate application and type of curing compound with concrete requirements, such as floor hardeners, air entrained concrete, etc.

B. If curing compounds are used, they shall be allowed to dissipate/disintegrate and properly wear off before installation of subsequent work. If the schedule does not allow for the compound to dissipate, then the concrete shall be water cured.

C. If the Contractor plans on removing the curing compound by physical, chemical or some other means (i.e. not waiting for compound to dissipate), the information shall be included in the submittal.

D. Provide information in the shop drawing that the manufacturer of the paint/coating system and any other subsequent trades do not have any issues or concerns of applying their product over the resin-type curing compounds.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Lambert Corporation of America, Inc.
   2. W.R. Meadows.
   3. Substitutions: Section 01 60 00 – Product Requirements

2.2 MEMBRANE CURING COMPOUNDS

A. Membrane Curing Compound:
   1. All curing compounds shall contain a fugitive dye. This will allow the Engineer to see the compound is completely covering the concrete surface.
   2. Type I-D with a red fugitive dye.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify requirements for membrane curing compound to dissipate.

3.2 PREPARATION

A. Prepare surface prior to application of membrane curing compound or applying water curing. Remove laitance, coatings, and unsound materials.

3.3 MIXING AND APPLICATION

A. Mix product at the jobsite in accordance with the manufacturer's recommendations.

B. Apply product in accordance with the manufacturer's recommendations. Apply product at the proper time after placement of concrete and before concrete dries.

C. Apply enough curing compound so that all surfaces are covered and Engineer can visually check the red dye applied over the entire concrete surface area.

D. Apply the number of coats and at proper intervals as recommended by manufacturer.

E. Do not mix different types of curing compounds together.

3.4 CURING AND PROTECTION

A. Freshly placed concrete shall be protected from rain and flowing water. Concrete shall not be allowed to dry out from the time it is placed until the expiration of the specified curing period.

B. Methods of curing, unless otherwise approved by the Engineer, shall be as follows:
   1. Curing with Water:
      a. Concrete slabs in water holding structures shall be kept wet with clean water and burlap for a period of 7 days after placing. Wet cure concrete slabs on grade by "flooding" the slab with 1 to 2 inches of standing water. Keep slab completely wet for seven days. If the slab does not have starter walls or the slope is such that the slab cannot be kept flooded, cover the slab with burlap or manufactured sand and water to keep slab wet.
      b. Walls, beams and columns shall be cured with burlap continuously soaked or cured with the forms in place continuously wet for a period of 7 days.
      c. Suspended or elevated slabs shall be cured with burlap continuously soaked (with the formwork in place) for a period of 7 days.
   2. Membrane Curing:
      a. For non water holding structures above grade, in lieu of curing with water, the Contractor at his option may use a membrane curing compound to seal in the water in the concrete except for surfaces which are to receive future concrete or mortar.
      b. Use curing compound such as W.R. Meadows 1240-White on concrete paving.
      c. Methods to lower concrete temperature will also be required during hot weather.
      d. The membrane curing compound shall be applied in accordance with the manufacturer's directions and in sufficient thickness to effectively hold the water in the concrete.
      e. The curing compound shall have a record of successful use for at least two years.
      f. The curing compound shall not adversely affect the air entrained concrete or the floor hardener applied to the concrete.
      g. The Contractor may request the Engineer review and approve the use of curing compounds for water holding structures. The Contractor shall provide this request, in writing, and include the proposed curing compound and the specific

structure to be cured. The Engineer may approve on a case by case basis. Not all water holding structures may be approved. Curing compounds may not be allowed on structures that will contain potable water.

3.5 CLEANING

A. Upon completion of work, all unused material and rubbish resulting there from shall be removed from the premises.

B. Finished concrete surfaces shall be left in a condition satisfactory to the Architect.

END OF SECTION

SECTION 076200- SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this section.

B. The workmanship and methods employed for forming, anchoring, and cleating for the expansion and contraction of sheet metal work shall conform to applicable details and description as indicated in the current edition of the Architectural Sheet Metal Manual.
   1. This manual is published by the Sheet Metal and Air Conditioning Contractors National Association, Inc. and hereinafter referred to as "The SMACNA Manual", unless otherwise noted on the Contract Drawings or specified herein.

1.2 SCOPE

A. The work covered by this section consists of furnishing all materials and equipment and performing all labor necessary for furnishing and installing all sheet metal flashing and trim, and appurtenances as indicated on the Drawings, as specified, and as required for completion of all work under this Contract.

1.3 SUBMITTALS

A. Shop Drawings:
   1. The Contractor shall furnish to the Owner for review (see section 01 33 00 for number of copies required) drawings and details for metal fabrications and fasteners.
   2. Details and layout shall show weight, gauge, or thickness of sheet metal, jointing, expansion joint spacing, and procedure to be followed during installation.
   3. The Architect shall confirm the colors on all the exposed metal.
      a. See colors indicated on drawings. Submit color chart and verification of adhering to color(s) indicated on drawings.
      b. This includes all flashing, roof parapet caps, conductor heads, downspouts, gutters, etc.
   4. Indicate bolt size and spacing, nailers or blocking required for securing work of this section.
   5. No fabrication, erection or installation of work shall commence until drawings and details covering such work have been reviewed by the Engineer.

B. Catalog Cuts:
   1. Submit catalog cuts for standard manufactured items, for checking and approval by the Engineer.

1.4 PRODUCT HANDLING

A. Handling and Storage:
   1. Sheet metal items shall be carefully handled to prevent damage to the surfaces, edges, and ends, and shall be stored at the site above ground in a covered dry location.

B. Replacement:

1. Damaged items that cannot be restored to like new condition shall be removed and replaced at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sheet Metal:
   1. Type and Location
      a. The type and location of the various kinds, gauge, thickness and finish of sheet metal to be used is specified hereinafter under the individual items.
      b. However, where sheet metal is indicated on Drawings and kind or type of metal is not definitely specified or noted, it shall be aluminum, size (thickness) as specified in The SMACNA Manual for the particular function.
   2. Aluminum Sheets
      a. Aluminum sheets shall conform to ASTM B209 gauge and finish specified for the item.
   3. Gauges
      a. The gauges for the following items are the minimum. Where size of item requires heavier materials, gauge shall be in accordance with The SMACNA Manual.
         1) Exposed Flashing:
            a) Cap or counter: 0.050”
            b) Base: 0.050″
            c) Sill: 0.050”
         2) Roof Trim:
            a) Fascia: 0.050″
            b) Finishing edge strips: 0.050″
         3) Roof Penetration Flashing: 0.050″
         4) Equipment supporting caps: 0.050″
         5) Conductor Heads, downspouts and fasteners: 0.050″

B. Accessories:
   1. All accessories or other items essential to the completeness of the sheet metal installation, though not specifically shown or specified, shall be provided.
   2. All such items shall be of the same material or compatible to the base material to which applied and the gauges shall conform to The SMACNA Manual recommendations.

C. Fasteners:
   1. All nails, screws, bolts, rivets and other fastenings for sheet metal, unless otherwise noted, shall be Type 304 or 305 stainless steel, and of size and type suitable for the intended use.
   2. Nails shall be minimum gauge, flat head annular-thread type, and of sufficient length to penetrate backing at least 3/4 inch.

D. Sealant:
   1. Sealing and caulking materials shall conform to the JOINT SEALANTS section of these specifications (07 90 00).

PART 3 EXECUTION

3.1 INSTALLATION OF SHEET METAL

A. Condition of Surfaces:
   1. Proper Surfaces
      a. Surfaces to which sheet metal is applied shall be even smooth, sound, thoroughly clean and dry and free from projecting nail heads or other defects that would affect the application. Prior to the installation of sheet metal, defects in surfaces or materials shall be corrected by the trades involved.
   2. Other Work
      a. Installation of other work that will be covered by or pass through sheet metal work shall be completed and approved before sheet metal work begins in that area.

B. Installation:
   1. Workmanship
      a. Fabricate and install sheet metal with lines, arises, and angles sharpened true, and plane surfaces free from waves, warps, or buckles.
      b. Exposed edges of sheet metal shall be folded back to form 1/2-inch wide hem on the side concealed from view.
      c. Finished work shall be free from water leakage under all weather conditions.
   2. Expansion Joints
      a. Provisions for expansion and contraction shall be provided in sheet metal work at intervals not exceeding thirty (30) feet or as recommended by the metal manufacturer.
      b. Where the continuous run of sheet metal exceeds the interval by more than 16 feet, an additional joint shall be provided.
      c. Where the run is less than the interval specified and more than 16 feet, one joint shall be provided at the center of the run. Joints shall be evenly spaced.
      d. Expansion and contraction joints shall be slip type, loose locked, and fabricated as indicated or in accordance with applicable details in The SMACNA Manual.
   3. Sealing
      a. Except where other methods of jointing are indicated or specified, all joint seams and connections of sheet metal work shall be sealed.
   4. Fastenings
      a. Unless otherwise indicated or specified, all fastenings shall be concealed.
      b. Nails where used to attach sheet metal shall be spaced on 6-inch centers unless otherwise specified herein or approved.
   5. Continuous Edge Strips
      a. Provide continuous edge strips at eaves and other locations indicated for attaching exposed terminating edge of fascia and other sheet metal work.
      b. Fabricate edge strips from the same material and gauge as the units attached to, in lengths of 8 or 10 feet. Edge strips shall be not less than 2 inches wide.
      c. Set edge strips straight and true and secure in place with nails or screws of proper size and type. Space fasteners not more than 6 inches apart.

3.2 CAP AND COUNTER FLASHING

A. Shape and Locations:
   1. Provide cap and/or counter flashing in locations indicated on the Drawings or as required for proper execution of the work.

2. Form flashing in 8 or 10-foot lengths, except where shorter pieces are required.

B. Jointing:
   1. Lap end joints a minimum of 3″.
   2. Do not solder or weld joints.
   3. Stagger joints with relation to base flashing joints.
   4. Make flashing continuous at angles.

C. Width:
   1. Cap and counter flashing shall overlap base flashing a minimum of 4″.
   2. Bottom edge of flashing shall be folded back 1/2" on underside.

3.3 MISCELLANEOUS FLASHING

A. Location:
   1. Provide where indicated or required for the proper execution of the work.

B. Forming:
   1. The forming and installation of flashing shall be as indicated on the Drawings and as required by applicable portion of The SMACNA Manual as referred to under "PRODUCTS".

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
2. Exterior joints in horizontal traffic surfaces.
3. Interior joints in vertical surfaces and horizontal nontraffic surfaces.

B. See Division 8 Section "Glazing" for glazing sealants.

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

2.1 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

2.2 QUALITY ASSURANCE

2.3 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of project turn-over.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of project turn-over.

PART 2 - PRODUCTS

3.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

3.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: To match adjacent surface color unless noted otherwise on construction documents.

3.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Single-Component Silicone Sealant for use as weatherseal at flashings, copings, thresholds, etc., perimeter of aluminum framed systems.

1. Available Products:
    a. Dow Corning Corporation; 790.
    b. Pecora Corporation; 864.
    c. GE Silicones; SilPruf NB SCS9000.
    d. Or equal.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50, 100/50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

C. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant for interior use where conditions of high humidity exists.

1. Available Products:
    a. Dow Corning Corporation; 786 Mildew Resistant.
    b. GE Silicones; Sanitary SCS1700.
    c. Tremco; Tremsil 200.
    d. Or equal.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

D. Single-Component Nonsag Urethane Sealant for use in exterior wall joints.

1. Available Products:
    a. Pecora Corporation; Dynatrol I-XL.
    b. Tremco; DyMonic.
    c. Tremco; Vulkem 921.
    d. Tremco; Vulkem 931.
    e. Or equal.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25, 50, 100/50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
6. Custom colors to match brick- selected by architect.

3.4 LATEX JOINT SEALANTS

A. Latex Sealant : Comply with ASTM C 834, Type P, Grade NF for use interior perimeter joints.

B. Available Products:
1. Pecora Corporation; AC-20+.
2. Sonneborn, Division of ChemRex Inc.; Sonolac.
3. Tremco; Tremflex 834.
4. Or equal.

3.5 PREFORMED JOINT SEALANTS

3.6 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type as recommended by sealant manufacture and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

3.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

4.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.

a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

2. Remove laitance and form-release agents from concrete.

a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, as recommended by sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

4.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth,

uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

F. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 079200

SECTION 099000- PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes surface preparation and field “touch up” application of painting systems and coatings only.

B. The Contractor shall furnish all materials, labor and equipment required to properly furnish and install protective coating systems for the surfaces, equipment and machinery listed herein, or in other documents, or on the Contract Drawings.

C. The Contractor shall repair and/or repaint all factory finishes of equipment and machinery, not required to be painted at the job site, that is defective or has been damaged in transit and/or installation.

D. Aluminum surfaces bearing on or embedded in concrete and facing surfaces of bolted aluminum joints, except anchor bars and anchor bolts, shall be given one coat of zinc chromate primer. The primer shall be allowed to dry prior to placing the aluminum in contact with concrete.

E. Shop Primed Products: Manufactured products may be shop cleaned and primed. Shop cleaning must equal or exceed cleaning specified in the Painting Schedule. Clean as specified and re-prime all abrasions, weld splatter, excessive weathering and other defects in the shop prime coating.

F. Manufacturers furnishing shop primed products shall certify that cleaning was performed in accordance with specification requirements and that the specified primer was used.

G. Fully field clean and prime any shop primed products which the Architects determines that were not cleaned in accordance with the Specifications prior to priming, that the wrong primer was applied, that the primer was applied improperly, or has excessively weathered, or that the product is otherwise unacceptable.

H. Finish Painted Products: Properly protect these products throughout the Project to maintain a bright and new appearance. If the finish surfaces are defaced, weathered or not of the selected color, the Contractor shall repaint as required by the Owner or Architect.

I. Existing Surfaces: Properly protect existing finish painted items and surfaces or equipment from damage throughout the Project. Repair any damage to existing coatings, surfaces or equipment to the full satisfaction of the Owner, at no expense to the Owner.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

2. ASTM D610 – Standard Practice for Evaluating Degree or Rusting on Painted Steel Surfaces.
3. ASTM D4138 – Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means.
4. ASTM D4258 – Standard Practice for Surface Cleaning Concrete for Coating.
5. ASTM D4259 – Standard Practice for Abrading Concrete.
6. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Society for Protective Coatings (SSPC):
1. Guide 6, Guide for Containing Debris Generated During Paint Removal Operations
2. SSPC-SP 1, Solvent Cleaning
3. SSPC-SP 2, Hand Tool Cleaning
4. SSPC-SP 3, Power Tool Cleaning
5. SSPC-SP 6, Commercial Blast Cleaning
6. SSPC-SP 10, Near-White Metal Blast Cleaning
7. SSPC-SP 11, Power Tool Cleaning to Bare Metal
8. SSPC SP13 (NACE 6), Surface Preparation of Concrete
9. SSPC-PA 2, Measurement of Dry Film Thickness with Magnetic Gages
10. SSPC-VIS 1, Visual Standard for Abrasive Blast Cleaned Steel

C. Equipment and Coating Manufacturers' Published Instructions.

D. RPO188 – NACE Standard Recommended Practice Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on all products.

C. Samples:
1. On site "touch up" sample areas- shall be approved by architect
2. The Architect shall select all finishes, colors and textures.

D. Manufacturer's Installation Instructions: Submit complete manufacturer's installation instructions including any special surface preparation procedures, and any substrate conditions requiring special attention. In case of conflict between this specification and the manufacturer's printed instructions, this specification shall prevail.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALITY ASSURANCE

A. Perform Work in a first class workmanlike manner.

B. Only those systems and components which are judged acceptable by the Architect shall be utilized in the work. No materials shall be delivered to the job site until the architect has evaluated their acceptability.

C. Maintain one copy of printed manufacturer's instructions at the job site. Explain all instructions in detail to all personnel involved with the project painting. All applied coatings shall strictly adhere to these requirements.

D. All material shall be pure and of the best quality, shall be delivered in unbroken original containers bearing the brand and manufacturer's name, manufacturer's stock number and manufacturer's application recommendations. All coatings shall be mixed in conformity with the manufacturer's specifications and directions.

E. Thinners shall not be used in amounts exceeding labeled directions.

F. As far as possible, paints shall be applied in alternating colors. For lighter shades, use differing tones which will permit easy detection of voids and holidays.

G. The Contractor shall submit manufacturer's written verification that coatings for contact with potable water have been approved by current federal and state regulations and that product formulations have not changed since approval with coating submittal.

H. Within ten days after notification, the Contractor shall submit manufacturer's written verification that coatings are for the service identified, that coatings for contact with potable water have received the appropriate ANSI/NSF 61 certification and that product formulations have not been changed since approval.

I. The manufacturer shall also certify that all coatings are lead and chromate free with exception of specific colors approved by Engineer, such as, safety colors.

1.7 SAMPLING AND ANALYSIS OF EXISTING MATERIALS

A. Sampling analysis of existing coatings, where available, is included in the appendix of these specifications.

B. However, the Owner assumes no responsibility for the actual toxic metal content or toxicity of the coating system. The Contractor is responsible for conducting appropriate testing of their own and shall comply with the applicable regulations for worker safety and health, protection of the environment and management of wastes.

C. Certified copies of the test results are to be supplied to the appropriate representative of the Owner. A representative of the Owner shall witness the required sampling.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing work of this section with minimum three years documented experience and approved by coating manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing, thinning or reducing, safety and storage information.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 95 degrees F, in well ventilated area, and as required by manufacturer's instructions.

E. Any material that has been determined to have exceeded the manufacturer's recommended shelf life shall be removed from the project and shall not be utilized in the completion of the work.

F. No materials other than those formally submitted and approved will be brought onto or stored on the project site.

G. Flammable coatings, thinners, solvents and materials shall be stored to conform to the applicable City, County, State and Federal safety codes for flammable materials.

PART 2

2.1 WARRANTY

A. Section 01 70 00 – Execution and Closeout Requirements: Product warranties and product bonds.

2.2 EXTRA MATERIALS

A. Section 01 70 00 – Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish the Owner at least one gallon of each type and color of paint used for finish coats and one gallon of each type of thinner required. Containers shall be tightly sealed and clearly labeled.

C. Label each container with color, type, texture, equipment, room locations, etc. in addition to manufacturer's label.

PART 3 PRODUCTS

3.1 PAINTS AND COATINGS

A. Manufacturers: Paint.
   1. Carboline.
   2. Induron
   3. Sherwin-Williams
   4. Tnemec.
   5. To the maximum extent possible, all coatings, thinners and additives shall be the products of a single manufacturer.
   6. Substitutions: Section 01 60 00 – Product Requirements.

B. Manufacturer: Coating "Stripper"
   1. Peel Away System as manufactured by Dumond Chemicals, Inc.
   2. Substitutions: Section 01 60 00 – Product Requirements

3.2 COMPONENTS

A. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:
   1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
   2. For good flow and brushing properties.
   3. Capable of drying or curing free of streaks or sags.

B. Application Data: All applicable data currently published by the paint manufacturer relating to surface preparation, coverage, film thickness, application technique, drying and overcoating times is included by reference as a part of this Section. It will be the responsibility of the Contractor to obtain and fully understand the appropriate data sheets for the coatings specified.

C. Paints shall be factory mixed and delivered to the site in unbroken original packages bearing the manufacturer's label. All coatings shall be applied in strict accordance with the manufacturer's printed specifications. Two component coatings shall be mixed in accordance with manufacturer's instructions. All two component coatings, once mixed, shall be applied within the pot life recommended by the manufacturer.

D. Unless otherwise specified, paints shall be of the best grade. All thinners, driers, varnish, etc., shall be of the best grade and shall be furnished by the coating manufacturer for use with the specified paints.

E. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified and first class quality.

F. Colors: The Owner will select the colors to be used on the various portions of the work. Provide color cards for the coatings proposed. Where more than one coat of paint is required, job tint the paint for each undercoat off shade to show complete coverage.

3.3 MIXING AND TINTING

A. When possible, all paints and other materials shall be mixed and tinted by the paint manufacturer prior to delivery to the job site.

B. When job site mixing and/or tinting is required, the manufacturer's recommendations shall be strictly adhered to. The Contractor shall be solely responsible for the proper conduct of all on-site mixing and/or tinting.

3.4 COATING COMPATIBILITY

A. The Contractor shall verify with the coating manufacturer that the proposed coating is compatible with the existing coating. The Contractor shall patch test unknown existing coatings for compatibility with proposed coatings. No additional payment will be made for patch testing.

PART 4 EXECUTION

4.1 GENERAL

A. The Contractor shall make themselves familiar with the site and provide, install and maintain the necessary tarps, tents, covers and containment structures and shall utilize the appropriate cleaning equipment and appurtenances required to adequately contain all materials as specified herein.

B. Cleaning operations shall not be initiated until the containment methods to be employed are in place.

C. If the project has a lead abatement scope, then all lead related debris shall be collected at the end of each day and stored in approved containers for disposal by the Contractor. The Contractor shall set up a waste storage area designated for proper storage and handling of hazardous waste. This area shall be properly maintained and inspected.

D. Adequately protect other surfaces from paint and damage. Furnish sufficient drop cloths, masking, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and, in particular, surfaces within storage and preparation area. Repair damage as a result of inadequate or unsuitable protection.

E. Upon completion of the work, all paint splatters or drippings shall be removed.

4.2 PRODUCT HANDLING

A. Deliver materials in original, sealed containers of the manufacturer with labels legible and intact. Each container shall be clearly marked or labeled to show paint identification, date of

manufacture, batch number, analysis or contents, identification of all toxic substances and special instructions.

B. Store only acceptable Project materials on the Project site.

C. Store material in a suitable location and in such a manner as to comply with all safety requirements including any applicable federal, state and local rules and requirements. Storage shall also be in accordance with the instructions of the paint manufacturer and the requirements of the insurance underwriters.

D. Restrict storage area to paint materials and related equipment.

E. Place any materials that may constitute a fire hazard in closed metal containers and remove daily from the Project site.

4.3 ENVIRONMENTAL CONDITIONS

A. Environmental conditions which affect coating application include, but are not necessarily limited to, ambient air temperature, surface temperature, humidity, dew point and environmental cleanliness. Comply with the manufacturer's recommendations regarding environmental conditions under which coatings may be applied.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Do not apply exterior coatings during rain, snow, fog or mist or when relative humidity is outside humidity ranges as established by coating manufacturer (or exceeds 85%), or moisture content of surfaces exceed those required by paint product manufacturer.

D. Minimum Application Temperatures: No paint shall be applied when the ambient conditions are less than 45 degrees F; unless required otherwise by manufacturer's instructions.

E. No paint shall be applied when the temperature of the surface to be painted is below 45° F, or when the temperature is expected to drop below 45^0F within six (6) hours after application of coating, or when freezing (32 degrees F) is predicted within 24 hours of application, or when the relative humidity is above 90%.

F. Paint shall not be applied to wet, damp or frosty surfaces.

G. Paint shall not be applied when the substrate temperature is less than 5° F above the dew point.

H. No material painted inside shall be moved outside in wet or freezing weather until the painted surfaces are thoroughly dry.

4.4 EXAMINATION

A. Section 01 30 00 – Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive Work as instructed by product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application. All defects in fabrication shall be noted.

D. The work pieces shall be inspected for the presence of oils and greases using an Underwriters Laboratories (UL)-approved ultra-violet lamp. Areas containing oil and grease shall be located and recorded and the oil or grease contamination removed by cleaning using a biodegradable cleaning solvent compatible with the specified coating.

E. Test shop applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces. Do not apply finishes unless moisture content of surfaces is below manufacturer's recommendations.

G. Fabrication defects noted in iron and steel materials and equipment to be coated shall be repaired. All voids, open and hollow places and irregularities shall be filled with a filler mixture suitable for the material and purpose and all laminations, scabs, rollovers and other defects of this type shall be removed by SSPC-SP2 "Hand Tool Cleaning" or SSPC-SP3, "Power Tool Cleaning".

4.5 PREPARATION

A. All surfaces to be coated shall be prepared in accordance with the best practice. Surface preparation and coating shall be performed only by crews experienced in this work. All surfaces to be coated shall be thoroughly cleaned of all dirt, dust, weld splatter and any foreign matter before beginning surface preparation.

B. The Contractor shall have the responsibility for containing, collecting and disposing of all paint particles, residues, dust, paint chips as well as all other debris generated during surface preparation performed in conjunction with the work specified herein.

C. Coatings shall be applied by a subcontractor having the approval of the manufacturer and whose workmen have been instructed in the application of these coatings by the manufacturer.

D. A representative of the paint manufacturer shall be present when work begins to instruct personnel in substrate preparation and application techniques.

E. The Engineer will inspect the surface preparation prior to the application of coatings. If the preparation is found to be satisfactory, a written order will be given to proceed with coatings.
   1. Application of the first coat shall follow immediately after surface preparation and cleaning. Cleaning performed on steel substrates within one day shall be primed the same day before rust blooms occur.
   2. Cleaned areas which are not coated within this period shall be re-cleaned prior to the application of the first coat.

F. The Engineer will inspect each coat prior to the application of subsequent coats. If the work is found to be satisfactory, a written order will be given to proceed.

G. Surface Appurtenances: Remove all electrical plates, surface hardware, light fixture trim, escutcheons, fittings and fastenings prior to preparing surfaces or finishing. These items are to be

carefully stored, cleaned and replaced upon completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

H. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.

I. Marks: Remove those which may bleed through surface finishes.

J. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

K. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

L. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply sealer or primer.

M. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

N. Concrete Surfaces: All concrete shall have cured a minimum of 28 days before cleaning or coating. Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

O. Concrete Surfaces: Reference Section 099010- High Performance Coatings

P. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer. Conduit on interior walls or ceilings shall be painted with the same color as that selected for the walls or ceilings unless otherwise directed by the Owner or Engineer.

Q. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
   1. All shop primed ferrous materials using a primer that is not compatible with finish coat or that the recoat time for primer has lapsed shall have that primer removed by abrasive blasting, and reprimed prior to final coat. Abrasive blasting, if required, shall be SSPC-6.

4.6 BLAST CLEANING

A. Blast cleaning equipment shall be well maintained with properly sized pots, hoses, nozzles and all support equipment required to complete the work as specified.

B. Compressors shall be installed with the necessary oil and water separators and filters to ensure that the compressed air supply is free from moisture and oil contamination.

C. Abrasives used in blast cleaning operations shall be new, washed, graded and free of contaminants that would interfere with the adhesion of the coating and shall not be reused unless approved by the Engineer.

D. If recycled abrasives are used, appropriate equipment to clean the abrasive, including fine particle and dust removal, shall be provided.

E. Abrasives used in blast cleaning shall be such that they will produce a 1.5 to 2.0 mil surface profile (37.5 microns to 50 microns) or as recommended by the coating manufacturer.

4.7 HAND AND POWER TOOLS

A. Hand and Power tools shall be well maintained and in proper working order.

B. Discs, brushes, wheels, etc shall be free from grease and oil and other materials that could contaminate the substrate and sized, when specified, to produce the required surface profile.

4.8 HIGH PRESSURE WATER JETTING

A. High pressure water jetting equipment shall be well maintained, in proper working order and sized to provide a minimum of 35,000 psi of water pressure.

B. The equipment shall be provided with the necessary nozzles and attachments to obtain the level of cleaning required without damaging the substrate being cleaned.

C. Water utilized in the water jetting operations shall be clean and free of contaminants.

D. Necessary steps shall be taken to ensure that damage does not occur to existing electrical equipment and appurtenances during power washing operations.

E. Should such equipment or appurtenances be damaged, the Contractor shall repair or replace these items to the full satisfaction of the Owner.

4.9 COATING “STRIPPER”

A. The coating stripper shall be an environmentally safe paint/coating removal system specifically designed to remove various types of coatings from varying substrates.

4.10 CONTAINMENT

A. The Contractor shall be responsible for containing, collecting and disposing of all paint particles, residues, dust, paint chips as well as all other debris generated from the water jetting, “stripping”, abrasive blasting, power tool cleaning, hand tool cleaning and other cleaning operations required in conjunction with the work specified herein.

B. All work shall be performed in accordance with OSHA Safety and Health Standards 29 CFR 1910.1025. The Contractor shall submit the details of the proposed containment methods and equipment to be utilized to the Engineer for review prior to initiating cleaning operations.

C. Disposal: Prior to beginning any cleaning operations, a representative sample of all existing coatings to be rehabilitated shall be removed from a designated portion of the various structures and sent to a laboratory for analysis.

1. Samples obtained for coatings to be removed using abrasive blast cleaning shall include the residues of the blasting operations.
2. The paint samples and blasting residues collected shall be analyzed to determine if the residues exceed the "leachable" limits for lead, arsenic, barium, cadmium, chromium, mercury, selenium and silver as determined by the EPA's Toxicity Characteristics Leaching Procedure (TCLP).
3. Should the results of the analysis exceed any of the EPA's maximum limits the Contractor shall apply for an EPA identification number for a generator of hazardous waste.
4. Application and disposal of debris shall be in a manner approved by the State in which the project is located.
5. If the results of the certified test are less than the EPA maximum limit the Contractor shall dispose of the debris generated in an approved landfill in accordance with all applicable regulations.

D. Monitoring: To assist in determining the suitability and efficiency of the containment systems to be employed by the Contractor to contain particles and debris generated during the various exterior cleaning processes specified, the Contractor will be required to provide, maintain and analyze various methods to assess the quantity of emissions generated. These methods are described as follows:
   1. Visible Emissions:
      a. During cleaning operations, the work area shall be monitored to provide an immediate assessment of the performance of the containment methods employed by the Contractor.
      b. Under no circumstance shall emission extend beyond the boundaries of where the coating work is being completed into general areas of the facility.
      c. Intermittent emissions, within the property, will be monitored and subject to adjustments as required by federal, local, or state statutes or regulations.
      d. If it is determined through monitoring or other means by the Engineer or Owner that the containment system selected and employed by the Contractor is not suitable or capable of containing the cleaning residues, debris and other materials as required, the Contractor shall, at no cost to the Owner, make use of other containment systems, equipment or measures as may be required to ensure that all materials are contained as specified.
      e. No further work shall proceed until the necessary improvements are in place. Any remediation which may be required as the result of improper containment shall be the responsibility of the Contractor.

4.11 PREPARATION OF EXISTING PAINTED SURFACES

A. The Contractor shall prepare and coat existing surfaces, structural members, equipment, piping, etc. which are noted in the Painting Schedule and/or on the Drawings to be repainted in the field.

B. All surfaces shall be prepared in accordance with the best practice. Surface preparation and coating shall be performed only by crews experienced in this work.

C. Coatings shall be applied by a subcontractor having the approval of the manufacturer and whose workmen have been instructed in the application of these coatings by the manufacturer.

D. A representative of the paint manufacturer shall be present when work begins to instruct personnel in substrate preparation and application techniques.

E. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified.

F. Where water jetting is specified or detailed on the plans, high pressure water jetting shall be performed using a minimum pressure of 35,000 psi to remove all existing paint/coatings, dirt, dust, mildew and all other foreign matter.
   1. All existing coating removed during water jetting (non-lead based) shall be separated from the wash water, contained and properly disposed of in accordance with the applicable regulations.
   2. The wash water resulting from the cleaning operations may be discharged to the plant's sanitary sewer system.
   3. Depending on the condition of the existing coating, the contractor may be required to utilize higher pressures than those specified or other cleaning techniques or additives.
   4. However, in no case shall the water pressures employed be as such that damage occur to the existing structures.
   5. All defective surfaces showing aggregate and visible holes shall be cut out and pointed with a special bonding grout as manufactured by Master Builders, or equal.
   6. When surfaces contain small holes which cannot be patched uniformly, or where special patching is necessary, the Contractor shall use Speed Crete Red Line by Tamms or equal prior to applying the specified coatings.

G. Where chemical removal of coatings is specified or detailed on the plans, all existing paint/coatings shall be removed utilizing an environmentally safe paint/coating removal system specifically designed to remove various types of coatings from varying substrates.
   1. The Contractor shall be responsible for testing the coating removal system in the areas where it is specified for use to determine the appropriate system to be utilized, the thickness to which the product will be applied and the amount of time required before the product is removed.
   2. The product shall be applied and utilized in strict accordance with the manufacturers printed instructions.
   3. Surfaces, which have been stripped, shall be treated in accordance with the manufacturer's recommendations and the coating system manufacturer's recommendations (i.e., neutralizing, water rinsing, power tool cleaning, abrasive blasting, etc.) before the specified coating system is applied.
   4. All water utilized in conjunction with the coating stripper in areas which are suspected to contain lead based coatings shall be collected and contained and disposed of in accordance with all applicable regulations.

H. Unless otherwise noted or specified all existing ferrous metals to be coated shall be power tool cleaned to bare metal in accordance with SSPC-SP-11 to remove all rust, scale and other areas of obvious coating breakdown (loose mill scale, loose rust, loose paint and other detrimental foreign matter).
   1. Prior to power tool cleaning, all metal surfaces shall be cleaned of foreign matter and oil and grease removed by biodegradable cleaning solvent compatible with the specified system to be applied.
   2. All edges shall be feathered a minimum of three (3) inches from the center of the cleaning to the tightly adhered existing paint and the existing coating roughened with 80 grit abrasive coated paper to assure proper adhesion of the specified primer.

3. In closed or inaccessible areas, hand wire brush at a minimum to guarantee adhesion prior to primer application.

I. All submerged surfaces outlined for coating under this section shall be abrasive blasted in accordance with SSPC-SP-10 “Near-White Metal Blast.

J. Where indicated on the Drawings, the Contractor shall remove wallpaper from the existing gypsum wall board and all scratches, gouges, and other imperfections filled with joint compound to provide a smooth surface suitable for painting.
   1. All joint compound shall be sanded smooth and the edges feathered to provide a smooth transition to the new dry wall.

4.12 APPLICATION

A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

B. All finishes must meet mil thickness and color requirements.

C. Paint shall be evenly spread and well brushed out so that there shall be no pinholes, drops, runs nor sagging of materials.

D. Embedded roller knaps and fibers, dry-spray and over-spray will not be acceptable.

E. Care shall be taken to ensure the application of a uniform coating and that paint is carefully worked around bolt heads, rivets, weld seams, ladder rungs, joints and other irregularities.

F. Painting which is found defective shall be removed and repainted. Remove and replace, at the direction of the Engineer, any painting work found to be defective or applied under adverse conditions.

G. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.

H. Sand metal surfaces lightly between coats to achieve required finish.

I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

4.13 FIELD QUALITY CONTROL

A. All phases of the work in connection with surface preparation and coating application shall be inspected and approved in a step-by-step procedure.

B. Inspections and testing may include, but are not limited to, surface preparation, post-cleaning cleanliness, paint application, dry film thickness film appearance, continuity and adhesion.
   1. If utilized, the Contractor will be responsible for marking and repairing all damage created by the destructive testing.
   2. Damaged areas shall be repaired so that the repairs blend in with the surrounding coating.

C. During coating application, the wet film thickness of each coat of paint shall be determined using a notch type wet film thickness gage in accordance with ASTM D4414.

D. Where applicable, the determination of the final surface appearance may be based upon comparison with the latest versions of SSPC-VIS-1 or ASTM D610.

E. During coating operations, the Contractor shall record and submit to the Engineer for his review daily coating application figures.
   1. Application rates should be recorded on a per gallon basis and include the location of and approximate square footage of the area in which the coating was applied.
   2. Coverage rates shall be in accordance with Manufacturer's recommendations.

F. Contractor shall repair all damaged test areas at no additional cost.

4.14 REMEDIAL AND REPAIR WORK

A. Prior to completion of the project, the Contractor shall identify and repair all damaged coatings.
   1. Localized coating damage shall first be solvent cleaned in accordance with SSPC-SP 1 "Solvent Cleaning" and then repaired by power tool cleaning in accordance with SSPC-SP 3 "Power Tool Cleaning" for damage which does not expose the substrate and SSPC-SP 11 "Power Tool Cleaning to Bare Metal" for damage that exposes the substrate.
   2. All edges shall be feathered a minimum of three (3) inches from the center of the damaged area to the tightly adhered existing paint and the existing coating roughened with 80 grit abrasive coated paper to assure proper adhesion of the coating repair.
   3. Extensive coating damage shall be repaired by abrasive blast cleaning to the specified surface cleanliness and the existing coating feathered to tightly adhered existing paint.
   4. When performing cleaning work using abrasive blast cleaning, caution shall be exercised to ensure that the existing coatings are not exposed to abrasion from the blast cleaning operations.
   5. For coating damage that exposes the bare substrate, the coating repair material shall consist of all coats of the specified coating system.
   6. For coating damage that does not expose the bare substrate, the coating shall consist of the damaged coatings.
   7. The total dry film thickness of the repair shall be within the specified total thickness tolerances of the coating system.

B. The Contractor shall identify and repair deficiencies in the coating work to the full satisfaction of the Owner.

C. All repair work shall be completed in accordance with the manufacturer's recommendations.

D. Repairs, which result in an uneven coloring or poor appearance, will not be acceptable.

4.15 CLEANING

A. Section 01 70 00 – Execution and Closeout Requirements: Final cleaning.

B. Upon completion of the work, all paint splatters or drippings shall be removed to the full satisfaction of the Owner. If the spray method is used for the application of the exterior paint, care

shall be taken to ensure that no overspray falls upon existing equipment and other materials/structures not to be painted. The Contractor shall be responsible for any and all damage resulting from overspray.

C. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

D. Final clean up and restoring the site to its original condition is the responsibility of the Contractor. All empty coating containers, waste coating, thinners and solvents will remain the property of the Contractor and will be properly disposed of and removed from the jobsite. Jobsite disposition of waste such as burning or pouring onto the soil or into surface drains will not be permitted.

E. Before the work will be considered complete, all rubbish and unused material due to, or connected with, the progress of the work shall be removed from the premises and disposed of in a manner satisfactory to the Owner. Private and public property disturbed and damaged as a result of the work shall be restored to their former condition by the Contractor; final payment will be withheld until that work is finished.

4.16 SCHEDULE - COLORS

A. Touch up colors to match color of material, approved by the architect.

END OF SECTION

SECTION 107300 - ALUMINUM PROTECTION COVERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Welded extruded aluminum walkway cover systems.
   2. Welded extruded aluminum cantilevered awnings

B. Products Furnished but not Installed Under this Section: Column sleeves (styrofoam blockouts) or anchor bolts (if required)

1.02 REFERENCES

INCLUDE ONLY THOSE REFERENCES THAT ARE CITED IN THIS SECTION.

A. The Aluminum Association (AA):
   1. The Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures.

B. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum.
   2. AAMA 2603, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. American Society of Civil Engineers (ASCE):
   1. ASCE 7, Minimum Design Loads for Buildings and Other Structures.

D. American Society for Testing and Materials (ASTM):
   1. ASTM B 209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
   2. ASTM B 221, Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   3. ASTM C 150, Specification for Portland Cement.
   4. ASTM C 404, Specification for Aggregates for Masonry Grout.

E. American Welding Society (AWS):
   1. ANSI/AWS D1.2, Structural Welding Code - Aluminum.

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Design Walkways in accordance with The Aluminum Design Manual 2000.
   2. Comply with the wind requirements of ASCE 7.
   3. Provide an all welded extruded aluminum system complete with internal drainage. Non-welded systems are not acceptable.
   4. Provide expansion joints to accommodate temperature changes of 120 degrees F. Provide expansion joints with no metal to metal contact.

B. Performance Requirements:
   1. Grout: Compressive strength of 2000 psi, minimum.

1.04 SUBMITTALS

A. Product Data: Manufacturer's product information, specifications, and installation instructions for walkway cover components and accessories.

B. Shop Drawings: Include plan dimensions, elevations, and details.

C. Samples:
   1. Selection: Manufacturer's standard range of colors for the finishes selected.
   2. Verification: 2-inch-square samples of each finish selected on the substrate specified.

D. Design Data: Design calculations bearing the seal of a Registered Professional Engineer, licensed in the state where the project is located. Design calculations shall state that the walkway cover system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least ten years' experience in the design, fabrication, and erection of extruded aluminum walkway cover systems.

B. Installer Qualifications: Have walkway covers installed by manufacturer, third party installation is not acceptable.

PART 2 PRODUCT

2.01 MANUFACTURERS

A. The design is based on products fabricated by: Peachtree Protective Covers, Inc., 1477 Rosedale Drive, Hiram, GA 30141, 770-439-2120, fax 770-439-2122.
   1. Comparable products by the following manufacturers also will be acceptable:
      a. Dittmer Architectural Aluminum.
      b. Avadek Walkway Cover Systems.
   2. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.02 MATERIALS

A. Aluminum Members: Extruded aluminum, ASTM B 221, 6063 alloy, T6 temper.

B. Fasteners: Aluminum, 18-8 stainless steel, or 300 series stainless steel.

C. Protective Coating for Aluminum Columns Embedded in Concrete: Clear acrylic.

D. Grout:
   1. Portland Cement: ASTM C 150, Type I.
   2. Sand: ASTM C 404.

3. Water: Potable.

E. Gaskets: Dry seal santoprene pressure type.

F. Aluminum Flashing: ASTM B 209, Type 3003 H14, 0.040 inch, minimum.

2.03 MIXES

A. Grout: 1 part portland cement to 3 parts sand, add water to produce a pouring consistency.

2.04 FABRICATION

A. General:
1. Shop Assembly: Assemble components in shop to greatest extent possible to minimize field assembly.
2. Welding: In accordance with ANSI/AWS D1.2.
3. Bent Construction: Factory assemble beams to columns to form one-piece rigid bents. Where used make welds smooth and uniform using an inert gas shielded arc. Perform suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints can be used if supported by engineering calculations and/or testing.
4. Deck Construction: Fabricate from extruded modules that interlock in a self-flashing manner. Positively fasten interlocking joints creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Assemble deck with sufficient camber to offset dead load deflection.

B. Columns: Provide radius-cornered tubular extrusions with cutout and internal diverter for drainage where indicated. Circular downspout opening in column not acceptable.

C. Beams: Provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner.

D. Deck: Extruded self-flashing sections interlocking into a composite unit. Provide welded plate closures at deck ends.

E. Fascia: Manufacturer's standard shape. Provide fascia splices where continuous runs of fascia are jointed. Locate splices to be in line with bents and fasten in place on hidden or non-vertical surfaces.

F. Factory Finishing: Finish designations prefixed by AA comply with system established by the AAMA for designating aluminum finishes.

1. High performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
a. Fluoropolymer Three-Coat Coating System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer,

fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.02 ERECTION

A. Erect protective cover true to line, level, and plumb. Protect aluminum columns embedded in concrete with clear acrylic. Fill downspout columns with grout to the discharge level to prevent standing water. Install weep holes at top of concrete in non-draining columns to remove condensation.
B. Provide hairline miters and fitted joints.

3.03 CLEANING

A. Clean all protective cover components promptly after installation.

3.04 PROTECTION

A. Protect materials during and after installation.

END OF SECTION 107300

SECTION 11 41 21
WALK-IN COOLERS AND FREEZERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies walk-in site assembled refrigerators and freezers.

1.2 RELATED WORK

A. Section 23 23 00, REFRIGERANT PIPING: Piping, pipe insulation and refrigerant.
B. Refer to Appendix A for the refrigeration equipment schedules and installation details.
C. Refer to Division 26, ELECTRICAL for lighting and power requirements on the electrical drawings.

1.3 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21, “Warranty of Construction”.
B. Refrigeration Compressor Warranty: Manufacturer agrees to repair or replace compressors that fail in materials or workmanship within five (5) years from the date of final acceptance by the Owner. Failure includes but is not limited to inability to maintain set temperature. Submit compressor warranty. Walk-in Panels to be warranted for ten (10) years.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's Literature and Data:
   1. Walk-in units, including assembly instructions.
   2. Evaporator Coil and Condensing units, with mounting rack where required.
   3. Temperature controls and alarms.
   4. Diagrams and details of piping, wiring and controls.
C. Operational test reports.
D. Final field test reports.
E. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
F. Manufacturer’s compressor warranty.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. Air-Conditioning and Refrigeration Institute (ARI):
   420-08..... Unit Coolers for Refrigeration.
   520-04..... Performance Rating of Positive Displacement Condensing Units.
C. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
   15-10-16 ..... Safety Standard for Refrigeration Systems
D. ASTM International (ASTM):
   A240/A240M-20 ..... Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and For General Applications
   E84-20 ..... Surface Burning Characteristics of Building Materials
E. National Sanitation Foundation/American National Standard (NSF/ANSI):
   7-09..... Commercial Refrigerators and Storage Freezers
F. National Fire Protection Association (NFPA):

70-20..... National Electric Code

G. Underwriters Laboratories, Inc. (UL):
207-08(R2014) ..... Refrigerant-Containing Components and Accessories, Nonelectrical
471-10(R2014) ..... Commercial Refrigerators and Freezers
1598-03(R2012) ..... Luminaires

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NSF Standards: Provide equipment that bears NSF Certification Mark certifying compliance with applicable standards.

B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.

C. Regulatory Requirements: Install equipment to comply with the following:
   1. ASHRAE 15, “Safety Code for Mechanical Refrigeration.”
   2. NFPA 70, “National Electric Code.”

2.2 WALK-IN FREEZER CONSTRUCTION

A. General: Prefabricated, sectional, all-metal clad, modular, designed for easy accurate field assembly.

B. Provide walk-in units manufactured for food service use conforming to NSF/ANSI 7, UL 207, and UL 471. Floor panel walk-in freezers with appropriate insulated floor assembly and polished aluminum or galvanized skin finish floor.

C. Panel Construction:
   1. General: Interchangeable, 1219 mm (48 inch) maximum width, 101 mm (4 inch) thick, filled with insulation. Double seal serrated neoprene rubber gaskets to assure air and vapor tight joints.
   2. Corner panels: 90 degree angle, radiuses 15 mm (0.5 inch) inside and outside, with 305 mm (12-inch) dimensions each side.
   3. Panel edges: Foam-in-place, tongue-and-grooved urethane to assure tight joints. Provide double seal serrated neoprene rubber gaskets to assure air and vapor tight joints on the interior and exterior of each panel along every tongue.
   4. Insulation: 101 mm (4 inch) minimum foamed-in-place polyurethane with manufacturer’s rated “K” factor of not more than 0.15, free rise design of not less than 27 kg per cubic meter (1.7 pounds per cubic foot), or in-place density of not less than 32 kg per cubic meter (2 pounds per cubic foot). Provide floor screeds with minimum of 63 mm (2-1/2 inches) of foamed insulation.
   5. Door Panel and Door:
      a. Provide channel thermal breaker type reinforcing steel frame around the entire perimeter of the door opening.
      b. Door to be an infitting flush-mounted type with dual flexible blade wiper gasket on the bottom, and a replaceable magnetic gasket on the top edge and along both sides.
      c. Provide heated, double glass view windows in refrigerator doors.
      d. Door to be equipped with a minimum of three (3) hinges, for rough usage including aluminum diamond plate on inside of door panel and frame to a height of 915 mm (36 inches).
      e. Provide hydraulic exterior door closer to prevent slamming and assure secure closing.
      f. Door hinges and latch and strike assembly: Manufacturer's standard, self-closing cam-lift type hinges, for 1219 mm (48 inch) door, chrome plated or polished aluminum finish, made to

provide for locking, but with an inside safety release mechanism to prevent anyone from being locked inside when door is locked from outside.

g. Concealed, energy use selective, anti-sweat heater wire circuit: Provide sufficient heat to prevent condensation and frost formation at the door jambs and exterior edges of the door on all sides.

h. Thermometer: Manufacturer's standard, 50 mm (2-inch) minimum diameter, dial type, flush mounted in door panel.

6. Pressure relief port: Provide for all freezers operating at 18 degree C (0 degree F), or lower, two-way type ports, to allow for an increase or decrease of air pressure on the interior of the freezer to equalize with air pressure on the exterior. Provide ports with automatically controlled, UL approved anti-sweat heaters. Complete device to carry UL Label and be assembled ready for connection. Install port in a wall panel away from the direct air stream flowing from the coils.

7. Floor Panels:

a. Floor Panel Strength: Capable of withstanding 28.7 kPa (600 pounds per square foot) uniform load.

b. Provide prefabricated floor panels of the same construction as wall/ceiling except with 1.9 mm (0.78 inch; 14 gauge) // galvanized skin // stainless steel // aluminum diamond treadplate //, sealed watertight. // Provide nonskid floor strips 101 x 915 mm (4 x 36 inch) and field apply at 305 mm (12 inch) spacing in all aisles. // Provide prefabricated floor panels which are // laid on // // recessed // with, // sloping interior floor ramps at exterior entrance doors // // panels flush with surrounding building floor //. Furnish two (2) sets of erection tools, compatible with fasteners, with each unit.

D. Wherever compartment dimension exceed clear-span ability of ceiling panels, provide I-beam support on exterior of ceiling or spline-hangers. Install 13 mm (1/2 inch) diameter steel rods through beam/hangers and secure to structure above. Beams or posts within compartments are not acceptable.

E. Rub rail wall protectors: Manufacturer’s standard, at floor line of walls exposed to traffic.

F. Lights: Provide high-efficiency rated LED light fixtures with safety shields. Lighting must conform with UL IP-65. Provide with diffuser and be capable of operating in minus 23 degrees C (-40 degrees Fahrenheit) temperature. Lights must run length of walk-in starting 610 mm (24 inches) from front panel and extending within 610 mm (24 inches) of back panel. Run between shelf rows to obtain 323 lux (30 foot-candles) at floor level regardless of any interior furnishings.

2.3 CONDENSING UNITS

A. BASIS OF DESIGN:

1. TRENTON, TEZ Indoor/Outdoor Air-Cooled Scroll Outdoor (Self Contained) Condensing Unit 2.

B. Comply with ARI Standard 520. Air cooled, water cooled or combination air/water cooled type as shown in construction documents.

C. Provide motor driven integral compressor, motor starter, condenser, receiver, common base, and safety/operational controls.

D. Receiver capacity not to be less than 125 percent of system refrigerant charge.

E. For units racked above each other and for units installed in a closet, provide a factory fabricated steel rack extending approximately 1143 mm (45 inches) above the floor.

F. Provide two (2) condensing units and unit coolers with independent refrigeration systems for freezer when shown on construction documents or recommended by manufacturer due to size or freezer.
G. Do not locate compressors on top of refrigerators or freezers.
H. Provide positive oil lubrication and oil level indicating device for each compressor. Provide water regulating valve for water cooled unit.
I. Compressor Motor: Squirrel cage induction type of ample size for continuous operating at maximum compressor performance. Provide inherent protection, in compressor terminal box, for each phase of motor.
J. Pressure Switches: Automatic reset low pressure switch, and automatic or manual reset high pressure cutout.
K. Air Cooled Condensing Units:
    1. High efficiency type piped and automatically controlled to operate at lower head pressures during low ambient temperature conditions. Designed and weather-proofed for outdoor installation, to operate satisfactorily at winter ambient temperatures down to 10 degrees F below the 99% column in ASHRAE Handbook weather data for the Charlotte, NC region, and be provided with crankcase and receiver heaters.
    2. The condenser fans are to be driven by permanent split capacitor motors.

2.4 UNIT COOLERS

A. BASIS OF DESIGN:
    1. TRENTON, TPLP Pre-Assembled Low Profile Low Temperature Evaporator w/ Air & Electric Defrost
B. Comply with ARI Standard 420. Units to be UL listed, forced-ventilation type. Provide demand defrost controllers for defrosting, internal or external refrigerant distributor, single or multiple fans and motors, drip-pan, deflectors, aluminum or baked-enamel steel housing, hangers, and all accessories. Unit coolers for kitchen walk-in units to be NSF approved.
C. Motors: Permanent split capacitor type in accordance with Section 11 05 12, GENERAL MOTOR REQUIREMENTS FOR EQUIPMENT. Provide motors with thermal overload protection and manual starting switch.
D. Drain Pans: Galvanized sheet steel. Provide additional drain pans under uncovered refrigerant connections, and interconnect them with main drain pan. For freezer units provide electrically heated drain pan with heated tape over condensate drain line.
E. Defrost Provision:
    1. Freezer defrost: Defrost to be by demand defrost with Evaporator Efficiency Controller.

2.5 MONITORING ALARM SYSTEM

A. Provide an electronic monitoring and alarm system for each section of each unit.
    1. System Components: Detecting thermostat, master control panel, interconnecting wiring, remote audible alarm, and defrost compensator. Provide dials showing temperatures and pilot lights, warning lights, switches, transformer, and buzzer, all as a part of the master control panel. Locate master control panel and remote audible alarm as indicated on construction documents. Provide power fuse to protect system components.
    2. System Operation: Set alarms at 5 degrees C (10 degrees F) above and below specified operating temperatures.

B. Personnel Alarm: For each unit, provide separate audible alarm system operable from inside unit, for use of personnel unable to exit unit. Locate remote audible alarm where indicated on construction documents.

2.6 EQUIPMENT IDENTIFICATION REQUIREMENTS

A. Identify all walk-ins, refrigeration equipment and alarm devices.

2.7 "SELF-CONTAINED" SINGLE REFRIGERATION SYSTEM

A. Digital System

B. The RDT UL-Listed, air-cooled system designed for outdoor installation. The unit shall be pre-wired for a single point electrical connection with a main fused disconnect. The refrigeration unit shall be housed in a weather-protected compact structural galvanized steel frame. The unit shall include individual dedicated air-cooled condensers. Condensers shall be aluminum fin/copper tube designed to operate at 15 degrees T.D. The exterior housing shall be brushed 304 stainless steel with one-piece stainless-steel lift out louver panels for easy access to service. Entire galvanized metal frame shall be pre-assembled, welded and cleaned. Lifting points shall be integrated in the feet at each corner to facilitate installation. Condenser fan motors shall be mounted within the enclosure.

C. All Primary multiplex compressors shall be digital semi-hermetic or scroll type and factory assembled to operate with the refrigerant specified.

D. All Conventional, stand-by, and/or parallel compressors shall be semi-hermetic or scroll type and factory assembled to operate with specified refrigerant blend.

E. Compressors and refrigeration piping will be installed in such a manner as to eliminate noise with vibration eliminators in refrigeration lines, as needed. Each compressor unit shall be equipped with; oversized receiver, dual pressure control for cut-in cut-out, a ball-bearing fan motor, fixed head pressure control, suction filter, liquid line sight glass, liquid line drier, crankcase heaters, headmaster controls and/or fan cycling, liquid line inlet and outlet valves, defrost cycle and armored super hose connections (in lieu of capillary tubes).

F. All digital systems to include digital sequencer controller, oil separators.

G. All refrigerant lines shall be extended to one side of the package in a neat and orderly manner. All tubing shall be securely supported and anchored with non-corrosive coated clamps. All joints must be brazed, not soldered. All piping and controls shall be factory pressure-tested with nitrogen at 175 PSI.

H. Evaporator coils shall be a direct expansion type. Evaporators used will be all "Underwriters Laboratory Listed" supplied from factory with an electric expansion valve, solenoid valve, suction transducer, and Eco-Smart on-demand defrost controller, pre-wired and pre-piped under nitrogen pressure and designed for use with the refrigerant specified. Isolation ball valves are to be installed on the liquid and suction lines at each evaporator coil.

I. All field piping installed as per factory standards and the sizing of the piping shall meet proper velocities as per factory standards. Insulation will be foam type 25/50 smoke and fire type. Medium temperature will use 3/4" thick wall, low temperature will use 1" thick wall and sub-cooled liquid lines will use 1/2" thick wall insulation. All insulation shall be jacketed with Aluminum (complying with division 15000,) 1-1/2" overlap and secured with bundling ties. All jacket elbows to be roll formed. All field piping installed with plastic bushing wherever steel to copper tubing comes together. Include all labor, material, equipment, tools, refrigerant, oil, and other required accessories for the complete installation of the systems as shown and specified. Interconnection of all accessories accomplished for ease of servicing.

J. After installation and before charging, evacuate all piping systems to a 500-micron evacuation. After evacuation, charge system with nitrogen and maintain pressure of 150% working pressure for 6 hours. Cap off, install pressure gauge and hold for 24 hours minimum. Re-evacuate, hold for 6 hours, charge and make electronic detector test all joints.
K. Final wiring of connections, conduit and/or pull boxes, provided under applicable electrical and plumbing contracts. See R-1 drawing for wiring schematic for field wiring.
L. Included shall be a full one (1) year warranty for all parts by factory, full one (1) year compressor warranty by compressor manufacture and a 90-day warranty on labor on the entire refrigeration package only from the day of final acceptance of the installation as previously specified. Factory labor warranty does not cover installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble walk-in units and install refrigeration equipment as described in the respective manufacturer's instructions. Make panel joints tight and seal all panel penetrations to prevent condensation or frosting.
   1. Unit cooler: NSF approval requires that the unit be suspended at 90 mm (3-1/2 inches) minimum distance below the ceiling to allow cleaning the top of the unit cooler.
   2. Mount pipe, conduit, and instrumentation on the exterior and pass thru neatly drilled penetrations to the lights or other devices.
B. Piping, Pipe Insulation and Refrigerant: Provide in accordance with Section 23 23 00, REFRIGERANT PIPING.
C. Controls Installation: As specified in Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

3.2 FREEZER START-UP, AND PERFORMANCE TESTS AND INSTRUCTIONS

A. Initial Start-up and Operational Test:
   1. Provide all lubricants and accessories before initial start-up. Start and operate all equipment.
   2. Follow the manufacturer’s procedures and place the systems under all modes of operation.
   3. Supplement initial charges of lubricating oil to assure maximum operating capacity.
   4. Adjust all safety and automatic control instruments. Record manufacturer’s recommended readings hourly.
   5. Operational tests must cover a period of not less than three (3) days. Submit operational test report.
B. Test Reports: Submit the final field test reports for each system tested, describing test apparatus, instrumentation calculations, and equipment data based on industry standard forms. Include in data:
   1. Compressor and air moving device ampere readings.
   2. Power supply characteristics, including phase imbalance, with 1/2 percent accuracy.
   3. Thermostatic expansion valve superheat-value as determined by field test.
   4. Sub-cooling.
   5. High and low refrigerant temperature switch set-points.
   6. Monitoring alarm system.
   7. Low oil pressure switch set-point.
   8. Defrost system timer and thermostat set-points.
   9. Moisture content.
   10. Ambient, condensing and coolant temperatures.

11. Capacity control set-points.
12. Field data and adjustments which affect unit performance and energy consumption.
13. Where final adjustments and settings cannot be permanently marked or drilled and pinned as an integral part of device, include adjustment and setting data in test report.

C. By arrangement with the Architect's consultant, 24 hours in advance, use the start-up and test period for required operation and maintenance instructions to Owner's personnel in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

- - - E N D - - -

114121-A WALK-IN FREEZER EQUIPMENT SCHEDULE

1	**91804997** **AMERIKOOLER** **(OR EQUAL)**	**1**

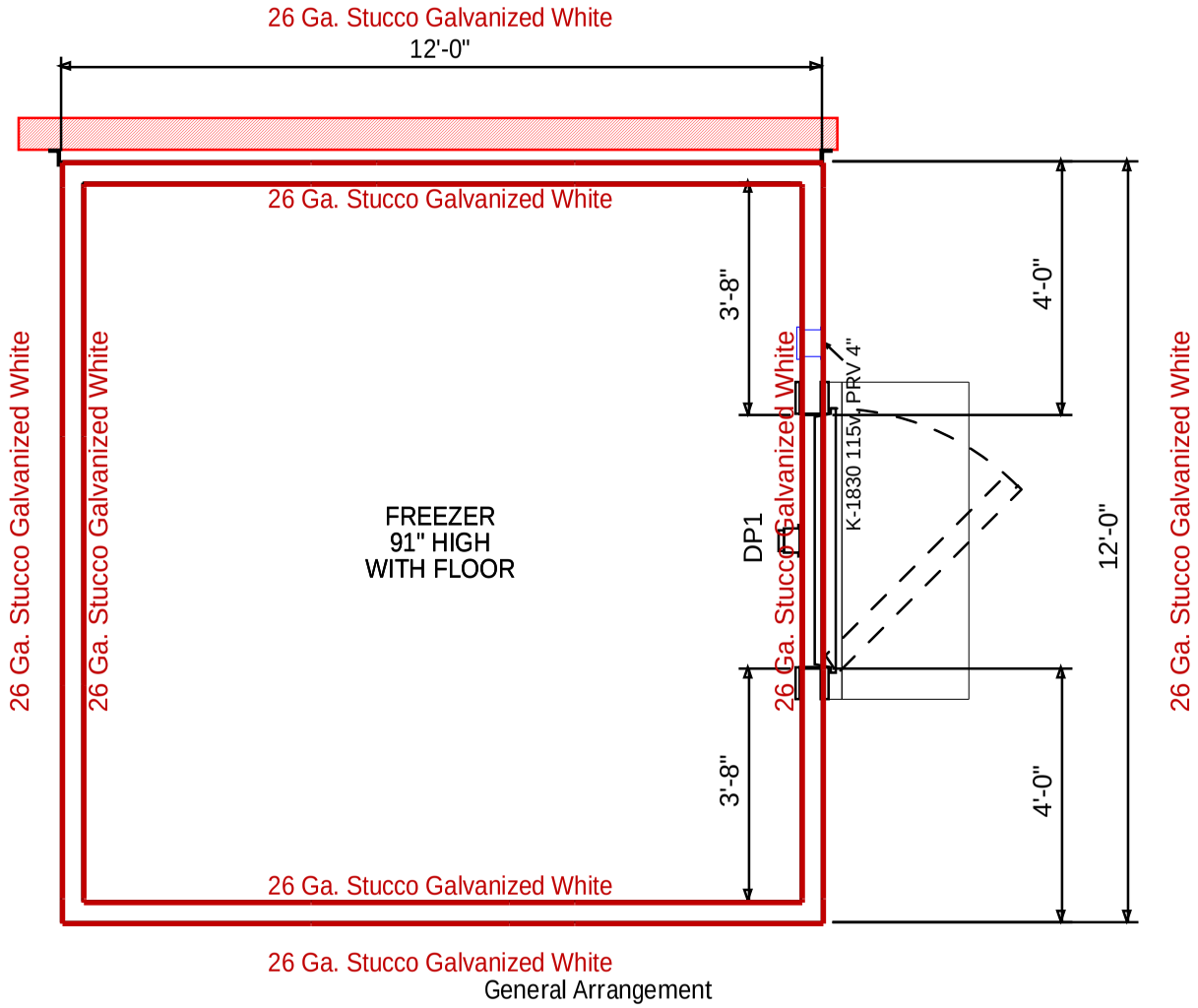
12X12X8 FREEZER OUTDOOOR W/ FLOOR

TEZA035L8HT3DF **TRENTON OR EQ.**	**1**

TRENTON SCROLL C/U L/T 3.5HP MULTIREF 208-230
Standard features include:
Sealed Liquid Line Filter Drier & Sight Glass
Weatherproof control box with contactor & fused cntl circuit Welded-hermetic Scroll compressor.
High efficiency enhanced tube and fin condenser design Pre-formed copper tubing secured with cushion clamps EC fan motor
Receiver with fusible plug and liquid shut off valve Suction service valve
Fixed high and low pressure control adjustable
Painted weather-resistant housing with removable hood Flooded head pressure control adjustable
Crankcase heater
Capacity @ -20F SST / 95F Ambient: 13300 BTUH R404A Voltage: 208-230/3/60
Minimum Circuit Ampacity: 17.0 Receiver capacity 90%: 14.0
LBS R404A Connections: 1/2 Liquid, 7/8 Suction
Dimensions: 36-3/8" W x 30-3/8" D x19-7/8" H Shipping Weight: 430 lbs

TPLP314LES2DR6 **TRENTON OR EQ.**	**1**

TRENTON PRE-ASSEM EVAP L/T R404A 230V



General Arrangement

-SPECIFICATION-

Box Height: Freezer 7'-7" (6'-11" Interior)

Insulation: 4" thick AK-XPS4 Extruded foam UL classified core flame spread 15, Smoke rating less than 165

Compartment 1 - Freezer

DP1 - (1) Plug Door - No Floor. 48" x 76" Door opening, 26 Ga. Stucco Embossed Acrylume finish.(FREEZER)
With Lights, switch & thermometer, PRV NARROW DOOR JAMB (2 1/2" Dia.) FOR 4" WALLS, 120 VAC. 11825000004 For 1600 FT^3 Mounted on Walls, External Ramp 24" deep x 48" wide

Refrigeration:

Refrigeration Supplied By Others
Recommended minimum duty 9341 Btu/hr at 95°F ambient

Wall Panels

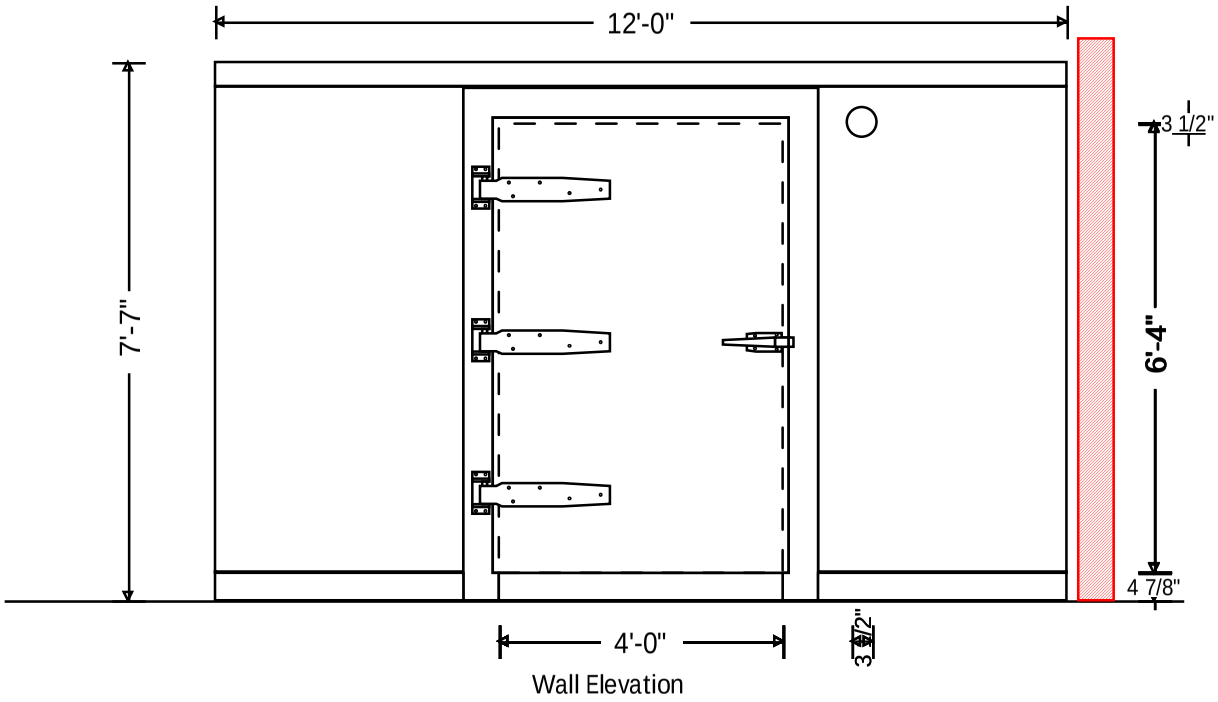
Interior Finish: 26 Ga. Stucco Galvanized White
Exterior Finish: 26 Ga. Stucco Galvanized White

Customer Approval:

_____

Quote No : 23-22613 Revision : 2	Project : York County Museum	Date : 08/01/2023
Customer : United Refrigeration, Inc	Page 1 of 3	

amerikooler
taking cool further™



Wall Elevation

-SPECIFICATION-Continued

Ceiling Panels

Interior Finish: 26 Ga. Stucco Galvanized White

Exterior Finish: 26 Ga. Stucco Galvanized White

Floor Panels

NSF Floor panel rated for 700 LBS/ SQ. FT.

22 Ga. Stainless Steel Integral

Application: Foot Traffic - No Rolling Carts

Accessories Shipped Loose

(144) Rain roof membrane w/ 10 ft. long with termination bars with1 screw every 12inch (per sq.ft.)

(1) 48" LED LIGHT STRIP FIXTURE 96 LUMENS /WATT 120VAC, 0.33 AMPS - TEMP RANGE: -30°F-104°F, SHIP LOOSE RECOMMENDED ONE FIXTURE EVERY 144 SQ. FT. AT 12' HIGH

(1) DOOR HOOD FROM 43" TO 78" LONG ACRYLUME STUCCO EMBOSSED, WITH 5 TEK SCREWS (LOOSE)

(9) PERIMETER REINFORCEMENT FLOOR ANGLE (.050 THICK ALUMINUM) 1 1/2" X 6 " X 48" EACH SECTION - SUPPLIED WITH STAILESS STEEL TEK SCREWS, TO SECURE WALL AND FLOOR. CONCRETE ANCHORS (BY OTHERS)

Customer Approval:

_____

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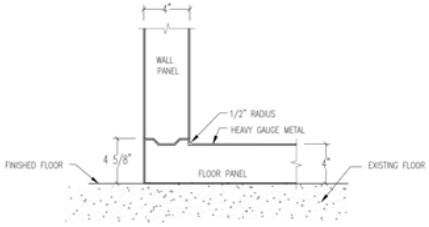
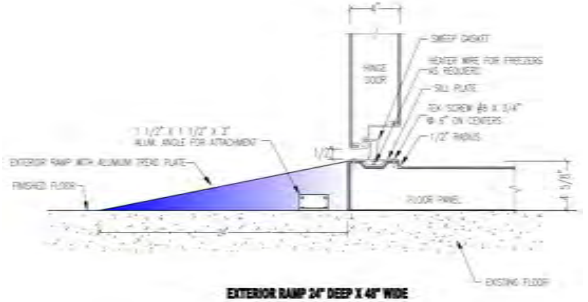


FLOOR & WALL DETAIL (700 LBS / FT², DIST. LOAD)

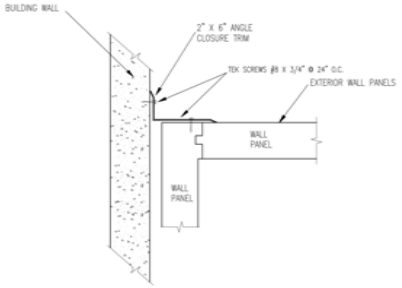
1B: NSF FLOOR 22 GAUGE SMOOTH STAINLESS STEEL INTEGRAL. NOT REINFORCED. RATED FOR 700 LBS/ SQ FT. (APPLICATION: FOOT TRAFFIC–NO ROLLING CARTS)

NOTE: IMPORTANT REQUIREMENT FOR INSTALLATION IS TO HAVE A PERFECTLY LEVEL FLOOR.



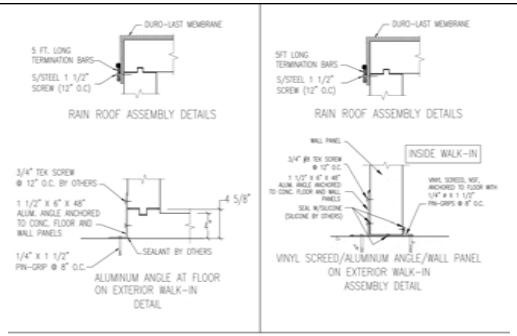
EXTERIOR RAMP 24" DEEP X 48" WIDE

244: EXTERIOR RAMP 24" DEEP X 48" WIDE (PEMMC)



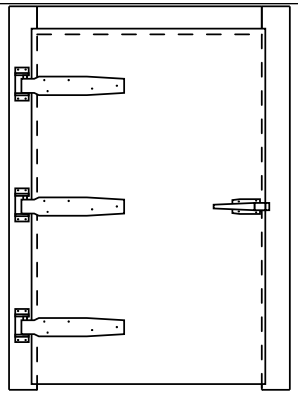
EXTERIOR ANGLE CLOSURE TRIM STRIP 2" X 6"

279 : EXTERIOR ANGLE CLOSURE TRIM 2" X 6" X 10' MAX. LENGTH WHITE STUCCO EMBOSSED FOR WALLS EACH



RAIN ROOF MEMBRANE

9462: RAIN ROOF MEMBRANE W/ 10 FT. LONG WITH TERMINATION BARS WITH1 SCREW EVERY 12INCH (PER SQ.FT.)



DP1

Quote No : 23-22613 Revision : 2	Project : York County Museum
Customer : United Refrigeration, Inc	Date : 08/01/2023 Page 3 of 3

amerikooler™ taking cool further™

EXHIBIT A

TPLP New Generation "D"
Pre-Assembled Low Profile Evaporators

Air & Electric Defrost

Medium Temperature Applications: 35°F
Low Temperature Applications: -10°F

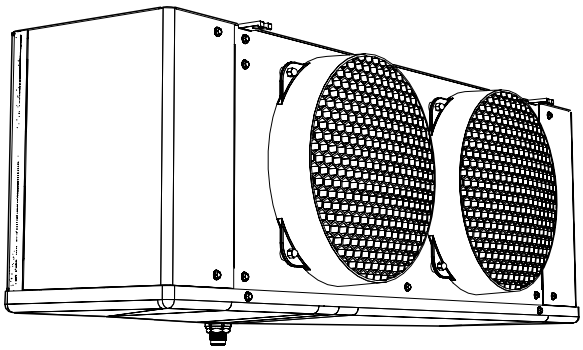
Electrical: 115/1/60, 208-230/1/60, 208-230/3/60

PRODUCT DATA & INSTALLATION

Bulletin T30-TPLPD-PDI-2E
Part #1109294

PRODUCT SUPPORT
web: **www.t-rp.com/tplp**
email: **evaps@t-rp.com**
call: **1-844-893-3222 x520**
scan:

INCLUDES MODELS FOR DOE & NRCAN
AWEF-COMPLIANT APPLICATIONS



INCLUDES RATINGS FOR LOW GWP REFRIGERANTS

SMARTSPEED™ FAN MOTOR TECHNOLOGY
STANDARD ON ALL MODELS

ESP+
see page 12 for details

CONTENTS

NOMENCLATURE

TP LP 3 16 L E S2 D R8 - ESP

Pre-Assembled

Low Profile Evaporator

Number of Fans

Nominal Capacity:
x 1000 @ 10°F TD, Btu/H, R404A

Application Range:
M = Medium to High Temp 6 FPI (25°F / -4°C) Evap Temp)
L = Low Temp 6 FPI (-20°F / -29°C) Evap Temp)
V = Low Temp 4 FPI (-20°F / -29°C) Evap Temp)

Defrost:
A = Air E = Electric

Designation:
ESP = ESP+

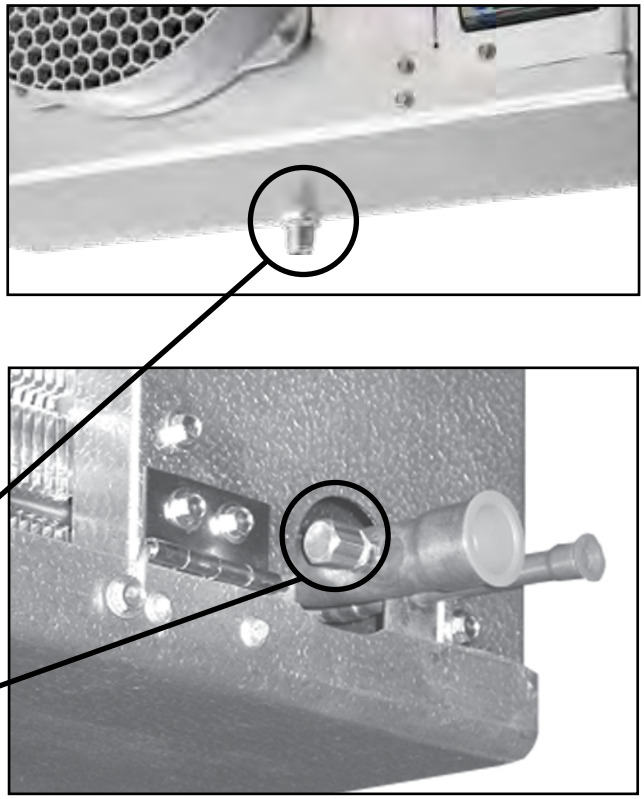
Refrigerant Designation:
R2 = R407A / R407C / R448A / R449A
R6 = R404A
R8 = R407A / R407C / R448A / R449A, R404A
(R8 applies to ESP+ models only)

Design Generation

Voltage:
S1 = 115/1/60
S2 = 208-230/1/60 T3 = 208-230/3/60

STANDARD FEATURES

- EC motors with patented SmartSpeed® Technology
- Compatible with Low GWP Refrigerants
- High efficiency and high strength fan guard
- Front access
- Internally enhanced tubing
- Convenient mounting brackets
- Ample electrical and header compartments
- Positive slope, hinged drain pan
- Centrally located, universal drain connection
- Large 3/4” ID (3/4” MPT) drain hole
- Schrader valve on suction header, located outside of cabinet



ESP+ (R8) MODELS

Include factory installed:

- ESP+ Adaptive Defrost Control
- ESP+ Remote Display
- EEV Electronic Expansion Valve
- Solenoid Valve

ELECTRO-MECHANICAL (R2 and R6) MODELS

Include factory installed:

- TX Valve
- Solenoid Valve
- Thermostat

R407A **R448A** **R449A**

Low Temperature - 6 FPI Models

Model TPLP	Qty. Fans	Evaporator Temperature Selection Capacity BTU/h					Air Flow		Refrig. Charge R407A **	
		0°F *(-18°C)*	-10°F *(-23°C)*	-20°F *(-29°C)*	-30°F *(-34°C)*	-40°F *(-40°C)*	CFM	L/S	LB.	*KG*
104L	1	**4310**	**4190**	**4070**	**3740**	**3460**	**750**	*350*	**0.7**	*0.3*
105L		**5190**	**5050**	**4900**	**4510**	**4170**	**705**	*330*	**1.1**	*0.5*
106L		**6710**	**6520**	**6330**	**5820**	**5380**	**680**	*320*	**1.5**	*0.7*
207L	2	**7590**	**7370**	**7160**	**6590**	**6090**	**1500**	*710*	**1.3**	*0.6*
209L		**9950**	**9670**	**9390**	**8640**	**7980**	**1410**	*670*	**1.4**	*0.6*
211L		**11980**	**11600**	**11300**	**10400**	**9610**	**1360**	*640*	**2.0**	*0.9*
314L	3	**14730**	**14300**	**13900**	**12800**	**11800**	**2115**	*1000*	**3.0**	*1.4*
316L		**17170**	**16700**	**16200**	**14900**	**13800**	**2040**	*960*	**4.0**	*1.8*
418L	4	**19500**	**19000**	**18400**	**16900**	**15600**	**2820**	*1330*	**3.3**	*1.5*
421L		**22470**	**21800**	**21200**	**19500**	**18000**	**2720**	*1280*	**3.9**	*1.8*
526L	5	**27670**	**26900**	**26100**	**24000**	**22200**	**3400**	*1600*	**6.5**	*2.9*
631L	6	**32970**	**32000**	**31100**	**28600**	**26400**	**4080**	*1930*	**7.8**	*3.5*

- Capacities at other TD within a range of 8 to 15 °F *(4.4 to 8.3°C)* are directly proportional to TD, or use formula:
Capacity = Rated capacity ÷ 10 x TD.
** For R448A/R449A, use conversion factor 0.96

R404A **R507**

Low Temperature - 6 FPI Models

Model TPLP	Qty. Fans	Evaporator Temperature Selection Capacity BTU/h					Air Flow		Refrig. Charge R404A R507	
		0°F *(-18°C)*	-10°F *(-23°C)*	-20°F *(-29°C)*	-30°F *(-34°C)*	-40°F *(-40°C)*	CFM	L/S	LB.	*KG*
104L	1	**4210**	**4090**	**3970**	**3650**	**3370**	**750**	*350*	**0.6**	*0.3*
105L		**5070**	**4920**	**4780**	**4400**	**4060**	**705**	*330*	**1.0**	*0.5*
106L		**6540**	**6360**	**6170**	**5680**	**5240**	**680**	*320*	**1.4**	*0.6*
207L	2	**7400**	**7190**	**6980**	**6420**	**5930**	**1500**	*710*	**1.2**	*0.5*
209L		**9710**	**9430**	**9160**	**8430**	**7790**	**1410**	*670*	**1.3**	*0.6*
211L		**11660**	**11330**	**11000**	**10120**	**9350**	**1360**	*640*	**1.8**	*0.8*
314L	3	**14420**	**14000**	**13600**	**12500**	**11560**	**2115**	*1000*	**2.8**	*1.3*
316L		**16750**	**16300**	**15800**	**14500**	**13430**	**2040**	*960*	**3.7**	*1.7*
418L	4	**18970**	**18400**	**17900**	**16500**	**15220**	**2820**	*1330*	**3.0**	*1.4*
421L		**21840**	**21200**	**20600**	**19000**	**17510**	**2720**	*1280*	**3.6**	*1.6*
526L	5	**27140**	**26400**	**25600**	**23600**	**21760**	**3400**	*1600*	**6.0**	*2.7*
631L	6	**32220**	**31300**	**30400**	**28000**	**25840**	**4080**	*1930*	**7.2**	*3.3*

The above capacities were rated based on nominal 10°F TD
Capacities at other TD within a range of 8 to 15 °F *(4.4 to 8.3°C)* are directly proportional to TD, or use formula:
Capacity = Rated capacity ÷ 10 x TD.

R407A **R448A** **R449A**

Low Temperature - 4 FPI Models

Model TPLP	Qty. Fans	Evaporator Temperature Selection Capacity BTU/h					Air Flow		Refrig. Charge R407A **	
		0°F *(-18°C)*	-10°F *(-23°C)*	-20°F *(-29°C)*	-30°F *(-34°C)*	-40°F *(-40°C)*	CFM	L/S	LB.	*KG*
103V	1	**3880**	**3770**	**3660**	**3370**	**3110**	**750**	*350*	**0.7**	*0.3*
104V		**4610**	**4480**	**4350**	**4000**	**3700**	**705**	*330*	**1.1**	*0.5*
106V		**5880**	**5720**	**5550**	**5110**	**4720**	**680**	*320*	**1.5**	*0.7*
207V	2	**7070**	**6870**	**6670**	**6140**	**5670**	**1500**	*710*	**1.3**	*0.6*
208V		**8590**	**8340**	**8100**	**7450**	**6890**	**1410**	*670*	**1.4**	*0.6*
211V		**11200**	**10900**	**10600**	**9750**	**9010**	**1360**	*640*	**2.0**	*0.9*
313V	3	**13400**	**13000**	**12600**	**11600**	**10700**	**2115**	*1000*	**3.0**	*1.4*
316V		**16500**	**16100**	**15600**	**14400**	**13300**	**2040**	*960*	**4.0**	*1.8*
418V	4	**18800**	**18200**	**17700**	**16300**	**15000**	**2820**	*1330*	**3.3**	*1.5*
421V		**22300**	**21600**	**21000**	**19300**	**17900**	**2720**	*1280*	**3.9**	*1.8*
524V	5	**25300**	**24600**	**23900**	**22000**	**20300**	**3400**	*1600*	**6.5**	*2.9*
627V	6	**28400**	**27600**	**26800**	**24700**	**22800**	**4080**	*1930*	**7.8**	*3.5*

- Capacities at other TD within a range of 8 to 15 °F *(4.4 to 8.3°C)* are directly proportional to TD, or use formula:
Capacity = Rated capacity ÷ 10 x TD.

** For R448A/R449A, use conversion factor 0.96

R404A **R507**

Low Temperature - 4 FPI Models

Model TPLP	Qty. Fans	Evaporator Temperature Selection Capacity BTU/h					Air Flow		Refrig. Charge R404A R507	
		0°F *(-18°C)*	-10°F *(-23°C)*	-20°F *(-29°C)*	-30°F *(-34°C)*	-40°F *(-40°C)*	CFM	L/S	LB.	*KG*
103V	1	**3640**	**3530**	**3430**	**3160**	**2920**	**750**	*350*	**0.6**	*0.3*
104V		**4300**	**4180**	**4060**	**3740**	**3450**	**705**	*330*	**1.0**	*0.5*
106V		**5500**	**5350**	**5190**	**4770**	**4410**	**680**	*320*	**1.4**	*0.6*
207V	2	**6600**	**6420**	**6230**	**5730**	**5300**	**1500**	*710*	**1.2**	*0.5*
208V		**8020**	**7800**	**7570**	**6960**	**6430**	**1410**	*670*	**1.3**	*0.6*
211V		**10460**	**10170**	**9870**	**9080**	**8390**	**1360**	*640*	**1.8**	*0.8*
313V	3	**12400**	**12100**	**11700**	**10760**	**9950**	**2115**	*1000*	**2.8**	*1.3*
316V		**15370**	**14900**	**14500**	**13300**	**12330**	**2040**	*960*	**3.7**	*1.7*
418V	4	**17600**	**17100**	**16600**	**15300**	**14110**	**2820**	*1330*	**3.0**	*1.4*
421V		**20880**	**20300**	**19700**	**18100**	**16750**	**2720**	*1280*	**3.6**	*1.6*
524V	5	**23640**	**23000**	**22300**	**20500**	**18960**	**3400**	*1600*	**6.0**	*2.7*
627V	6	**26610**	**25900**	**25100**	**23100**	**21340**	**4080**	*1930*	**7.2**	*3.3*

The above capacities were rated based on nominal 10°F TD

Capacities at other TD within a range of 8 to 15 °F *(4.4 to 8.3°C)* are directly proportional to TD, or use formula:
Capacity = Rated capacity ÷ 10 x TD.

115/1/60: Air Defrost Models

Model TPLP	FPI	FAN MOTORS					
		Qty.	Standard SMARTSPEED® EC Motors				
			HP	FLA Total	Watts	MCA (A)	Max. Fuse (AMPS)
104MA-S1D	6	1	1/15	1.0	60	1.3	15
106MA-S1D		1	1/15	1.0	60	1.3	15
107MA-S1D		1	1/15	1.0	60	1.3	15
209MA-S1D		2	1/15	2.0	120	2.3	15
211MA-S1D		2	1/15	2.0	120	2.3	15
214MA-S1D		2	1/15	2.0	120	2.3	15
317MA-S1D		3	1/15	3.0	180	3.3	15
320MA-S1D		3	1/15	3.0	180	3.3	15
422MA-S1D		4	1/15	4.0	240	4.3	15
427MA-S1D		4	1/15	4.0	240	4.3	15
534MA-S1D		5	1/15	5.0	300	5.3	15
640MA-S1D		6	1/15	6.0	360	6.3	15

208-230/1/60: Air Defrost Models

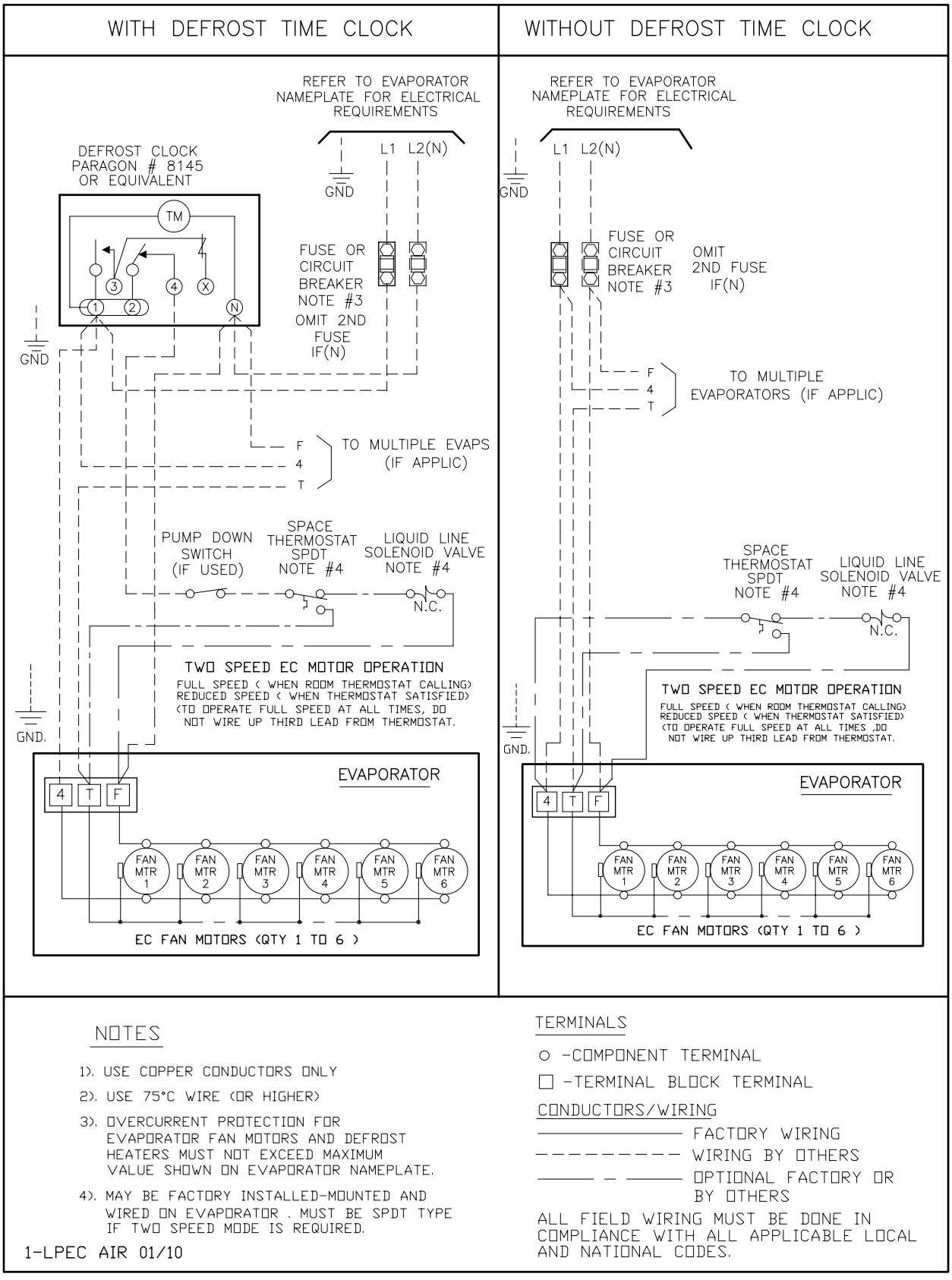
Model TPLP	FPI	FAN MOTORS					
		Qty.	Standard SMARTSPEED® EC Motors				
			HP	FLA Total	Watts	MCA (A)	Max. Fuse (AMPS)
104MA-S2D	6	1	1/15	0.6	60	0.8	15
106MA-S2D		1	1/15	0.6	60	0.8	15
107MA-S2D		1	1/15	0.6	60	0.8	15
209MA-S2D		2	1/15	1.2	120	1.4	15
211MA-S2D		2	1/15	1.2	120	1.4	15
214MA-S2D		2	1/15	1.2	120	1.4	15
317MA-S2D		3	1/15	1.8	180	2.0	15
320MA-S2D		3	1/15	1.8	180	2.0	15
422MA-S2D		4	1/15	2.4	240	2.6	15
427MA-S2D		4	1/15	2.4	240	2.6	15
534MA-S2D		5	1/15	3.0	300	3.2	15
640MA-S2D		6	1/15	3.6	360	3.8	15

208-230/1/60 & 208-230/3/60: Electric Defrost Models

Model TPLP	FPI	FAN MOTORS						Total WATTS	DEFROST HEATERS					
		Qty.	Standard SMARTSPEED EC Motors						208-230/1/60			208-230/3/60		
			HP	FLA Total	Watts	MCA (A)	Max. Fuse (AMPS)		Total AMPS	MCA (A)	Max. Fuse (AMPS)	Total AMPS	MCA (A)	Max. Fuse (AMPS)
104ME-*	6	1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
106ME-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
107ME-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
209ME-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
211ME-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
214ME-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
317ME-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
320ME-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
422ME-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
427ME-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
534ME-*		5	1/15	3.0	300	3.2	15	4400	19.1	23.9	25	12.0	15.0	20
640ME-*		6	1/15	3.6	360	3.8	15	5230	22.7	28.4	30	15.0	18.0	20
104LE-*	6	1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
105LE-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
106LE-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
207LE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
209LE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
211LE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
314LE-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
316LE-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
418LE-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
421LE-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
526LE-*		5	1/15	3.0	300	3.2	15	4400	19.1	23.9	25	12.0	15.0	20
631LE-*		6	1/15	3.6	360	3.8	15	5230	22.7	28.4	30	15.0	18.0	20
103VE-*	4	1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
104VE-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
106VE-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
207VE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
208VE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
211VE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
313VE-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
316VE-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
418VE-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
421VE-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
524VE-*		5	1/15	3.0	300	3.2	15	4400	19.1	23.9	25	12.0	15.0	20
627VE-*		6	1/15	3.6	360	3.8	15	5230	22.7	28.4	30	15.0	18.0	20

*** = S2 or T3. Refer to nomenclature for details.**

115/1/60, 208-230/1/60: Air Defrost Models



NOTES

1). USE COPPER CONDUCTORS ONLY

2). USE 75°C WIRE (OR HIGHER)

3). OVERCURRENT PROTECTION FOR EVAPORATOR FAN MOTORS AND DEFROST HEATERS MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.

4). MAY BE FACTORY INSTALLED-MOUNTED AND WIRED ON EVAPORATOR . MUST BE SPDT TYPE IF TWO SPEED MODE IS REQUIRED.

1-LPEC AIR 01/10

TERMINALS

○ -COMPONENT TERMINAL

□ -TERMINAL BLOCK TERMINAL

CONDUCTORS/WIRING

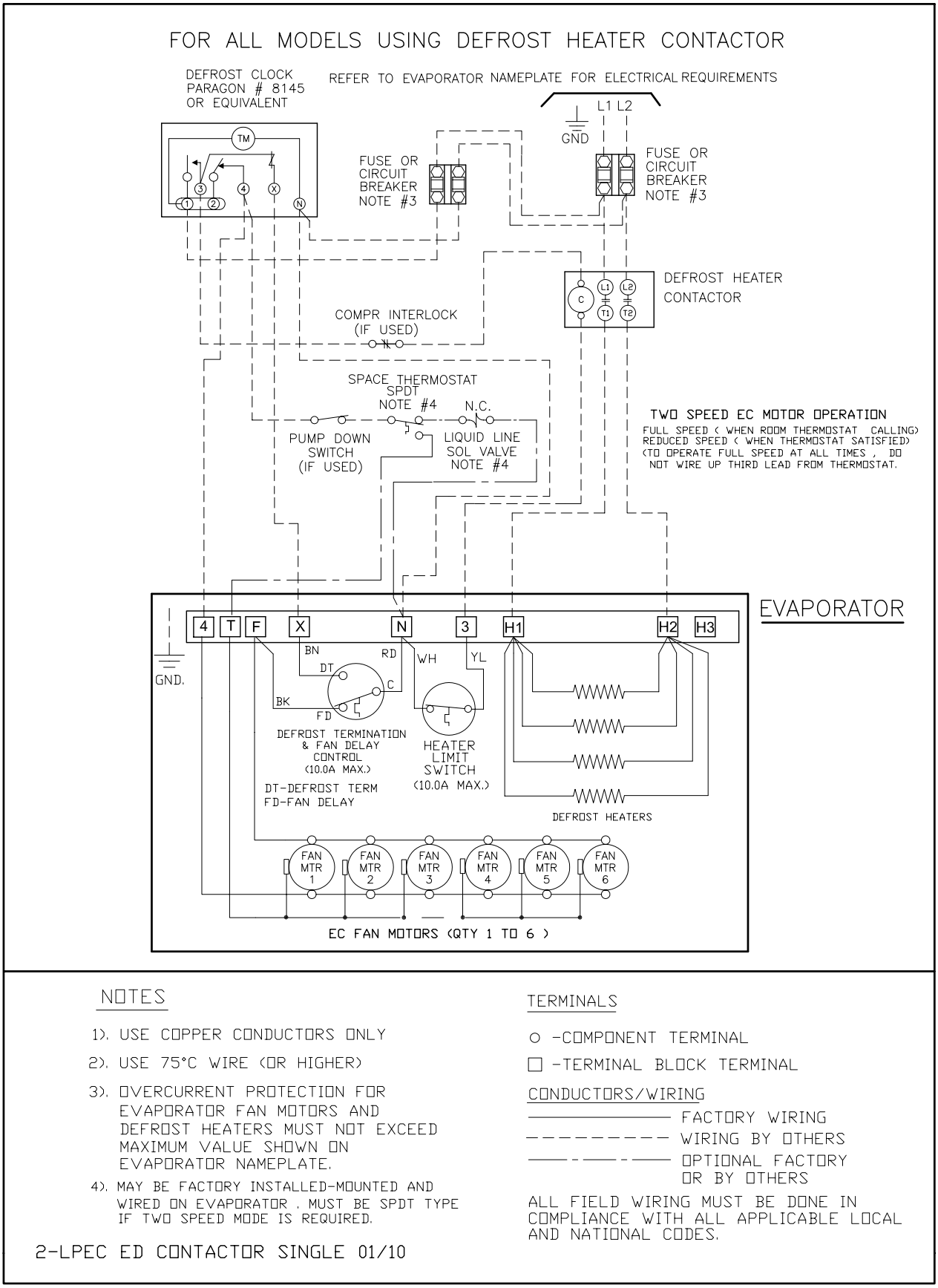
——————— FACTORY WIRING

– – – – – – – – – WIRING BY OTHERS

——— – ——— OPTIONAL FACTORY OR BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

208-230/1/60: Electric Defrost Models



NOTES

1). USE COPPER CONDUCTORS ONLY

2). USE 75°C WIRE (OR HIGHER)

3). OVERCURRENT PROTECTION FOR EVAPORATOR FAN MOTORS AND DEFROST HEATERS MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.

4). MAY BE FACTORY INSTALLED-MOUNTED AND WIRED ON EVAPORATOR . MUST BE SPDT TYPE IF TWO SPEED MODE IS REQUIRED.

2-LPEC ED CONTACTOR SINGLE 01/10

TERMINALS

○ -COMPONENT TERMINAL

□ -TERMINAL BLOCK TERMINAL

CONDUCTORS/WIRING

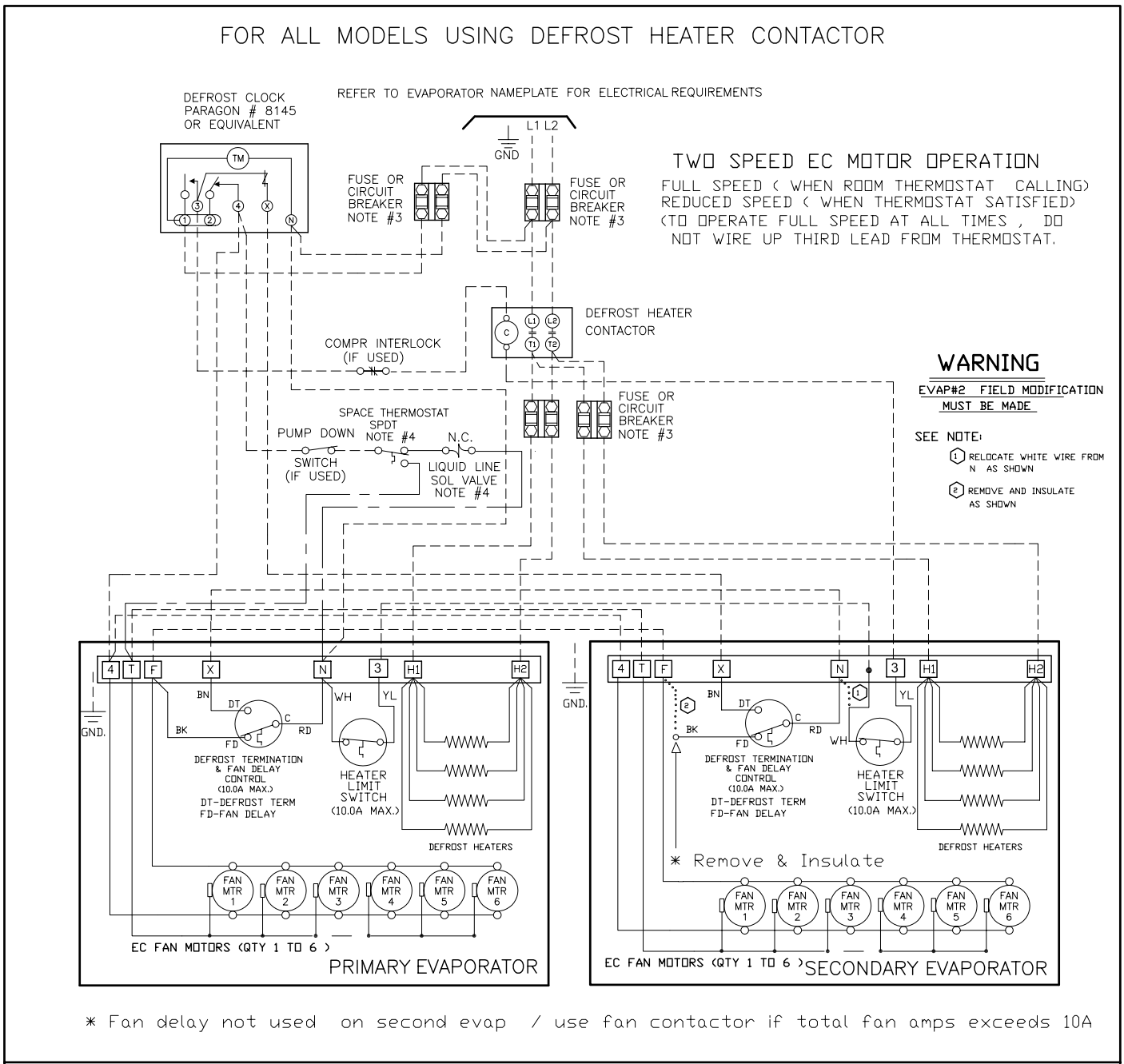
———————— FACTORY WIRING

– – – – – – – – – WIRING BY OTHERS

———-———-——— OPTIONAL FACTORY OR BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

208-230/1/60: Electric Defrost Models with Multiple Evaporators



NOTES

1). USE COPPER CONDUCTORS ONLY

2). USE 75°C WIRE (OR HIGHER)

3). OVERCURRENT PROTECTION FOR EVAPORATOR FAN MOTORS AND DEFROST HEATERS MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.

4). MAY BE FACTORY INSTALLED-MOUNTED AND WIRED ON EVAPORATOR . MUST BE SPDT TYPE IF TWO SPEED MODE IS REQUIRED.

3-LPEC ED CONTACTOR MULTI 01/10

TERMINALS

○ -COMPONENT TERMINAL

□ -TERMINAL BLOCK TERMINAL

CONDUCTORS/WIRING

———————— FACTORY WIRING

- - - - - - - - - - - - WIRING BY OTHERS

——— – ——— OPTIONAL FACTORY OR BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

ESP+ INTUITIVE EVAPORATOR CONTROL TECHNOLOGY

What is ESP+?
Trenton Refrigeration's ESP+ intuitive evaporator control technology is designed to replace traditional electro-mechanical refrigeration controls typically used on medium and low temperature applications. By combining award winning adaptive technology along with an electronic expansion valve, Trenton Refrigeration continues Leading The Way with innovative, state-of-the-art designs.

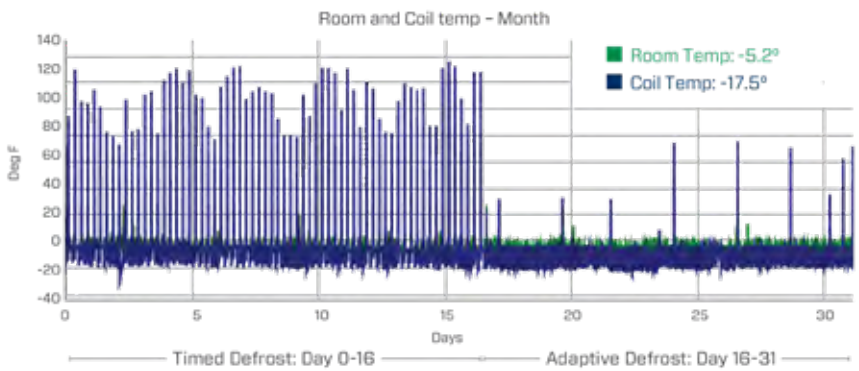
Installing an evaporator utilizing the ESP+ intuitive evaporator control technology is simple. Two pipes, two wires and you're done. No interconnecting control wiring between the evaporator and the condensing unit is required.

- Quick simple installation
- Improved evaporator performance by minimizing excessive frost on the evaporator
- Eliminates ice build up on surfaces and product
- Energy savings through evaporator fan management
- Energy savings with reduction in the number of defrost cycles
- Defrost heater management
- Improved system diagnostics and service through advanced alarm notification text/email
- Remote monitoring & system control
- User friendly interface
- Precise temperature control for prolonged product shelf life
- Improved product integrity with less potential for spoilage
- Downloadable data provides system history for prior 30 days
- Remotely view and change system parameters and alarm settings
- Manually control system
- Easily troubleshoot issues

ESP+ controls:
- Box Temperature - Superheat - Liquid Line Solenoid
- Defrost Initiation - Defrost Termination - Fan Motors
- Defrost Heater (Electric Defrost Models)

Plus - User can access operating data directly from the system interface

15-20% System Energy Savings over a Properly Commissioned System!



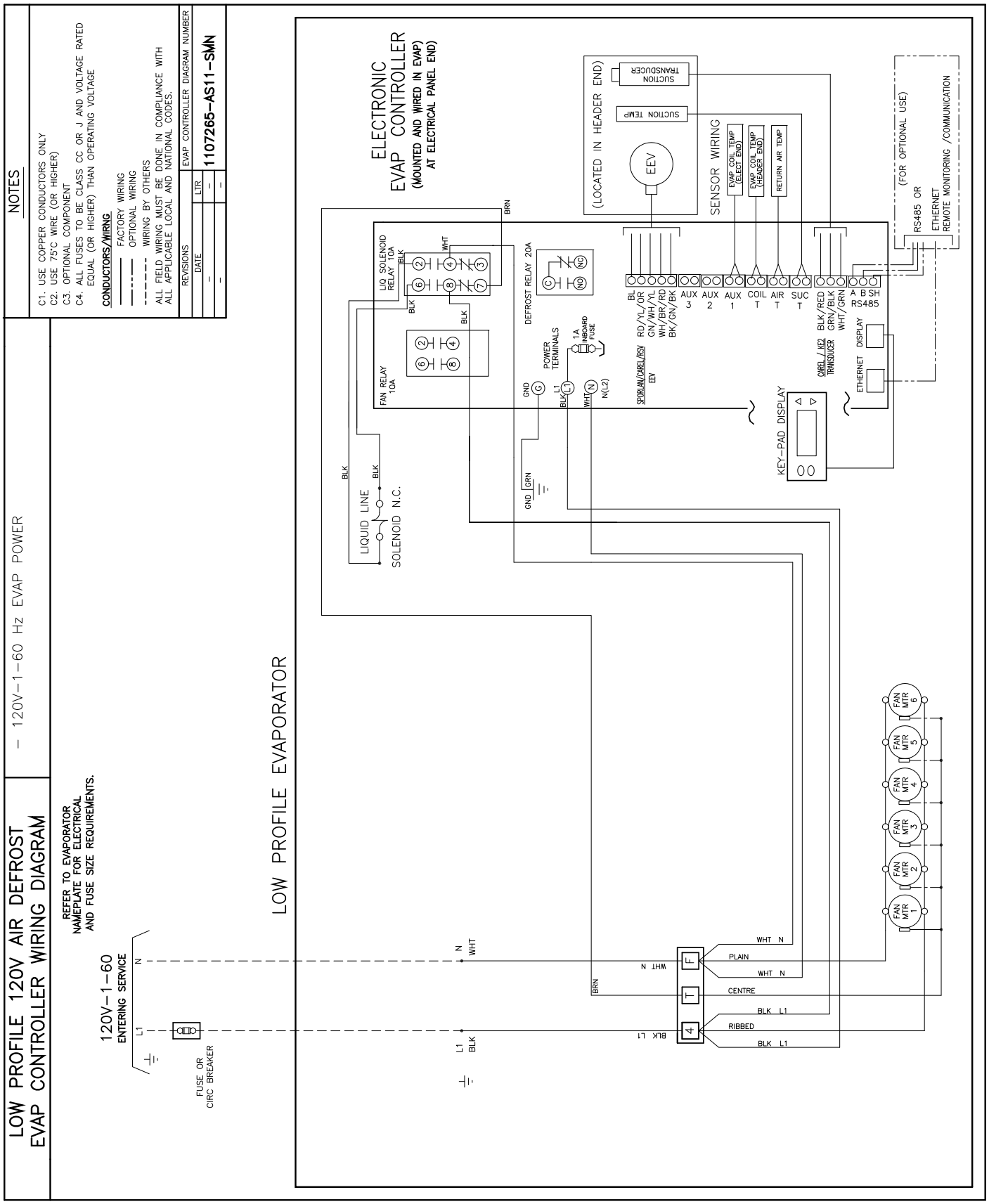
86% Fewer Defrost Cycles*

- Enhanced system performance
- Energy Savings
- Improved product integrity

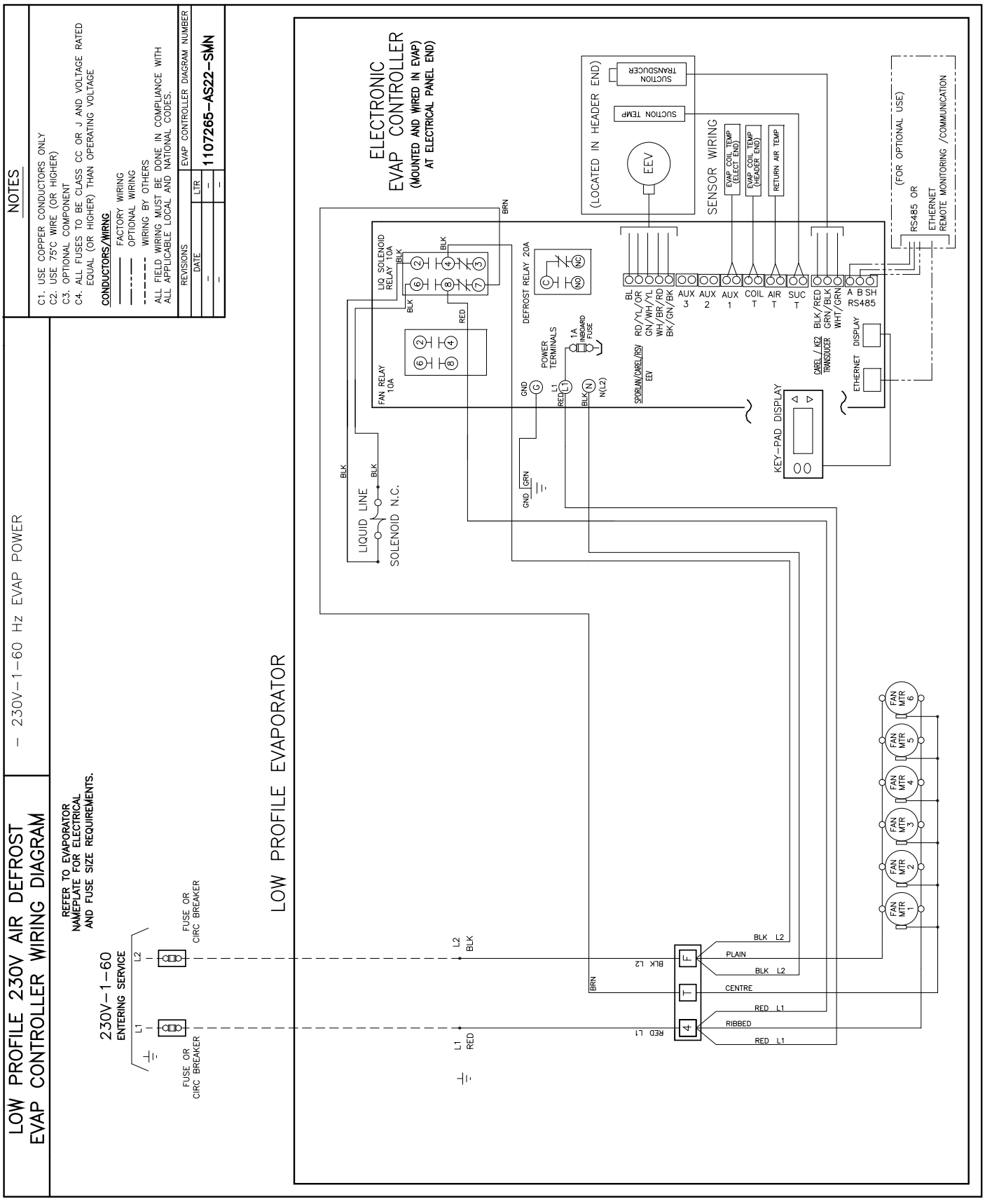
* Data may vary depending on application

Visit www.t-rp.com/esp for details

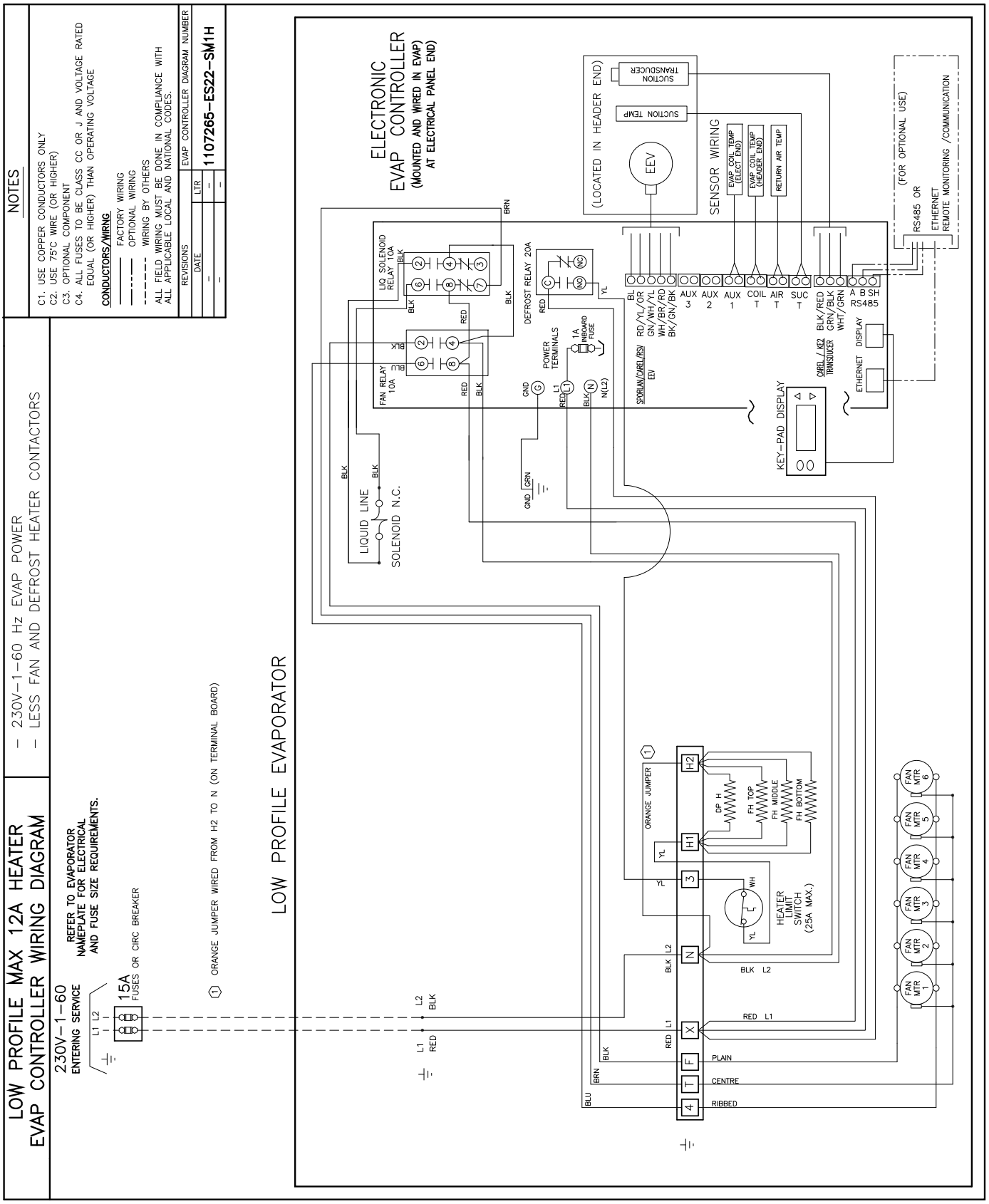
115/1/60: Air Defrost Models with ESP+



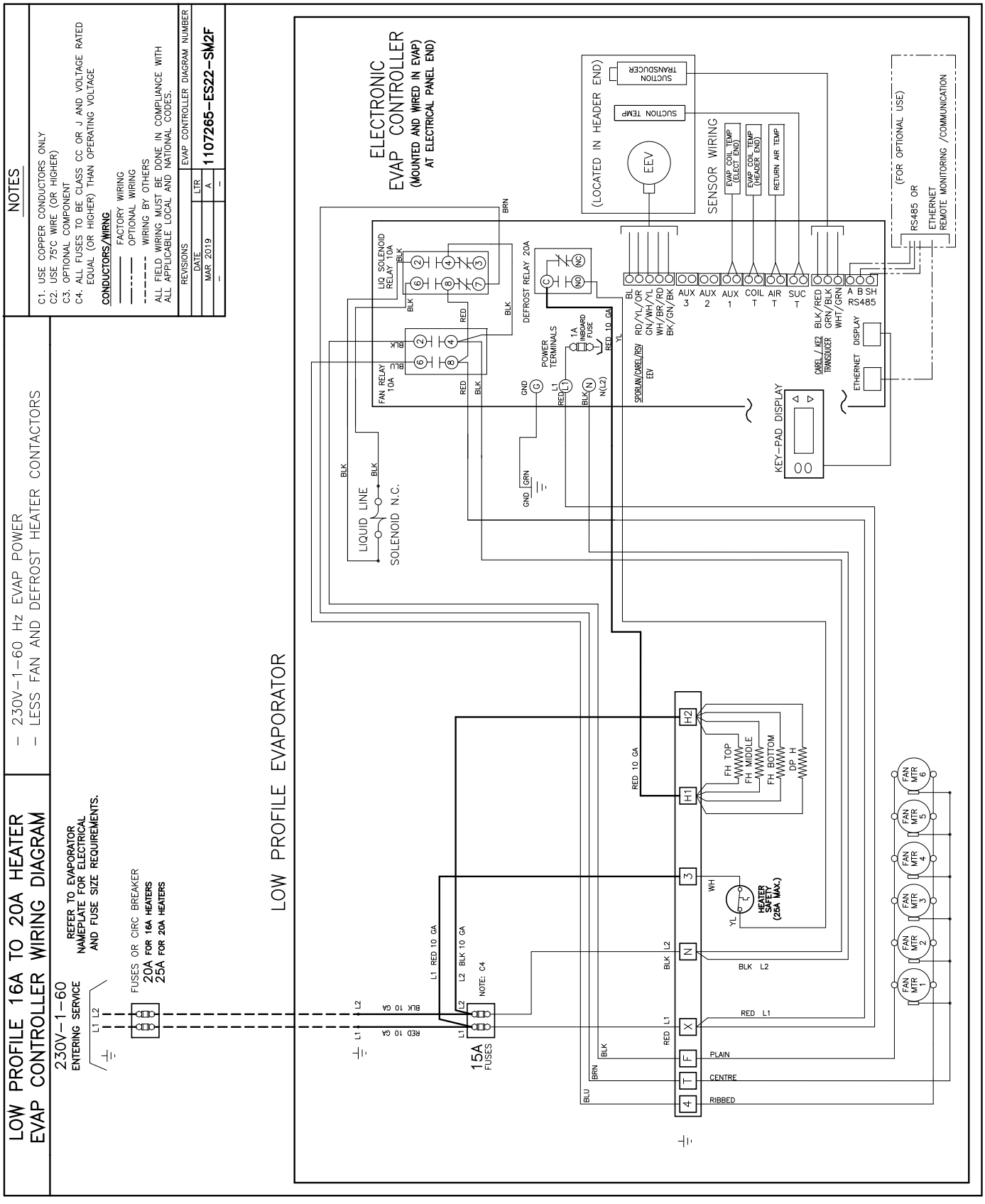
208-230/1/60: Air Defrost Models with ESP+



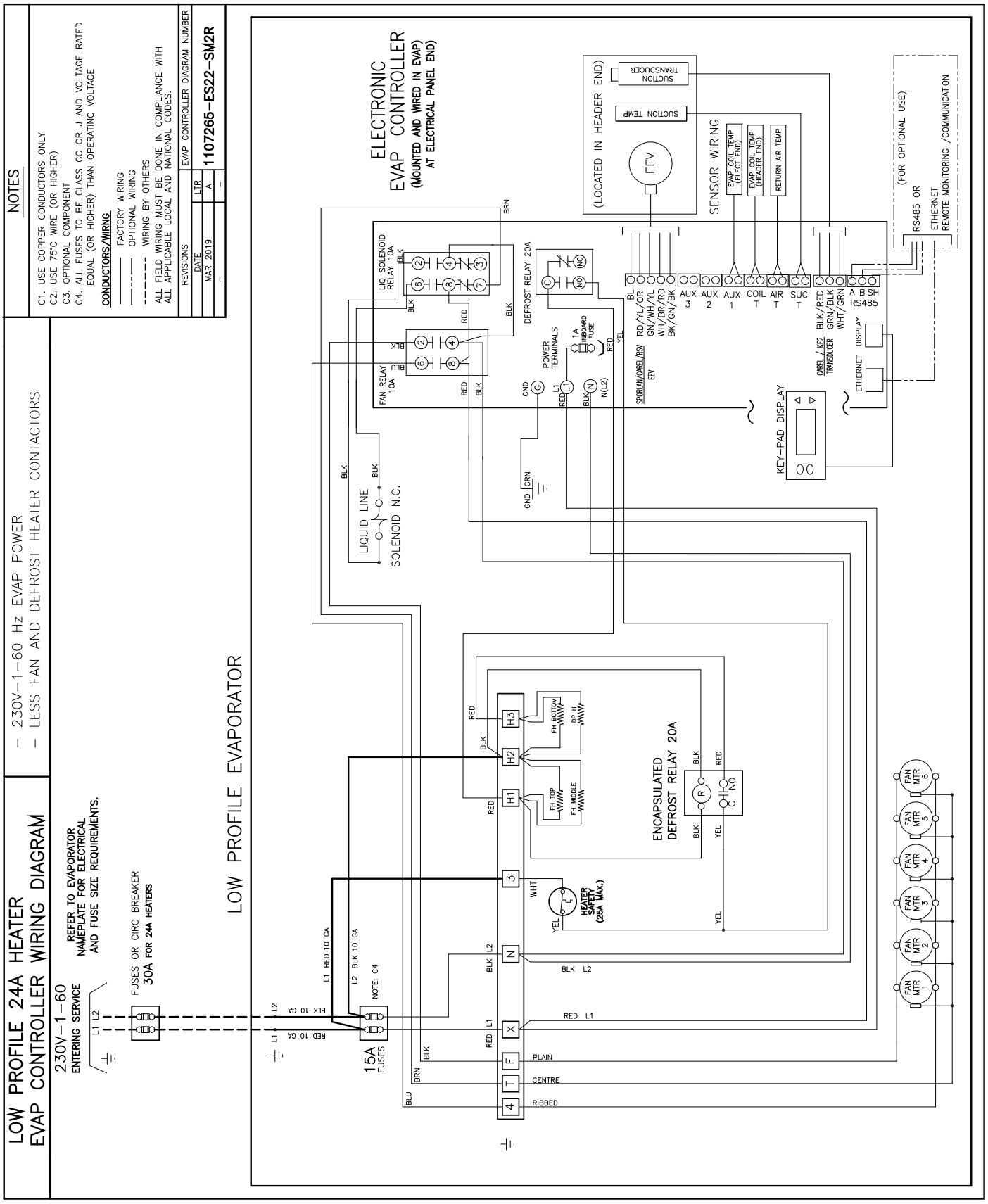
208-230/1/60: 1-3 Fan Electric Defrost Models with ESP+ Max.12A



208-230/1/60: 4-5 Fan Electric Defrost Models with ESP+ 16A to 20A



208-230/1/60: 6 Fan Electric Defrost Models with ESP+24A



Annual Walk-In Energy Factor Ratings - Medium Temperature

If a numerical value is listed in the table below, the following statement applies to that corresponding model: "This refrigeration system is designed and certified for use in walk-in cooler applications."

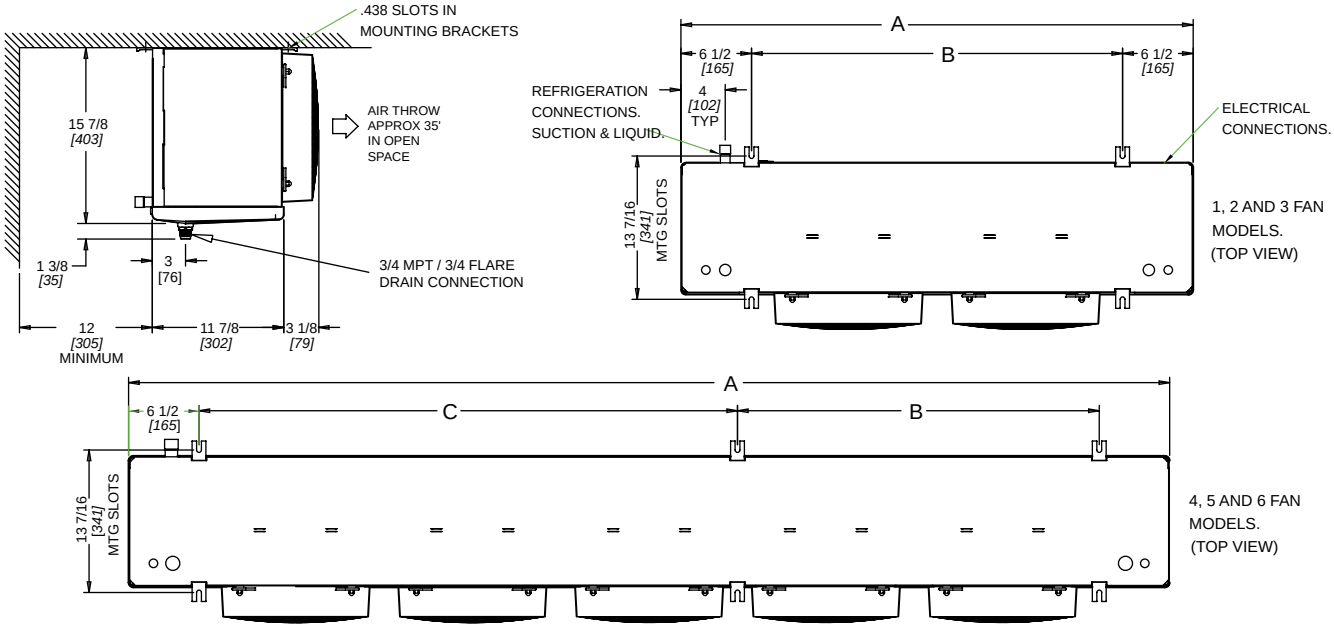
Model TPLP	R404A R507	R407A R407C	R448A R449A
104M	9.00	9.00	9.00
106M	9.00	9.00	9.00
107M	9.00	9.00	9.00
209M	9.00	9.00	9.00
211M	9.00	9.00	9.00
214M	9.00	9.00	9.00
317M	9.00	9.00	9.00
320M	9.00	9.00	9.00
422M	9.00	9.00	9.00
427M	9.00	9.00	9.00
534M	9.00	9.00	9.00
640M	9.00	9.00	9.00

Annual Walk-In Energy Factor Ratings - Low Temperature

If a numerical value is listed in the table below, the following statement applies to that corresponding model: "This refrigeration system is designed and certified for use in walk-in freezer applications."

Model TPLP	R404A R507	R407A	R448A R449A
104L	3.96	3.96	3.96
105L	3.97	3.97	3.97
106L	3.99	3.99	3.99
207L	3.99	3.99	3.99
209L	4.02	4.02	4.02
211L	4.04	4.04	4.04
314L	4.07	4.07	4.07
316L	4.10	4.10	4.10
418L	4.13	4.13	4.13
421L	4.15	4.15	4.15
526L	4.15	4.15	4.15
631L	4.15	4.15	4.15

Model TPLP	R404A R507	R407A	R448A R449A
103V	3.95	3.95	3.95
104V	3.96	3.96	3.96
106V	3.98	3.98	3.98
207V	3.99	3.99	3.99
208V	4.01	4.01	4.01
211V	4.04	4.04	4.04
313V	4.06	4.06	4.06
316V	4.10	4.10	4.10
418V	4.13	4.13	4.13
421V	4.15	4.15	4.15
524V	4.15	4.15	4.15
627V	4.15	4.15	4.15



MODEL TPLP	NO. OF FANS	A		B		C		SUCTION CONNECTION (ID) SWEAT
		IN	*mm*	IN	*mm*	IN	*mm*	
104M	1	30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
106M		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
107M		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
209M	2	46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
211M		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
214M		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
317M	3	62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	7/8
320M		62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	7/8
422M	4	78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
427M		78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
534M	5	94 1/4	*2394*	32 5/8	*829*	48 5/8	*1235*	1 3/8
640M	6	110 1/4	*2800*	48 5/8	*1235*	48 5/8	*1235*	1 3/8
104L	1	30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
105L		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
106L		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
207L	2	46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
209L		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
211L		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
314L	3	62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	7/8
316L		62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	1 1/8
418L	4	78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
421L		78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
526L	5	94 1/4	*2394*	32 5/8	*829*	48 5/8	*1235*	1 3/8
631L	6	110 1/4	*2800*	48 5/8	*1235*	48 5/8	*1235*	1 3/8
103V	1	30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
104V		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
106V		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
207V	2	46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
208V		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
211V		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
313V	3	62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	7/8
316V		62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	1 1/8
418V	4	78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
421V		78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
524V	5	94 1/4	*2394*	32 5/8	*829*	48 5/8	*1235*	1 3/8
627V	6	110 1/4	*2800*	48 5/8	*1235*	48 5/8	*1235*	1 3/8

Air Defrost Models

MODEL NUMBER TPLP							SHIPPING WEIGHT	
							LB.	*kg*
104MA							45	*20*
106MA	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	47	*21*
107MA							49	*22*
209MA	**209MT**	**209MG**	**207LG**	**207LT**	**207VG**	**207VT**	70	*32*
211MA	**211MT**	**211MG**	**209LG**	**209LT**	**208VG**	**208VT**	74	*33*
214MA	**214MT**	**214MG**	**211LG**	**211LT**	**211VG**	**211VT**	78	*35*
317MA	**317MT**	**317MG**	**314LG**	**314LT**	**313VG**	**313VT**	101	*46*
320MA	**320MT**	**320MG**	**316LG**	**316LT**	**316VG**	**316VT**	107	48
422MA	**422MT**	**422MG**	**418LG**	**418LT**	**418VG**	**418VT**	117	*53*
427MA	**427MT**	**427MG**	**421LG**	**421LT**	**421VG**	**421VT**	135	*61*
534MA	**534MT**	**534MG**	**526LG**	**526LT**	**524VG**	**524VT**	163	*74*
640MA	**640MT**	**640MG**	**631LG**	**631LT**	**627VG**	**627VT**	192	*87*

Electric Defrost Models

MODEL NUMBER TPLP			SHIPPING WEIGHT	
			LB.	*kg*
104ME	**104LE**	**103VE**	49	*22*
106ME	**105LE**	**104VE**	51	*23*
107ME	**106LE**	**106VE**	53	*24*
209ME	**207LE**	**207VE**	76	*35*
211ME	**209LE**	**208VE**	80	*36*
214ME	**211LE**	**211VE**	84	*38*
317ME	**314LE**	**313VE**	109	*49*
320ME	**316LE**	**316VE**	115	52
422ME	**418LE**	**418VE**	127	*58*
427ME	**421LE**	**421VE**	145	*66*
534ME	**526LE**	**524VE**	176	*80*
640ME	**631LE**	**627VE**	207	*94*

FACTORY INSTALLED THERMAL EXPANSION VALVE SELECTIONS

Medium Temperature Models

Model TPLP	R404A R507		R407A R407C R448A R449A	
	SPORLAN	SOLENOID VALVES	SPORLAN	SOLENOID VALVES
104MA-S1D	EBQSE-AA-C	3	EBQVE-AAA-C	3
106MA-S1D	EBQSE-A-C	3	EBQVE-AA-C	3
107MA-S1D	EBQSE-A-C	3	EBQVE-AA-C	3
209MA-S1D	EBQSE-A-C	3	EBQVE-A-C	3
211MA-S1D	EBQSE-B-C	3	EBQVE-A-C	3
214MA-S1D	EBQSE-B-C	5	EBQVE-A-C	3
317MA-S1D	EBQSE-B-C	5	EBQVE-A-C	3
320MA-S1D	EBQSE-B-C	5	EBQVE-B-C	5
422MA-S1D	EBQSE-C-C	6	EBQVE-B-C	5
427MA-S1D	EBQSE-C-C	6	EBQVE-B-C	5
534MA-S1D	EBSSE-6-C	6	EBQVE-C-C	6
640MA-S1D	EBSSE-6-C	6	EBQVE-C-C	6

Above selections based on: 1) 100°F (38°C) vapor free liquid entering expansion valve, 2) 110°F (43°C) condensing temperature, 3) 9-12°F (4.4-6.7C) evaporator TD

Low Temperature 6FPI Models

Model TPLP	R404A R507		R407A R448A R449A	
	SPORLAN	SOLENOID VALVES	SPORLAN	SOLENOID VALVES
104LE-S2D	EBQSE-AA-ZP	3	EBQVE-AA-ZP	3
105LE-S2D	EBQSE-A-ZP	3	EBQVE-AA-ZP	3
106LE-S2D	EBQSE-A-ZP	3	EBQVE-AA-ZP	3
207LE-S2D	EBQSE-A-ZP	3	EBQVE-A-ZP	3
209LE-S2D	EBQSE-A-ZP	3	EBQVE-A-ZP	3
211LE-S2D	EBQSE-B-ZP	3	EBQVE-A-ZP	3
314LE-S2D	EBQSE-B-ZP	5	EBQVE-B-ZP	3
316LE-S2D	EBQSE-C-ZP	5	EBQVE-B-ZP	5
418LE-S2D	EBQSE-C-ZP	5	EBQVE-B-ZP	5
421LE-S2D	EBQSE-C-ZP	6	EBQVE-C-ZP	5
526LE-S2D	EBSSE-6-ZP	6	EBQVE-C-ZP	5
631LE-S2D	EBSSE-6-ZP	6	EBQVE-C-ZP	6

Above selections based on: 1) 100°F (38°C) vapor free liquid entering expansion valve, 2) 110°F (43°C) condensing temperature, 3) 9-12°F (4.4-6.7C) evaporator TD

Low Temperature 4FPI Models

Model TPLP	R404A R507		R407A R448A R449A	
	SPORLAN	SOLENOID VALVES	SPORLAN	SOLENOID VALVES
103VE-S2D	EBQSE-AA-ZP	3	EBQVE-AA-ZP	3
104VE-S2D	EBQSE-AA-ZP	3	EBQVE-AA-ZP	3
106VE-S2D	EBQSE-A-ZP	3	EBQVE-AA-ZP	3
207VE-S2D	EBQSE-A-ZP	3	EBQVE-A-ZP	3
208VE-S2D	EBQSE-A-ZP	3	EBQVE-A-ZP	3
211VE-S2D	EBQSE-A-ZP	3	EBQVE-A-ZP	3
313VE-S2D	EBQSE-B-ZP	5	EBQVE-B-ZP	3
316VE-S2D	EBQSE-B-ZP	5	EBQVE-B-ZP	3
418VE-S2D	EBQSE-C-ZP	5	EBQVE-B-ZP	3
421VE-S2D	EBQSE-C-ZP	6	EBQVE-B-ZP	5
524VE-S2D	EBSSE-6-ZP	6	EBQVE-C-ZP	5
627VE-S2D	EBSSE-6-ZP	6	EBQVE-C-ZP	5

Above selections based on: 1) 100°F (38°C) vapor free liquid entering expansion valve, 2) 110°F (43°C) condensing temperature, 3) 9-12°F (4.4-6.7C) evaporator TD

FACTORY INSTALLED EXPANSION VALVE SELECTIONS

Models with ESP+

Medium Temperature Air Or Electric Defrost All Refrigerants

MODEL TPLP	FACTORY INSTALLED NOZZLE	FACTORY INSTALLED EXPANSION VALVE	FACTORY INSTALLED LIQUID LINE SOLENOID VALVE
104M* **	N/A	E2V9	E3
106M* **	L1/2	E2V11	E3
107M* **	L1/2	E2V14	E3
209M* **	L3/4	E2V14	E3
211M* **	L1	E2V14	E3
214M* **	L1	E2V18	E3
317M* **	L1-1/2	E2V18	E5
320M* **	L1-1/2	E2V24	E5
422M* **	L2	E2V24	E5
427M* **	L2	E2V24	E5
534M* **	L2-1/2	E2V35	E6
640M* **	G3	E2V35	E6

*** Insert Air or Electric Defrost type. See nomenclature for details.

Low Temperature Electric Defrost 6 FPI All Refrigerants

MODEL TPLP	FACTORY INSTALLED NOZZLE	FACTORY INSTALLED EXPANSION VALVE	FACTORY INSTALLED LIQUID LINE SOLENOID VALVE
104LE	L1/2	E2V9	E3
105LE	L3/4	E2V9	E3
106LE	L1	E2V11	E3
207LE	L1	E2V11	E3
209LE	L1-1/2	E2V11	E3
211LE	L2	E2V14	E3
314LE	L2	E2V14	E5
316LE	L3	E2V18	E5
418LE	L3	E2V18	E5
421LE	G4	E2V24	E5
526LE	G4	E2V24	E6
631LE	G5	E2V24	E6

Low Temperature Electric Defrost 4 FPI All Refrigerants

MODEL TPLP	FACTORY INSTALLED NOZZLE	FACTORY INSTALLED E2V EXPANSION VALVE	FACTORY INSTALLED LIQUID LINE SOLENOID VALVE
103VE	L1/2	E2V9	E3
104VE	L3/4	E2V9	E3
106VE	L1	E2V9	E3
207VE	L1	E2V11	E3
208VE	L1-1/2	E2V11	E3
211VE	L2	E2V11	E3
313VE	L2	E2V14	E3
316VE	L2-1/2	E2V14	E5
418VE	J2-1/2	E2V18	E5
421VE	G3	E2V18	E5
524VE	G4	E2V24	E5
627VE	G5	E2V24	E6

Medium Temperature, 6 FPI

TEMP	FPI	# of Fans	Model TPLP	Voltage	1 X EVAPORATOR		2 X EVAPORATOR	
					Defrost Kit	Fuse Package	Defrost Kit	Fuse Package
ME - MEDIUM TEMPERATURE	6	1	**104ME-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			104ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			106ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			106ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			107ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			107ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		2	**209ME-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			209ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			211ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			211ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			214ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			214ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		3	**317ME-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			317ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			320ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			320ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		4	**422ME-S2D**	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			422ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			427ME-S2D	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			427ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		5	**534ME-S2D**	208-230/1/60	DFK-02	FP-007	DFK-06	FP-010
			534ME-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019
		6	**640ME-S2D**	208-230/1/60	DFK-02	FP-020	DFK-09	FP-021
			640ME-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019

Low Temperature, 6 FPI

TEMP	FPI	# of Fans	Model TPLP	Voltage	1 X EVAPORATOR		2 X EVAPORATOR	
					Defrost Kit	Fuse Package	Defrost Kit	Fuse Package
LE - LOW TEMPERATURE	6	1	**104LE-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			104LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			105LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			105LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			106LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			106LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		2	**207LE-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			207LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			209LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			209LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			211LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			211LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		3	**314LE-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			314LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			316LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			316LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		4	**418LE-S2D**	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			418LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			421LE-S2D	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			421LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		5	**526LE-S2D**	208-230/1/60	DFK-02	FP-007	DFK-06	FP-010
			526LE-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019
		6	**631LE-S2D**	208-230/1/60	DFK-02	FP-020	DFK-09	FP-021
			631LE-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019

Low Temperature, 4 FPI

TEMP	FPI	# of Fans	Model TPLP	Voltage	1 X EVAPORATOR		2 X EVAPORATOR	
					Defrost Kit	Fuse Package	Defrost Kit	Fuse Package
VE - LOW TEMPERATURE	4	1	**103VE-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			103VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			104VE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			104VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			106VE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			106VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		2	**207VE-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			207VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			208VE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			208VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			211VE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			211VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		3	**313VE-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			313VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			316VE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			316VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		4	**418VE-S2D**	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			418VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			421VE-S2D	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			421VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		5	**524VE-S2D**	208-230/1/60	DFK-02	FP-007	DFK-06	FP-010
			524VE-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019
		6	**627VE-S2D**	208-230/1/60	DFK-02	FP-020	DFK-09	FP-021
			627VE-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019

For info on matched Trenton condensing units, visit www.t-rp.com/cu

Defrost Kit & Fuse Package Online Selection Tool:

www.t-rp.com/dfk

Defrost Kits

Number of Evaps.	Kit Part Number	Description
1	**DFK-01**	Time Clock, HtrCont - 1x 40A (3P), FB 1x 30A (1P)
1	**DFK-02**	Time Clock, HtrCont - 1x 40A (3P), FB 1x 30A (2P)
1	**DFK-03**	Time Clock, HtrCont - 1x 40A (3P), FB 1x 30A (3P)
1	**DFK-04**	Time Clock, HtrCont - 1x 40A (3P), FB 1x 60A (2P)
2	**DFK-05**	Time Clock, HtrCont - 1x 40A (3P), FB 2x 30A (1P)
2	**DFK-06**	Time Clock, HtrCont - 1x 40A (3P), FB 2x 30A (2P)
2	**DFK-07**	Time Clock, HtrCont - 1x 40A (3P), FB 2x 30A (3P)
2	**DFK-08**	Time Clock, HtrCont - 1x 50A (3P), FB 2x 60A (2P)
2	**DFK-09**	Time Clock, HtrCont - 1x 50A (3P), FB 2x 30A (2P)
1	**DFK-10**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P)
1	**DFK-11**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (3P)
2	**DFK-12**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 4x 30A (2P)
2	**DFK-13**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 4x 30A (3P)
1	**DFK-14**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (2P), FB 1x 30A (3P)
1	**DFK-15**	Time Clock, HtrCont - 1x40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (2P), FB 1x 60A (2P)
1	**DFK-16**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (2P), FB 1x 60A (3P)
1	**DFK-17**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (3P), FB 1x 60A (3P)
2	**DFK-18**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 2x 30A (3P)
2	**DFK-19**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 4x 30A (2P)
2	**DFK-20**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 4x 30A (3P)
1	**DFK-21**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 1x 30A (2P), FB 1x 60A (2P)
1	**DFK-22**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 1x 30A (3P), FB 1x 60A (3P)
2	**DFK-23**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 2x 30A (3P)
2	**DFK-24**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 2x 30A (3P), FB 2x 60A (3P)
1	**DFK-25**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (2P), FB 2x 60A (2P)
1	**DFK-26**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (3P), FB 2x 60A (3P)
2	**DFK-27**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 2x 60A (2P)
2	**DFK-28**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 2x 60A (3P)
2	**DFK-29**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (3P), FB 2x 60A (3P)
2	**DFK-30**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 50A (3P), FB 2x 30A (2P), FB 2x 60A (3P)
1	**DFK-31**	Time Clock, HtrCont - 2x 50A (3P), FanCont - 1x 40A (3P), FB 1x 30A (3P), FB 2x 60A (3P)
2	**DFK-32**	Time Clock, HtrCont - 2x 50A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 2x 60A (2P)
2	**DFK-33**	Time Clock, HtrCont - 2x 50A (3P), FanCont - 1x 40A (3P), FB 2x 30A (3P), FB 2x 60A (3P)
2	**DFK-34**	Time Clock, HtrCont - 4x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 4x 60A (2P)
2	**DFK-35**	Time Clock, HtrCont - 4x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (3P), FB 4x 60A (3P)
2	**DFK-36**	Time Clock, HtrCont - 4x 40A (3P), FanCont - 1x 50A (3P), FB 2x 30A (2P), FB 4x 60A (2P)
2	**DFK-37**	Time Clock, HtrCont - 4x 40A (3P), FanCont - 1x 50A (3P), FB 2x 30A (3P), FB 4x 60A (3P)
2	**DFK-38**	Time Clock, HtrCont - 4x 50A (3P), FanCont - 1x 50A (3P), FB 2x 30A (3P), FB 4x 60A (3P)
1	**DFK-39**	Time Clock, HtrCont1 - 1x 40A (3P), HtrCont2 - 2x 50A (3P), FanCont - 1x 40A (3P), FB 4x 60A (3P)

NOTE: HtrCont = Heater Contactor, FanCont = Fan Contactor, FB = Fuse Block, (1P), (2P), (3P) = Number of Poles

Fuse Packages

Package Part Number	Description
FP-001	FUSES (1) 15AMP
FP-002	FUSES (1) 20AMP
FP-003	FUSES (1) 25AMP
FP-004	FUSES (2) 15AMP
FP-006	FUSES (2) 20AMP
FP-007	FUSES (2) 25AMP
FP-008	FUSES (4) 15AMP
FP-010	FUSES (4) 25AMP
FP-012	FUSES (2) 35AMP
FP-013	FUSES (3) 15AMP
FP-014	FUSES (3) 20AMP
FP-015	FUSES (4) 20AMP
FP-016	FUSES (4) 20AMP (6) 45AMP
FP-017	FUSES (4) 35AMP
FP-018	FUSES (6) 15AMP
FP-019	FUSES (6) 20AMP
FP-020	FUSES (2) 30AMP
FP-021	FUSES (4) 30AMP
FP-022	FUSES (8) 15AMP
FP-023	FUSES (2) 25AMP (3) 50AMP
FP-024	FUSES (2) 20AMP (3) 45AMP
FP-025	FUSES (6) 20AMP (6) 60AMP
FP-026	FUSES (6) 15AMP (12) 40AMP
FP-027	FUSES (6) 15AMP (6) 40AMP
FP-028	FUSES (6) 20AMP (12) 40AMP
FP-029	FUSES (6)15AMP (6) 50AMP
FP-030	FUSES (6) 15AMP (6) 45AMP
FP-031	FUSES (6) 15AMP (6) 35AMP
FP-032	FUSES (6) 15AMP (6) 30AMP
FP-033	FUSES (6) 25AMP (12) 50AMP
FP-034	FUSES (6) 20AMP (12) 35AMP
FP-035	FUSES (4) 25AMP (6) 50AMP
FP-036	FUSES (6) 25AMP (12) 60AMP
FP-037	FUSES (6) 20AMP (12) 60AMP
FP-038	FUSES (6) 20AMP (12) 50AMP
FP-039	FUSES (6) 20AMP (12) 45AMP
FP-040	FUSES (6) 15AMP (12) 45AMP
FP-041	FUSES (5) 15AMP
FP-042	FUSES (10) 15AMP
FP-043	FUSES (3) 25AMP (6) 60AMP
FP-044	FUSES (3) 20AMP (6) 60AMP
FP-045	FUSES (3) 20AMP (6) 50AMP
FP-046	FUSES (3) 25AMP (6) 45AMP
FP-047	FUSES (3) 15AMP (6) 45AMP
FP-048	FUSES (4) 15AMP (4) 45AMP
FP-049	FUSES (4) 15AMP (4) 40AMP
FP-050	FUSES (3) 15AMP (3) 60AMP
FP-051	FUSES (4) 20AMP (6) 50AMP
FP-052	FUSES (4) 15AMP (6) 45AMP
FP-053	FUSES (4) 15AMP (6) 30AMP

Package Part Number	Description
FP-054	FUSES (3)15AMP (6) 35AMP
FP-055	FUSES (2) 15AMP (2) 45AMP
FP-056	FUSES (2) 15AMP (2) 40AMP
FP-057	FUSES (2) 20AMP (3) 50AMP
FP-058	FUSES (2) 15AMP (3) 45AMP
FP-059	FUSES (2) 15AMP (3) 30AMP
FP-060	FUSES (2) 15AMP (2) 35AMP
FP-061	FUSES (2) 15AMP (2) 50AMP
FP-062	FUSES (2) 15AMP (2) 60AMP
FP-063	FUSES (2) 15AMP (3) 25AMP
FP-064	FUSES (2) 15AMP (3) 35AMP
FP-065	FUSES (2) 15AMP (3) 40AMP
FP-066	FUSES (2) 15AMP (3) 20AMP
FP-067	FUSES (4) 15AMP (4) 35AMP
FP-068	FUSES (4) 15AMP (4) 50AMP
FP-069	FUSES (4) 15AMP (4) 60AMP
FP-070	FUSES (4) 15AMP (6) 25AMP
FP-071	FUSES (4) 15AMP (6) 35AMP
FP-072	FUSES (4) 15AMP (6) 40AMP
FP-073	FUSES (4) 15AMP (6) 20AMP
FP-074	FUSES (3) 20AMP (3) 60AMP
FP-075	FUSES (3) 20AMP (6) 35AMP
FP-076	FUSES (3) 25AMP (6) 50AMP
FP-077	FUSES (3) 35AMP (9) 45AMP
FP-078	FUSES (3) 15AMP (3) 35AMP
FP-079	FUSES (3)15AMP (3) 45AMP
FP-080	FUSES (3) 15AMP (3) 50AMP
FP-081	FUSES (3) 20AMP (6) 40AMP
FP-082	FUSES (3) 15AMP (3) 40AMP
FP-083	FUSES (3) 15AMP (6) 40AMP
FP-084	FUSES (6) 15AMP (6) 60AMP
FP-085	FUSES (6) 15AMP (12) 35AMP
FP-086	FUSES (3) 35AMP (3) 45AMP (6) 60AMP
FP-087	FUSES (4) 20AMP (4) 40AMP (4) 50AMP
FP-088	FUSES (4) 15AMP (4) 35AMP (4) 40AMP
FP-089	FUSES (2) 20AMP (2) 40AMP (2) 50AMP
FP-090	FUSES (2) 15AMP (2) 35AMP (2) 40AMP
FP-091	FUSES (2) 20AMP (2) 35AMP (2) 40AMP
FP-092	FUSES (2) 25AMP (2) 40AMP (2) 50AMP
FP-093	FUSES (4) 20AMP (4) 35AMP (4) 40AMP
FP-094	FUSES (6) 15AMP (6) 25AMP
FP-095	FUSES (3) 15AMP (3) 25AMP
FP-096	FUSES (3) 15AMP (3) 30AMP
FP-097	FUSES (4) 15AMP (4) 30AMP
FP-098	FUSES (4) 15AMP (4) 25AMP
FP-099	FUSES (4) 15AMP (4) 20AMP
FP-100	FUSES (2) 15AMP (2) 20AMP
FP-101	FUSES (2) 15AMP (2) 25AMP
FP-102	FUSES (2) 15AMP (2) 30AMP
FP-103	FUSES (4) 25AMP (4) 40AMP (4) 50AMP

NOTE: FUSES 30AMP and Below - Class CC Type, FUSES 35AMP and Above - Class J Type

INSTALLATION
The installation and start-up of evaporators should only be performed by qualified refrigeration mechanics.
This equipment should be installed in accordance with all applicable codes, ordinances and local by-laws.

INSPECTION
Inspect all equipment before unpacking for visible signs of damage or loss. Check shipping list against material received to ensure shipment is complete.

IMPORTANT: Remember, you, the consignee, must make any claim necessary against the transportation company. Shipping damage or missing parts, when discovered at the outset, will prevent later unnecessary and costly delays.
If damage or loss during transport is evident, make claim to carrier, as this will be their responsibility, not the manufacturer's.
Should carton be damaged, but damage to equipment is not obvious, a claim should be filed for "concealed damage" with the carrier.

IMPORTANT: The electrical characteristics of the unit should be checked at this time to make sure they correspond to those ordered and to electrical power available at the job site.

Save all shipping papers, tags and instruction sheets for reference by installer and owner.

APPLICATION
TPLP evaporators are designed for walker-in cooler and freezer applications used with a wide range of refrigerants. For room temperatures above 35°F *(2°C)* AND evaporating temperatures above 26°F *(-3°C)*, positive defrosting means (electric) may not be required, otherwise, electric defrost defrost models should be used. Electric defrost models come with defrost termination and fan delay as standard to control the defrost cycle termination and fan delay, while defrost initiation means (e.g. defrost timer) is not included.

The coil must not be exposed to any abnormal atmospheric or acidic environments. This may result in corrosion to the cabinet and possible coil failure (leaks).

LOCATION
The unit location in the room should be selected to ensure uniform air distribution throughout the entire space to be refrigerated. Be sure that the product does not obstruct the free circulation of air. Allow a minimum of 24" clearance at each end. Do not locate evaporators over doors. Consideration should be given to the coil location in order to minimize the piping run length to the condensing unit and floor drain.

EXPANSION VALVE (TXV) PRE-SELECTED
Locate the expansion valve bulb on a horizontal length of suction line preferably 3 to 6 inches from the suction header. Locate the bulb at 4 or 8 clock position and insulate with a waterproof type of insulation. Clamp the bulb to ensure 100% contact of the bulb with the suction line.

After following the manufacturer's installation instructions and after the room has reached the desired temperature the valve superheat should be checked. This will confirm that the evaporator is operating properly and performing to maximum efficiency. The superheat should be around 6 *(3.3°C)* to 8°F *(4.4°C)* for a 10 to 12°F T.D *(5.6 to 6.7°C)*. Too high or low a super heat will result in unsatisfactory system performance and possible compressor problems.

MOUNTING
Refer to dimensional drawing for recommended mounting arrangements. Ensure adequate clearance is provided behind the coil as well as each end. The evaporators may be mounted flush with ceiling with bolts, or hanging down with rod hangers. When using rod hangers, allow adequate space between the top of the unit and the ceiling for cleaning to comply with NSF Standard 7.
Ensure that the ceiling is level since the drain pan has been sloped for drainage during the defrost cycle.

DRAIN LINE
The drain line should be run from the drain connection, sloping at least 1" *(25 mm)* per foot and should have the size at least as large as the drain connection. A P-Trap in a warm area outside the room must be provided to allow proper draining through the tubing. Connection should be made to proper drainage facilities that comply with local regulations.
To prevent freeze-up when the temperature of the refrigerated space is 35°F *(2°C)* or lower, the drain line should be heated along its run inside the cold room. The heated drain line should be insulated. It is recommended that the heater be energized at all times. A heat input of 20 watts per foot in a 28°F *(-2°C)* room and 30 watts per foot for -20°F *(-29°C)* rooms, is satisfactory. Drain line heaters are not required for constant room temperature above 35°F *(2°C)*. Always trap evaporator drain line individually to prevent vapor migration.

Ensure that the drain line has sufficient slope for proper drainage (prevention of ice build up/blockage in pan).

PIPING

Refrigeration grade piping must be used for all field refrigeration piping. Refrigerant line sizes are important and **may not** be the same size as the coil connections. Consult ASHRAE handbook or other similar reference book for proper line sizing.
Refrigerant piping and control system should be designed to prevent possible liquid slugging (from oil or refrigerant) of the compressors on start-up after the defrost cycle. Also, it should prevent oil logging and minimize refrigerant pressure drop.

WIRING

Wire system in accordance with governing standards and local codes. See data and wiring diagrams on pages 4 to 20 for typical wiring arrangement. Electrical wiring is to be sized in accordance with minimum circuit ampacity rating (MCA). Size fuses used must not exceed the Maximum Fuse Size ratings.

For ease of identifying the proper wiring terminal, unit wiring is color coded and terminal block connections are identified.

When **fan delay thermostats** (combination fan delay and defrost termination) are installed, on start-up, the fans do not operate until the coil temperature is reduced to approximately 25ºF *(-4°C)*. It is normal for the fans to cycle a few times until the room temperature is brought down. At higher evaporating temperatures this control may not close and therefore should either be by-passed temporarily or replaced with an adjustable type. (set for a higher temperature cut-in point).

MAINTENANCE

The unit should be periodically inspected for any dirt or ice build-up on the fin surface and cleaned if necessary with a soft whisk or brush. Also ensure coils inner (and outer) drain pans do not have any ice build-up from improper defrost operation. When replacing heater elements first remove heater retainer brackets and heater clips.

SYSTEM CHECK

Before Start-Up:

1. All wiring should be in accordance with local codes.
2. Refrigerant lines should be properly sized.
3. Thorough evacuation and dehydration has been performed.
4. The suction, discharge, and receiver service valves must be open.
5. The system preferably include a liquid line filter drier moisture indicator and suction filter.
6. Pour enough water into the drain pan to allow a good check on drainage and seal the trap.

After Start-Up:

1. Check the oil level to be sure the oil charge is correct.
2. On initial start up the fans do not start until coil temperature is pulled down to approximately 25°F *(-4°C)* on the coil. Also, it is normal for the fan to cycle a few times until the room temperature is pulled down.
3. If necessary, temporarily by-pass fan delay control (to run fans until room temp is lowered).
4. Be sure that the expansion valve is properly set to provide the correct amount of superheat.
5. After the box temperature is close to reaching the desired temperature, the evaporator superheat must be checked and adjustment made if necessary. In general, evaporators running with a TD of 10°F *(5.6°C*) should have a superheat reading of 6° to 8°F *(3.3°C to 4.4°C)*. For evaporators with another T.D., the general rule is that the superheat should be around 60 to 80% of T.D.
6. Heavy moisture loads are usually encountered when starting the system for the first time. This may cause a rapid build-up of frost on the evaporator. During the initial pull down, we suggest that the frost build-up be watched and defrosted manually as required.
7. Observe that the system goes through at least one complete DEFROST CYCLE.

System	
Model Number	Date of Start-Up
Serial Number	Service Contractor
Refrigerant	Phone
Electrical Supply	E-mail

web: **www.t-rp.com/tplp**
email: **evaps@t-rp.com**
call: **1-844-893-3222 x520**

email: **troubleshooting@t-rp.com**
call: **1-844-893-3222 x529**

web: **www.t-rp.com/parts**
email: **parts@t-rp.com**
call: **1-844-893-3222 x504**

web: **www.t-rp.com/warranty**
email: **warranty@t-rp.com**
call: **1-844-893-3222 x507**

email: **orders@t-rp.com**
call: **1-844-893-3222 x501**

email: **shipping@t-rp.com**
call: **1-844-893-3222 x503**

HOW CAN WE HELP YOU?

visit **www.t-rp.com/contact**

Service Parts List Label To Be Attached *HERE*

Trenton Refrigeration
Brantford, ON • Longview, TX
1-800-463-9517 info@t-rp.com www.t-rp.com

TEZ New Generation "D" Condensing Units

PRODUCT DATA & SPECIFICATIONS

Bulletin T40-TEZD-PDS-9
Part # 1108862

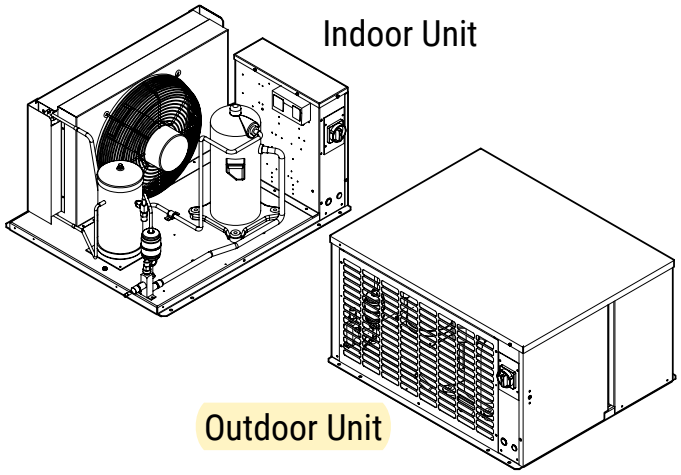
PRODUCT SUPPORT
web: **www.t-rp.com/tez**
email: **smcu@t-rp.com**
call: **1-844-893-3222 x521**
scan:

60 Hz

Indoor/Outdoor Air-Cooled Scroll Condensing Units

3/4 to 17 HP -
High and Low
Temperature Refrigeration

INCLUDES MODELS FOR DOE & NRCAN
AWEF-COMPLIANT APPLICATIONS



SMARTSPEED™ FAN MOTOR TECHNOLOGY
See Page 4 for details

LIMITROL FLOATING HEAD PRESSURE CONTROL SYSTEM
See Page 5 for details

CONTENTS

NOMENCLATURE

TEZ A 075 H 8 - H T4 D - A

Model Series
TEZ = Excel Scroll Air Cooled Condensing Unit Line

Compressor Manufacturer
A = Copeland

Nominal HP
007 - 170 = 3/4 - 17 HP

Application Range
H = High and Med Temp
L = Low Temp

Refrigerant*
8 = R407A, R407C, R448A, R449A, R404A, R507

Enclosure
H = Outdoor
I = Indoor

Voltage*
S2 = 208/230-1-60
S3 = 230-1-60
S6 = 200/220-1-50
S7 = 200-1-50
T3 = 208/230-3-60
T4 = 460-3-60
T5 = 575-3-60
T7 = 200/220-3-50
T9 = 380/400-3-50

* subject to compressor availability

Design Generation
D = Latest Catalog Series

Pre-Selected Factory Mounted Option Packages
See detail on next page

STANDARD FEATURES

Indoor Unit:

- Compatible with Low GWP Refrigerants
- Weatherproof electrical control box with compressor contactor and fused control circuit
- Copeland scroll compressor
- High efficiency enhanced tube and fin condenser design
- SmartSpeed EC Fan Motor Technology standard on models using chassis 1 (see page 35)
- Energy efficient PSC condenser fan motor on models using chassis 2 thru 6 (see page 35)
- Receiver with fusible plug and liquid shut off valve
- Suction service valve
- Pre-formed copper tubing
- Liquid injection (low temp. models)
- Unit leak tested and shipped with helium holding charge
- Fixed high pressure switch and adjustable low pressure control
- Receiver inlet valve on 2-fan units models only
- Discharge thermostat on applicable models only
- Painted cabinet
- Time delay relay for compressor
- QuickVac Evacuation and Refrigerant Recovery Valves

Outdoor Unit: All Standard Features of Indoor Unit, Plus:

- Painted weather-resistant housing with removable hood
- Flooded head pressure control (adjustable)
- Crankcase heater
- Fan cycling control with flex hose (2 fan units)

AVAILABLE OPTIONS

- Suction accumulator with and without boil-out coil
- Discharge line check valve
- Oil separator with and without oil return filter and solenoid valve
- Receiver inlet ball valve
- Heated and Insulated receiver
- Over-sized receiver
- Sealed liquid line filter drier & sight-glass
- Ball valve - liquid line (shipped loose)
- Insulated suction lines
- Leg kits
- Discharge air hood
- Sub cooling circuit on 5 - 17 HP models
- Liquid line solenoid valve (with standard 230 volt coil) - shipped loose
- Variable speed EC motors as head pressure control (see Bulletin T40-HPC-AG or https://docs.t-rp.com/1101111.pdf for details)
- Dual pressure control with flex hoses
- Compressor circuit breaker
- Current sensing relay - for use with oil safety control (where applicable)
- Defrost heater contactor c/w fuse block
- Evaporator fan contactor c/w fuse block
- Disconnect switch
- Disconnect fusing
- Pump down toggle switch
- Lock out control circuit relay
- Mechanical time clock
- Electronic voltage / Phase monitor
- **SmartSpeed Fan Motor Technology on models using chassis 2-6 (see page 4)**
- **Limitrol+ Floating Head Pressure Control System (see page 5 or Bulletin T40-LIMITROL-AG or docs.t-rp.com/1101114.pdf for details)**

PRE-SELECTED FACTORY MOUNTED OPTION PACKAGES

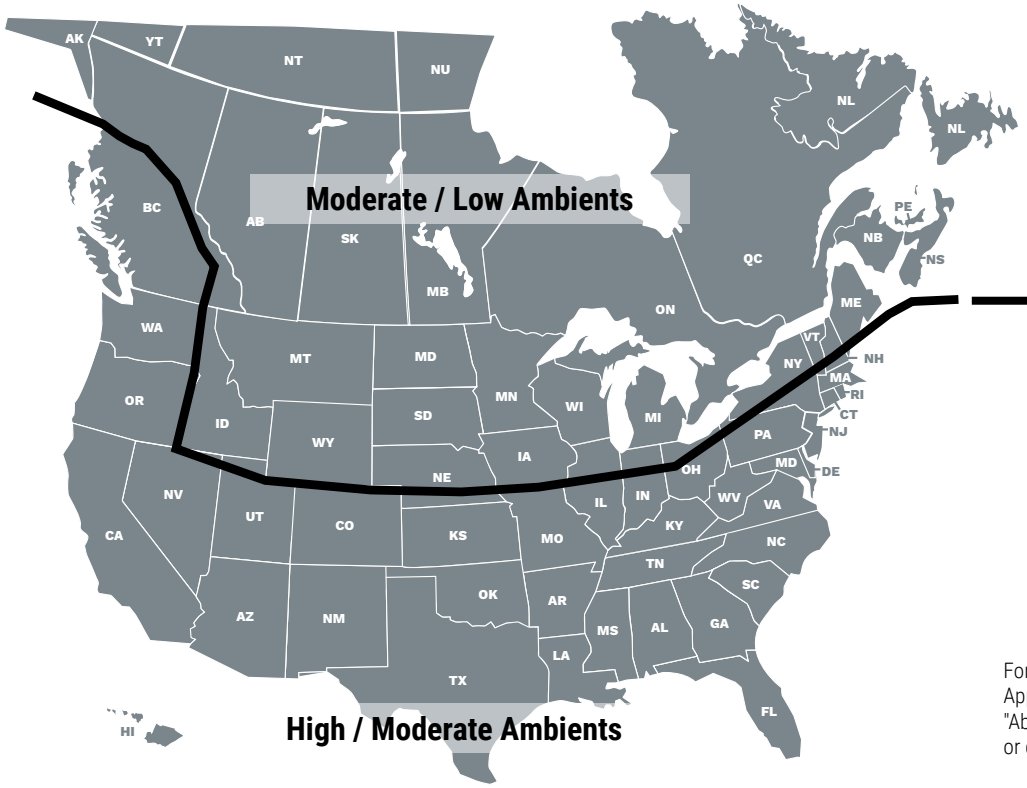
	For High / Moderate Ambients	For Moderate / Low Ambients
GOOD	**Package B**: + Liquid Line Filter Drier[1] & Sight Glass	**Package D**: + Liquid Line Filter Drier[1] & Sight Glass + Heated and Insulated Receiver
BETTER	**Package N**: + Liquid Line Filter Drier[1] & Sight Glass + Suction Accumulator w/o Heat Exchanger	**Package J**: + Liquid Line Filter Drier[1] & Sight Glass + Suction Accumulator w/o Heat Exchanger + Heated and Insulated Receiver
BEST	**Package P**: + Liquid Line Filter Drier[1] & Sight Glass + Suction Accumulator w/o Heat Exchanger + Suction Filter[2] + Non-Fused Disconnect	**Package Q**: + Liquid Line Filter Drier[1] & Sight Glass + Suction Accumulator w/o Heat Exchanger + Suction Filter[2] + Non-Fused Disconnect + Heated and Insulated Receiver

[1] Liquid Line Filter Drier: Sealed on ALL One Fan Model Units, Replaceable on ALL Two Fan Model Units.

[2] Suction Filter: Sealed on ALL One Fan Model Units, Replaceable on ALL Two Fan Model Units.

For information on Evaporator Defrost Kits and Fuse Packages, visit www.t-rp.com/dfk

RECOMMENDATIONS FOR SELECTING FACTORY MOUNTED OPTION PACKAGES



For Moderate / Low Ambients:

Good: Package D
Better: Package J
Best: Package Q

For High / Moderate Ambients:

Good: Package B
Better: Package N
Best: Package P

For further details, visit our website and see Application Bulletin TAB-0101-02-1: "About Heated And Insulated Receivers" or contact your local sales representative.

US Patent No. 9,297,567

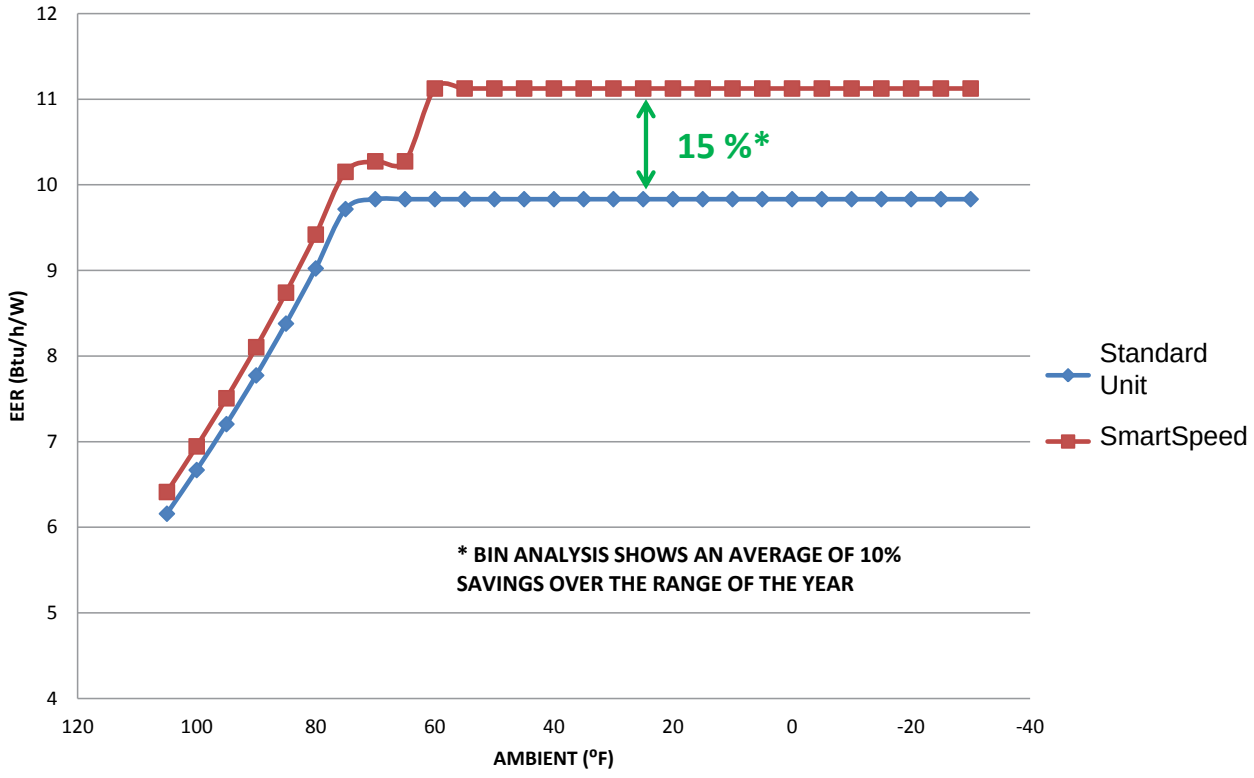
SMARTSPEED™
FAN MOTOR TECHNOLOGY

AWARD WINNING

DESIGN FEATURES

- Standard on models using chassis 1 (optional on chassis 2 thru 6)
- No special controls required. No worries about wind or cold climates.
- Ambients above 55°F - EC motor operates at full speed, crankcase heater and heated + insulated receiver disabled from control circuit
- Ambients below 55°F - EC motor operates at low speed, crankcase heater and heated + insulated receiver enabled from control circuit

Condensing Unit EER - Standard Unit vs. SmartSpeed



Refer to Pages 35-36 For Wiring Details

Condensing Unit with SmartSpeed Power Consumption Per Motor		
Chassis Size (see pages 31-35)	**Ambients above 55°F.** Fan Full Speed. Crankcase and Receiver Heaters Off.	**Ambients below 55°F.** Fan Low Speed. Crankcase and Receiver Heaters On.
1	102 W	19 W
2	168 W	37 W
3,4	362 W	76 W
5	630 W	152 W

LIMITROL+

FLOATING HEAD PRESSURE CONTROL SYSTEM

- **Reduces compressor energy consumption and run time**
- **EC motor technology further saves energy and reduces electrical requirements**
- **Lowered environmental impact through reduced refrigerant use**
- **Stable system performance in lower ambients**

What is Limitrol+? Limitrol+ combines various technologies into a responsive system that floats head pressure, saving energy and reduces environmental impact.
Unlike competitive systems, Limitrol+ combines variable speed EC motor technology, condenser portioning and various systems modifications to provide the ultimate in performance and control.
As a result, Limitrol+ functions in much colder ambients where previous systems have proven ineffective.

What does it do? Conventional head pressure control systems maintain a constant head pressure regardless of ambient temperatures. Limitrol+ intelligently responds to ambient conditions to float head pressure without sacrificing system performance at lower temperatures.

What are its applications?
- Condensing units over 5 HP
- Ideally suited and most effective in applications with fluctuating ambients
- Perfect for installations where reduced refrigerant charges are desired or required.

How much can Limitrol+ save you?

MODEL	Philadelphia, PA		New York, NY		Boston, MA		Charlotte, NC		Atlanta, GA		Los Angeles, CA		St Louis, MO		St. Paul, MN		Toronto, ON	
	%	$	%	$	%	$	%	$	%	$	%	$	%	$	%	$	%	$
5 HP Cooler	22	616	23	1,099	25	1,081	18	474	16	521	16	835	20	624	25	798	27	638
7.5 HP Cooler	21	1,008	22	1,805	23	1,707	18	843	17	954	17	1,499	19	1,053	24	1,270	25	1,000
10 HP Cooler	18	1,204	18	2,131	20	2,095	15	975	14	1,089	18	2,446	16	1,227	20	1,529	21	1,223
15 HP Cooler	19	1,852	20	3,300	21	3,170	16	1,567	15	1,767	19	3,570	17	1,916	22	2,337	22	1,834
6 HP Freezer	24	903	25	1,621	26	1,548	21	753	20	848	23	1,548	22	928	26	1,119	27	891
7.5 HP Freezer	21	994	21	1,783	23	1,726	17	800	16	891	18	1,591	19	1,012	23	1,255	24	1,004

* The above is a BIN Hour Analysis. Weather data was used from ASHRAE Weather Data Viewer and electrical rates for each city are based on June 2013 data from EIA (U.S. Energy Information Administration).
** Above numbers do not include refrigerant savings, and further cost savings can be expected.

For more information on Limitrol+ Floating Head Pressure Control System visit t-rp.com/limitrol or see Bulletin T40-LIMITROL-AG (https://docs.t-rp.com/1101114.pdf)

For more information on Head Pressure Control, please refer to our “Head Pressure Control Application Guide” Bulletin T40-HPC-AG (https://docs.t-rp.com/1101111.pdf)

R404A R507 Low Temperature

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
	0	-17.8	5540	5310	5070	4840	4600	4360
	-5	-20.6	4940	4740	4530	4330	4120	3910
TEZA008L8	-10	-23.3	4410	4230	4050	3870	3680	3500
	-15	-26.1	3930	3770	3620	3460	3300	3140
Compressor	-20	-28.9	3500	3370	3230	3100	2960	2820
Model	-25	-31.7	3120	3010	2900	2780	2660	2540
ZF03KAE	-30	-34.4	2790	2690	2600	2500	2400	2290
	-35	-37.2	2500	2420	2330	2250	2160	2070
	-40	-40.0	2240	2170	2100	2030	1950	1880
	0	-17.8	7320	7020	6710	6400	6080	5770
	-5	-20.6	6560	6280	6000	5720	5440	5150
TEZA010L8	-10	-23.3	5850	5600	5350	5100	4850	4590
	-15	-26.1	5200	4980	4750	4530	4300	4070
Compressor	-20	-28.9	4600	4410	4210	4010	3810	3610
Model	-25	-31.7	4070	3900	3730	3550	3380	3200
ZF04KAE	-30	-34.4	3600	3450	3310	3150	3000	2850
	-35	-37.2	3200	3070	2940	2820	2680	2550
	-40	-40.0	2860	2750	2650	2540	2430	2320
	0	-17.8	8640	8280	7920	7550	7180	6800
	-5	-20.6	7810	7480	7160	6820	6490	6150
TEZA015L8	-10	-23.3	7020	6730	6430	6140	5830	5520
	-15	-26.1	6280	6020	5760	5490	5220	4940
Compressor	-20	-28.9	5590	5360	5130	4890	4650	4400
Model	-25	-31.7	4960	4750	4550	4340	4120	3900
ZF05KAE	-30	-34.4	4380	4200	4020	3840	3640	3450
	-35	-37.2	3860	3710	3550	3390	3220	3050
	-40	-40.0	3410	3280	3140	3000	2850	2700
	0	-17.8	12200	11600	11000	10400	9790	9150
	-5	-20.6	11100	10600	10100	9530	8960	8390
TEZA020L8	-10	-23.3	10100	9670	9190	8690	8190	7670
	-15	-26.1	9190	8770	8340	7910	7460	7000
Compressor	-20	-28.9	8290	7920	7550	7160	6770	6360
Model	-25	-31.7	7440	7110	6780	6440	6100	5740
ZF07KAE	-30	-34.4	6610	6330	6040	5740	5440	5120
	-35	-37.2	5810	5560	5300	5040	4770	4500
	-40	-40.0	5010	4790	4560	4330	4100	3860
	0	-17.8	15300	14600	14000	13300	12600	11900
	-5	-20.6	13900	13300	12800	12200	11500	10900
TEZA025L8	-10	-23.3	12600	12100	11600	11100	10500	9930
	-15	-26.1	11400	11000	10500	10000	9530	9010
Compressor	-20	-28.9	10300	9880	9470	9040	8600	8140
Model	-25	-31.7	9200	8860	8500	8120	7730	7320
ZF08K4E	-30	-34.4	8210	7900	7590	7250	6900	6540
	-35	-37.2	7290	7020	6730	6440	6120	5800
	-40	-40.0	6440	6200	5940	5670	5390	5100
	0	-17.8	16900	16200	15500	14700	13900	13200
	-5	-20.6	15400	14800	14100	13500	12800	12100
TEZA030L8	-10	-23.3	14000	13500	12900	12300	11700	11000
	-15	-26.1	12700	12200	11700	11200	10600	10000
Compressor	-20	-28.9	11500	11000	10600	10100	9620	9110
Model	-25	-31.7	10300	9940	9540	9120	8680	8220
ZF09K4E	-30	-34.4	9240	8900	8540	8170	7780	7380
	-35	-37.2	8210	7910	7590	7260	6920	6560
	-40	-40.0	7230	6960	6680	6390	6090	5770
	0	-17.8	20100	19100	18200	17200	16200	15200
	-5	-20.6	18400	17600	16700	15900	14900	14000
TEZA035L8	-10	-23.3	16800	16100	15300	14500	13700	12900
	-15	-26.1	15300	14600	14000	13300	12500	11800
Compressor	-20	-28.9	13800	13300	12700	12100	11400	10700
Model	-25	-31.7	12500	12000	11400	10900	10300	9720
ZF11K4E	-30	-34.4	11200	10700	10300	9800	9300	8760
	-35	-37.2	9940	9560	9170	8750	8310	7850
	-40	-40.0	8780	8460	8110	7750	7370	6960

table continues in next column ↗

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
	0	-17.8	25100	24100	23000	21900	20800	19600
	-5	-20.6	22800	21900	20900	19900	18900	17800
TEZA045L8	-10	-23.3	20600	19700	18900	18000	17000	16100
	-15	-26.1	18500	17700	17000	16200	15300	14500
Compressor	-20	-28.9	16600	15900	15200	14500	13800	13000
Model	-25	-31.7	14700	14100	13500	12900	12300	11700
ZF13K4E	-30	-34.4	13000	12500	12000	11500	11000	10400
	-35	-37.2	11400	11000	10600	10200	9740	9320
	-40	-40.0	9990	9630	9290	8950	8620	8300
	0	-17.8	30900	29600	28300	27000	25600	24200
	-5	-20.6	28000	26900	25700	24500	23300	22000
TEZA055L8	-10	-23.3	25300	24300	23300	22200	21100	20000
	-15	-26.1	22800	21900	21000	20100	19100	18100
Compressor	-20	-28.9	20500	19700	18900	18100	17200	16300
Model	-25	-31.7	18300	17600	16900	16200	15400	14700
ZF15K4E	-30	-34.4	16300	15700	15100	14500	13800	13100
	-35	-37.2	14500	13900	13400	12800	12300	11700
	-40	-40.0	12700	12300	11800	11300	10800	10300
	0	-17.8	36100	34600	33100	31600	30000	28400
	-5	-20.6	32900	31600	30200	28900	27500	26000
TEZA060L8	-10	-23.3	29800	28700	27500	26300	25100	23800
	-15	-26.1	27000	26000	24900	23900	22800	21700
Compressor	-20	-28.9	24300	23400	22500	21600	20600	19600
Model	-25	-31.7	21800	21000	20200	19400	18600	17700
ZF18K4E	-30	-34.4	19400	18800	18100	17400	16700	15900
	-35	-37.2	17200	16600	16100	15400	14800	14200
	-40	-40.0	15100	14600	14100	13600	13000	12500
	0	-17.8	45300	43600	41800	40000	38100	36300
	-5	-20.6	41100	39500	37900	36300	34600	33000
TEZA075L8	-10	-23.3	37200	35800	34300	32900	31400	29900
	-15	-26.1	33500	32200	31000	29700	28400	27100
Compressor	-20	-28.9	30100	29000	27800	26700	25600	24500
Model	-25	-31.7	26900	25900	25000	24000	23000	22100
ZF25K4E	-30	-34.4	24000	23100	22300	21500	20700	19900
	-35	-37.2	21200	20500	19800	19200	18500	17900
	-40	-40.0	18700	18200	17600	17100	16600	16100
	0	-17.8	50400	48400	46400	44300	42200	40000
	-5	-20.6	45900	44000	42200	40300	38400	36500
TEZA085L8	-10	-23.3	41600	39900	38300	36600	34900	33200
	-15	-26.1	37500	36100	34600	33100	31700	30200
Compressor	-20	-28.9	33800	32500	31200	29900	28600	27400
Model	-25	-31.7	30200	29100	28000	26900	25800	24700
ZF28K4E	-30	-34.4	27000	26000	25100	24100	23200	22400
	-35	-37.2	23900	23100	22400	21600	20900	20200
	-40	-40.0	21200	20500	19900	19300	18700	18200
	0	-17.8	56500	54000	51500	48900	46200	43400
	-5	-20.6	51600	49400	47200	44800	42400	39900
TEZA100L8	-10	-23.3	47000	45100	43000	41000	38800	36500
	-15	-26.1	42700	40900	39100	37300	35300	33300
Compressor	-20	-28.9	38500	37000	35400	33700	32000	30200
Model	-25	-31.7	34500	33200	31800	30300	28800	27200
ZF34K5E	-30	-34.4	30800	29600	28300	27100	25700	24400
	-35	-37.2	27200	26100	25000	23900	22700	21500
	-40	-40.0	23700	22800	21800	20900	19800	18700
	0	-17.8	72400	69500	66400	63300	60100	56700
	-5	-20.6	66100	63500	60700	57900	55000	52000
TEZA130L8	-10	-23.3	60100	57800	55400	52900	50300	47600
	-15	-26.1	54500	52400	50300	48100	45700	43300
Compressor	-20	-28.9	49200	47400	45500	43500	41400	39300
Model	-25	-31.7	44200	42600	40900	39200	37300	35400
ZF41K5E	-30	-34.4	39400	38000	36600	35000	33400	31600
	-35	-37.2	34900	33700	32400	31000	29500	28000
	-40	-40.0	30600	29500	28400	27100	25800	24400

table continues on next page >>>

R404A R507 Low Temperature *(cont'd)*

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
	0	-17.8	85100	81500	77800	74000	70000	66000
	-5	-20.6	77700	74500	71100	67700	64100	60400
TEZA150L8	-10	-23.3	70700	67800	64800	61700	58500	55100
	-15	-26.1	64000	61400	58800	56000	53100	50100
Compressor	-20	-28.9	57700	55400	53100	50600	48000	45300
Model	-25	-31.7	51800	49800	47700	45500	43200	40800
ZF49K5E	-30	-34.4	46300	44500	42600	40700	38600	36500
	-35	-37.2	41100	39500	37900	36100	34300	32400
	-40	-40.0	36300	34900	33400	31900	30200	28500
	0	-17.8	103000	99000	95100	91100	87000	82700
	-5	-20.6	93200	89800	86300	82700	79100	75200
TEZA170L8	-10	-23.3	84100	81100	78000	74900	71600	68200
	-15	-26.1	75700	73100	70400	67600	64700	61700
Compressor	-20	-28.9	67900	65600	63200	60800	58200	55600
Model	-25	-31.7	60700	58700	56600	54500	52200	49800
ZF54K5E	-30	-34.4	54000	52300	50500	48600	46600	44500
	-35	-37.2	47900	46400	44800	43100	41300	39400
	-40	-40.0	42300	40900	39500	38000	36400	34700

R407A Low Temperature

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
	0	-17.8	4830	4650	4470	4310	4150	4000
	-5	-20.6	4310	4150	4000	3850	3720	3590
TEZA008L8	-10	-23.3	3830	3700	3570	3450	3340	3230
	-15	-26.1	3410	3300	3190	3090	2990	2900
Compressor	-20	-28.9	3030	2940	2850	2760	2680	2600
Model	-25	-31.7	2710	2630	2540	2470	2390	2330
ZF03KAE	-30	-34.4	2420	2340	2270	2210	2140	2080
	-35	-37.2	2160	2090	2030	1960	1900	1850
	-40	-40.0	1920	1860	1800	1730	1680	1630
	0	-17.8	6590	6350	6100	5850	5590	5320
	-5	-20.6	5840	5630	5410	5180	4950	4710
TEZA010L8	-10	-23.3	5160	4960	4770	4570	4370	4170
	-15	-26.1	4530	4360	4190	4020	3840	3660
Compressor	-20	-28.9	3960	3810	3680	3530	3370	3210
Model	-25	-31.7	3470	3340	3210	3090	2960	2840
ZF04KAE	-30	-34.4	3030	2930	2820	2720	2610	2500
	-35	-37.2	2680	2590	2510	2420	2330	2240
	-40	-40.0	2390	2330	2260	2180	2110	2030
	0	-17.8	7720	7430	7140	6850	6540	6240
	-5	-20.6	6860	6600	6340	6070	5810	5530
TEZA015L8	-10	-23.3	6060	5830	5600	5370	5120	4880
	-15	-26.1	5320	5120	4910	4710	4500	4290
Compressor	-20	-28.9	4650	4480	4310	4130	3950	3760
Model	-25	-31.7	4060	3920	3760	3610	3450	3300
ZF05KAE	-30	-34.4	3540	3410	3290	3160	3030	2900
	-35	-37.2	3090	2990	2890	2780	2680	2570
	-40	-40.0	2720	2640	2550	2480	2390	2310
	0	-17.8	11200	10700	10200	9740	9220	8660
	-5	-20.6	10100	9680	9250	8800	8330	7830
TEZA020L8	-10	-23.3	9080	8730	8340	7940	7520	7080
	-15	-26.1	8150	7830	7500	7140	6760	6360
Compressor	-20	-28.9	7280	7000	6710	6390	6060	5700
Model	-25	-31.7	6470	6230	5960	5690	5390	5070
ZF07KAE	-30	-34.4	5700	5490	5260	5010	4750	4450
	-35	-37.2	4970	4780	4580	4360	4120	3850
	-40	-40.0	4250	4080	3910	3710	3490	3240

table continues in next column ↗

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
	0	-17.8	14100	13500	13100	12600	12100	11400
	-5	-20.6	12600	12200	11800	11300	10800	10300
TEZA025L8	-10	-23.3	11300	10900	10500	10100	9710	9270
	-15	-26.1	10100	9730	9390	9030	8650	8260
Compressor	-20	-28.9	8900	8620	8320	8000	7670	7320
Model	-25	-31.7	7830	7580	7320	7050	6750	6450
ZF08K4E	-30	-34.4	6860	6640	6410	6160	5900	5640
	-35	-37.2	5960	5780	5570	5360	5130	4900
	-40	-40.0	5170	4990	4810	4620	4420	4220
	0	-17.8	15500	15000	14600	14100	13400	12800
	-5	-20.6	13700	13200	12800	12300	11800	11200
TEZA030L8	-10	-23.3	12000	11700	11200	10800	10300	9820
	-15	-26.1	10500	10200	9850	9460	9040	8580
Compressor	-20	-28.9	9230	8940	8620	8280	7920	7500
Model	-25	-31.7	8060	7810	7540	7250	6930	6560
ZF09K4E	-30	-34.4	7010	6790	6570	6330	6060	5750
	-35	-37.2	6050	5880	5700	5510	5300	5050
	-40	-40.0	5160	5030	4910	4780	4620	4430
	0	-17.8	18900	18300	17600	16900	16100	15100
	-5	-20.6	16600	16100	15500	14800	14100	13200
TEZA035L8	-10	-23.3	14700	14200	13700	13000	12400	11700
	-15	-26.1	12900	12400	12000	11400	10800	10200
Compressor	-20	-28.9	11200	10900	10500	10000	9480	8890
Model	-25	-31.7	9850	9520	9170	8780	8330	7800
ZF11K4E	-30	-34.4	8580	8310	8020	7700	7320	6880
	-35	-37.2	7420	7210	6990	6740	6440	6080
	-40	-40.0	6360	6220	6060	5880	5670	5400
	0	-17.8	23000	22300	21500	20700	20000	19100
	-5	-20.6	20600	19800	19200	18500	17700	16900
TEZA045L8	-10	-23.3	18300	17600	17000	16300	15600	14900
	-15	-26.1	16100	15500	14900	14300	13700	13000
Compressor	-20	-28.9	14200	13700	13000	12500	12000	11300
Model	-25	-31.7	12400	11900	11400	10900	10400	9860
ZF13K4E	-30	-34.4	10800	10400	10000	9580	9140	8670
	-35	-37.2	9500	9190	8860	8530	8160	7780
	-40	-40.0	8520	8270	8040	7790	7520	7210

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R407A Low Temperature *(cont'd)*

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA055L8 Compressor Model ZF15K4E	0	-17.8	28100	27200	26300	25400	24400	23400
	-5	-20.6	25100	24400	23500	22600	21700	20800
	-10	-23.3	22400	21600	20800	20100	19200	18400
	-15	-26.1	19700	19100	18400	17600	16900	16100
	-20	-28.9	17400	16800	16200	15500	14800	14100
	-25	-31.7	15300	14800	14300	13700	13000	12300
	-30	-34.4	13500	13000	12600	12100	11400	10800
	-35	-37.2	12100	11700	11200	10700	10200	9650
	-40	-40.0	10900	10500	10200	9740	9290	8790
TEZA060L8 Compressor Model ZF18K4E	0	-17.8	33200	32100	31100	30000	29000	27800
	-5	-20.6	29800	28900	27900	26900	25900	24900
	-10	-23.3	26600	25700	24900	23900	23000	22100
	-15	-26.1	23500	22800	22100	21200	20400	19400
	-20	-28.9	20800	20200	19400	18700	18000	17100
	-25	-31.7	18400	17700	17100	16500	15800	15000
	-30	-34.4	16200	15600	15100	14500	13900	13200
	-35	-37.2	14400	13900	13400	12900	12400	11800
	-40	-40.0	12900	12500	12200	11700	11200	10700
TEZA075L8 Compressor Model ZF25K4E	0	-17.8	41400	40100	38700	37500	36100	34700
	-5	-20.6	37200	36000	34800	33500	32200	31000
	-10	-23.3	33100	32000	31000	29800	28700	27500
	-15	-26.1	29400	28500	27400	26500	25400	24300
	-20	-28.9	25900	25100	24300	23300	22400	21300
	-25	-31.7	22900	22100	21300	20500	19600	18700
	-30	-34.4	20200	19500	18800	18100	17300	16500
	-35	-37.2	17900	17300	16700	16100	15400	14700
	-40	-40.0	16100	15600	15100	14600	14000	13300
TEZA085L8 Compressor Model ZF28K4E	0	-17.8	47700	46100	44500	42900	41300	39600
	-5	-20.6	42800	41400	40000	38500	37000	35400
	-10	-23.3	38200	37000	35600	34300	32900	31400
	-15	-26.1	33900	32800	31600	30300	29100	27700
	-20	-28.9	30000	29000	27900	26800	25600	24400
	-25	-31.7	26500	25500	24600	23600	22600	21400
	-30	-34.4	23400	22600	21700	20900	20000	18900
	-35	-37.2	20800	20100	19300	18600	17700	16800
	-40	-40.0	18700	18200	17500	16900	16200	15300
TEZA100L8 Compressor Model ZF34K5E	0	-17.8	55800	53800	51800	49700	47500	45200
	-5	-20.6	50100	48300	46400	44500	42500	40300
	-10	-23.3	44700	43100	41400	39600	37700	35700
	-15	-26.1	39700	38200	36600	35100	33300	31400
	-20	-28.9	35000	33700	32300	30800	29200	27500
	-25	-31.7	30800	29600	28400	27000	25500	23900
	-30	-34.4	27100	26000	24900	23700	22400	20900
	-35	-37.2	23900	23000	22100	20900	19700	18400
	-40	-40.0	21400	20700	19700	18800	17600	16500
TEZA130L8 Compressor Model ZF41K5E	0	-17.8	70100	67900	65800	63500	61100	58700
	-5	-20.6	63000	61100	59100	57000	54800	52500
	-10	-23.3	56300	54500	52700	50800	48700	46600
	-15	-26.1	50100	48400	46700	44900	43200	41100
	-20	-28.9	44200	42800	41300	39700	37900	36100
	-25	-31.7	39100	37700	36300	34900	33300	31500
	-30	-34.4	34400	33300	32000	30700	29200	27600
	-35	-37.2	30600	29500	28400	27200	25800	24400
	-40	-40.0	27400	26500	25500	24400	23100	21700
TEZA150L8 Compressor Model ZF49K5E	0	-17.8	83400	80600	77900	75100	72000	68900
	-5	-20.6	74900	72300	69800	67200	64400	61400
	-10	-23.3	66800	64500	62200	59700	57100	54300
	-15	-26.1	59100	57100	55000	52700	50300	47700
	-20	-28.9	52200	50400	48400	46300	44100	41700
	-25	-31.7	46000	44300	42500	40600	38500	36300
	-30	-34.4	40500	39100	37500	35700	33800	31700
	-35	-37.2	36000	34700	33300	31700	29900	28000
	-40	-40.0	32600	31400	30100	28700	27100	25300

table continues in next column

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA170L8 Compressor Model ZF54K5E	0	-17.8	93300	90300	87300	84200	81100	77800
	-5	-20.6	83400	80700	78100	75400	72600	69800
	-10	-23.3	74200	71900	69600	67200	64800	62400
	-15	-26.1	65800	63800	61700	59700	57600	55400
	-20	-28.9	58100	56400	54600	52800	50900	49000
	-25	-31.7	51100	49600	48000	46400	44800	43200
	-30	-34.4	44800	43500	42100	40600	39300	37800
	-35	-37.2	39200	37900	36600	35400	34100	32800
	-40	-40.0	34000	32900	31700	30600	29400	28100

R448A R449A Low Temperature

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
	0	-17.8	5090	4910	4740	4570	4400	4230
	-5	-20.6	4540	4390	4230	4080	3940	3800
TEZA008L8	-10	-23.3	4050	3920	3790	3650	3530	3410
	-15	-26.1	3610	3500	3390	3280	3170	3070
Compressor	-20	-28.9	3220	3130	3030	2930	2850	2750
Model	-25	-31.7	2880	2790	2710	2630	2540	2460
ZF03KAE	-30	-34.4	2560	2490	2420	2340	2270	2190
	-35	-37.2	2280	2220	2140	2070	2000	1930
	-40	-40.0	2020	1950	1880	1820	1740	1680
	0	-17.8	6900	6660	6420	6160	5910	5660
	-5	-20.6	6140	5920	5710	5490	5270	5040
TEZA010L8	-10	-23.3	5440	5250	5060	4870	4670	4470
	-15	-26.1	4800	4630	4460	4290	4130	3960
Compressor	-20	-28.9	4210	4070	3930	3780	3630	3490
Model	-25	-31.7	3690	3570	3440	3320	3200	3080
ZF04KAE	-30	-34.4	3220	3130	3020	2920	2810	2710
	-35	-37.2	2840	2750	2670	2580	2490	2400
	-40	-40.0	2510	2440	2360	2300	2230	2150
	0	-17.8	8070	7790	7510	7210	6920	6620
	-5	-20.6	7220	6970	6710	6450	6180	5910
TEZA015L8	-10	-23.3	6420	6200	5960	5730	5500	5260
	-15	-26.1	5670	5480	5280	5070	4860	4650
Compressor	-20	-28.9	4990	4820	4640	4460	4280	4100
Model	-25	-31.7	4370	4220	4070	3920	3760	3600
ZF05KAE	-30	-34.4	3810	3690	3560	3420	3290	3150
	-35	-37.2	3330	3210	3110	2990	2880	2760
	-40	-40.0	2910	2810	2720	2630	2530	2440
	0	-17.8	11600	11100	10600	10200	9720	9260
	-5	-20.6	10400	9990	9600	9190	8780	8370
TEZA020L8	-10	-23.3	9330	8990	8640	8280	7930	7570
	-15	-26.1	8380	8090	7780	7480	7160	6840
Compressor	-20	-28.9	7510	7250	6980	6720	6450	6170
Model	-25	-31.7	6700	6480	6250	6020	5790	5550
ZF07KAE	-30	-34.4	5940	5740	5550	5360	5160	4960
	-35	-37.2	5210	5040	4880	4700	4540	4360
	-40	-40.0	4490	4350	4200	4050	3910	3750
	0	-17.8	14800	14400	14000	13400	12900	12400
	-5	-20.6	13300	12900	12500	12100	11700	11200
TEZA025L8	-10	-23.3	12000	11600	11200	10800	10500	10100
	-15	-26.1	10600	10300	10000	9690	9360	9000
Compressor	-20	-28.9	9460	9190	8900	8620	8320	8010
Model	-25	-31.7	8360	8130	7880	7620	7360	7100
ZF08K4E	-30	-34.4	7360	7150	6930	6710	6480	6250
	-35	-37.2	6460	6270	6070	5870	5670	5460
	-40	-40.0	5640	5460	5280	5100	4920	4740
	0	-17.8	15800	15200	14800	14400	13900	13300
	-5	-20.6	14200	13900	13400	13000	12600	12200
TEZA030L8	-10	-23.3	12800	12500	12200	11900	11400	11000
	-15	-26.1	11600	11200	11000	10700	10300	9950
Compressor	-20	-28.9	10300	10100	9860	9590	9280	8940
Model	-25	-31.7	9200	9010	8790	8550	8260	7950
ZF09K4E	-30	-34.4	8140	7960	7770	7550	7290	6990
	-35	-37.2	7120	6960	6780	6570	6330	6040
	-40	-40.0	6140	6000	5820	5620	5380	5090
	0	-17.8	19300	18600	18000	17200	16500	15800
	-5	-20.6	17400	16800	16300	15600	14900	14300
TEZA035L8	-10	-23.3	15600	15100	14600	14100	13400	12900
	-15	-26.1	14100	13500	13100	12600	12200	11700
Compressor	-20	-28.9	12500	12200	11800	11300	10900	10400
Model	-25	-31.7	11100	10800	10500	10100	9710	9310
ZF11K4E	-30	-34.4	9900	9610	9300	8980	8650	8300
	-35	-37.2	8770	8510	8240	7960	7680	7370
	-40	-40.0	7740	7520	7280	7040	6780	6520

table continues in next column

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
	0	-17.8	24600	23700	22700	21700	20700	19600
	-5	-20.6	22100	21200	20400	19400	18500	17500
TEZA045L8	-10	-23.3	19600	18900	18200	17300	16500	15600
	-15	-26.1	17400	16800	16100	15400	14700	14000
Compressor	-20	-28.9	15300	14800	14200	13700	13000	12500
Model	-25	-31.7	13400	12900	12500	12000	11600	11100
ZF13K4E	-30	-34.4	11800	11300	10900	10600	10300	9940
	-35	-37.2	10200	9900	9630	9390	9180	8990
	-40	-40.0	8850	8650	8490	8370	8280	8240
	0	-17.8	30000	28900	27700	26500	25200	23900
	-5	-20.6	27000	25900	24900	23800	22800	21600
TEZA055L8	-10	-23.3	24000	23200	22300	21400	20400	19400
	-15	-26.1	21400	20700	19800	19100	18300	17400
Compressor	-20	-28.9	19000	18400	17600	17000	16300	15500
Model	-25	-31.7	16800	16200	15600	15100	14500	14000
ZF15K4E	-30	-34.4	14700	14300	13900	13300	12900	12500
	-35	-37.2	12900	12600	12200	11900	11600	11200
	-40	-40.0	11300	11000	10800	10500	10300	10100
	0	-17.8	35200	33800	32400	31100	29700	28200
	-5	-20.6	31700	30600	29400	28100	26900	25600
TEZA060L8	-10	-23.3	28500	27400	26500	25400	24300	23200
	-15	-26.1	25400	24600	23700	22800	21800	21000
Compressor	-20	-28.9	22600	21800	21100	20400	19600	18900
Model	-25	-31.7	20000	19400	18800	18200	17600	17000
ZF18K4E	-30	-34.4	17600	17100	16700	16200	15800	15300
	-35	-37.2	15400	15100	14700	14400	14100	13900
	-40	-40.0	13400	13200	13000	12800	12600	12500
	0	-17.8	44100	42600	41100	39400	37800	36100
	-5	-20.6	39600	38200	36800	35400	33900	32600
TEZA075L8	-10	-23.3	35300	34000	32900	31600	30300	29200
	-15	-26.1	31400	30200	29200	28200	27200	26100
Compressor	-20	-28.9	27700	26900	25900	25100	24300	23500
Model	-25	-31.7	24500	23700	23000	22400	21700	21200
ZF25K4E	-30	-34.4	21500	20900	20400	20000	19500	19200
	-35	-37.2	18900	18500	18100	17900	17600	17500
	-40	-40.0	16600	16400	16200	16100	16100	16200
	0	-17.8	50600	48700	46800	44900	43100	41200
	-5	-20.6	45500	43800	42100	40500	38900	37200
TEZA085L8	-10	-23.3	40600	39200	37700	36300	34900	33500
	-15	-26.1	36100	35000	33700	32400	31300	30100
Compressor	-20	-28.9	32000	31000	29900	29000	28000	27100
Model	-25	-31.7	28200	27400	26600	25800	25200	24600
ZF28K4E	-30	-34.4	24900	24300	23600	23100	22700	22400
	-35	-37.2	21900	21400	21100	20800	20600	20500
	-40	-40.0	19300	19100	18900	18900	18900	19100
	0	-17.8	55200	53300	51300	49400	47100	44900
	-5	-20.6	49900	48200	46400	44500	42600	40600
TEZA100L8	-10	-23.3	44800	43400	41800	40100	38400	36600
	-15	-26.1	40100	38700	37400	35900	34400	32900
Compressor	-20	-28.9	35600	34400	33300	32000	30800	29400
Model	-25	-31.7	31500	30500	29400	28400	27300	26100
ZF34K5E	-30	-34.4	27600	26700	25800	25000	24000	23200
	-35	-37.2	23900	23200	22500	21700	21000	20400
	-40	-40.0	20500	19800	19300	18800	18300	17700
	0	-17.8	71300	69100	66900	64500	62100	59500
	-5	-20.6	64400	62400	60400	58300	56100	53900
TEZA130L8	-10	-23.3	57900	56200	54300	52500	50500	48500
	-15	-26.1	51800	50200	48600	47000	45300	43600
Compressor	-20	-28.9	46100	44700	43400	41900	40400	38900
Model	-25	-31.7	40700	39600	38300	37100	35800	34500
ZF41K5E	-30	-34.4	35700	34800	33700	32700	31600	30500
	-35	-37.2	31100	30200	29300	28500	27600	26700
	-40	-40.0	26800	26000	25300	24600	23800	23100

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R448A R449A Low Temperature *(cont'd)*

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA150L8 Compressor Model ZF49K5E	0	-17.8	84700	82000	79200	76200	73200	70000
	-5	-20.6	76400	73900	71400	68800	66000	63200
	-10	-23.3	68600	66400	64200	61700	59300	56800
	-15	-26.1	61200	59300	57300	55200	53100	50800
	-20	-28.9	54400	52700	50900	49100	47300	45400
	-25	-31.7	48100	46600	45000	43500	41900	40200
	-30	-34.4	42200	41000	39600	38300	37000	35600
	-35	-37.2	36800	35700	34700	33500	32400	31400
	-40	-40.0	31900	31000	30100	29300	28400	27600
TEZA170L8 Compressor Model ZF54K5E	0	-17.8	96100	93000	89900	86800	83700	80400
	-5	-20.6	86100	83500	80700	78000	75200	72300
	-10	-23.3	77000	74600	72200	69800	67400	64900
	-15	-26.1	68500	66500	64400	62300	60200	58000
	-20	-28.9	60700	58900	57200	55300	53400	51600
	-25	-31.7	53700	52100	50600	49000	47400	45700
	-30	-34.4	47100	45900	44500	43200	41800	40200
	-35	-37.2	41400	40200	39100	37900	36500	35300
	-40	-40.0	36100	35100	34100	33000	31800	30700

Standard Models

Model TEZA		Compressor Model No.	Power Supply	Compressor		Condenser Fan Motor			Unit	
				RLA	LRA	Quantity	Watts	FLA	MCA	MOP
TEZA007H8-*	S2D	ZB06KAE-PFV	208-230/1/60	6.0	36.0	1	100**	1.0	8.5	15
	T3D	ZB06KAE-TF5	208-230/3/60	4.8	37.8	1	100**	1.0	7.0	15
TEZA008H8-*	S2D	ZB07KAE-PFV	208-230/1/60	6.3	48.0	1	100**	1.0	8.9	15
	T3D	ZB07KAE-TF5	208-230/3/60	5.2	37.8	1	100**	1.0	7.5	15
TEZA009H8-*	S2D	ZB08KAE-PFV	208-230/1/60	8.0	47.2	1	100**	1.0	11.0	15
	T3D	ZB08KAE-TF5	208-230/3/60	5.3	37.8	1	100**	1.0	7.6	15
TEZA010H8-*	S2D	ZS09KAE-PFV	208-230/1/60	10.0	40.3	1	240	1.1	13.6	20
	T3D	ZS09KAE-TF5	208-230/3/60	8.0	55.4	1	240	1.1	11.1	15
	T4D	ZS09KAE-TFD	460/3/60	3.8	28	1	240	0.6	5.4	15
TEZA011H8-*	S2D	ZS11KAE-PFV	208-230/1/60	12.6	55	1	240	1.1	16.9	25
	T3D	ZS11KAE-TF5	208-230/3/60	10.4	58	1	240	1.1	14.1	20
	T4D	ZS11KAE-TFD	460/3/60	4.3	28	1	240	0.6	6.0	15
TEZA015H8-*	S2D	ZS13KAE-PFV	208-230/1/60	12.0	56	1	240	1.1	16.1	25
	T3D	ZS13KAE-TF5	208-230/3/60	9.7	58	1	240	1.1	13.2	20
	T4D	ZS13KAE-TFD	460/3/60	4.8	29	1	240	0.6	6.6	15
	T5D	ZS13KAE-TFE	575/3/60	3.6	24.5	1	240	0.5	5.0	15
TEZA020H8-*	S2D	ZS15KAE-PFV	208-230/1/60	15.7	68	1	240	1.1	20.7	35
	T3D	ZS15KAE-TF5	208-230/3/60	10.6	58	1	240	1.1	14.4	25
	T4D	ZS15KAE-TFD	460/3/60	5.4	29	1	240	0.6	7.4	15
	T5D	ZS15KAE-TFE	575/3/60	3.9	24	1	240	0.5	5.4	15
TEZA025H8-*	S2D	ZS19KAE-PFV	208-230/1/60	18.0	75	1	400	2.1	24.6	40
	T3D	ZS19KAE-TF5	208-230/3/60	13.7	73	1	400	2.1	19.2	30
	T4D	ZS19KAE-TFD	460/3/60	6.5	38	1	400	1.1	9.2	15
	T5D	ZS19KAE-TFE	575/3/60	4.3	28	1	400	0.9	6.3	15
TEZA030H8-*	S2D	ZS21KAE-PFV	208-230/1/60	23.2	112	1	400	2.1	31.1	50
	T3D	ZS21KAE-TF5	208-230/3/60	15.2	93	1	400	2.1	21.1	35
	T4D	ZS21KAE-TFD	460/3/60	6.9	48	1	400	1.1	9.7	15
	T5D	ZS21KAE-TFE	575/3/60	5.8	33	1	400	0.9	8.2	15
TEZA035H8-*	S2D	ZS26KAE-PFV	208-230/1/60	23.6	104	1	400	2.1	31.6	50
	T3D	ZS26KAE-TF5	208-230/3/60	15.5	93	1	400	2.1	21.5	35
	T4D	ZS26KAE-TFD	460/3/60	6.9	48	1	400	1.1	9.7	15
	T5D	ZS26KAE-TFE	575/3/60	6.4	38	1	400	0.9	8.9	15
TEZA040H8-*	S2D	ZS29KAE-PFV	208-230/1/60	26.1	137	1	400	2.1	34.7	60
	T3D	ZS29KAE-TF5	208-230/3/60	20.5	114	1	400	2.1	27.7	45
	T4D	ZS29KAE-TFD	460/3/60	9.4	58	1	400	1.1	12.9	20
	T5D	ZS29KAE-TFE	575/3/60	5.8	43	1	400	0.9	8.2	15
TEZA045H8-*	S2D	ZS33KAE-PFV	208-230/1/60	25.6	146	1	400	2.1	34.1	60
	T3D	ZS33KAE-TF5	208-230/3/60	22.3	114	1	400	2.1	30.0	50
	T4D	ZS33KAE-TFD	460/3/60	10.0	52	1	400	1.1	13.6	20
	T5D	ZS33KAE-TFE	575/3/60	6.9	39.5	1	400	0.9	9.5	15
TEZA050H8-*	S2D	ZB38KCE-PFV	208-230/1/60	31.1	175	1	400	2.1	41.0	70
	T3D	ZB38KCE-TF5	208-230/3/60	22.1	128	1	400	2.1	29.7	50
	T4D	ZB38KCE-TFD	460/3/60	9.6	63	1	400	1.1	13.1	20
	T5D	ZB38KCE-TFE	575/3/60	7.1	50	1	400	0.9	9.8	15
TEZA060H8-*	T3D	ZB45KCE-TF5	208-230/3/60	22.5	156	1	400	2.1	30.2	50
	T4D	ZB45KCE-TFD	460/3/60	11.5	75	1	400	1.1	15.5	25
	T5D	ZB45KCE-TFE	575/3/60	7.9	54	1	400	0.9	10.8	15
TEZA061H8-*	T3D	ZB48KCE-TF5	208-230/3/60	25.4	164	1	400	2.1	33.9	50
	T4D	ZB48KCE-TFD	460/3/60	13.6	100	1	400	1.1	18.1	30
	T5D	ZB48KCE-TFE	575/3/60	10.1	78	1	400	0.9	13.5	20
TEZA070H8-*	T3D	ZB57KCE-TF5	208-230/3/60	35.5	224	2	800	4.2	48.6	80
	T4D	ZB57KCE-TFD	460/3/60	15.2	99	2	800	2.2	21.2	35
	T5D	ZB57KCE-TFE	575/3/60	11.6	82.4	2	800	1.8	16.3	25
TEZA076H8-*	T3D	ZB66K5E-TFC	208-230/3/60	39.3	225	2	800	4.2	53.3	90
	T4D	ZB66K5E-TFD	460/3/60	17.3	114	2	800	2.2	23.8	40
	T5D	ZB66K5E-TFE	575/3/60	14.3	80	2	800	1.8	19.7	30
TEZA085H8-*	T3D	ZB76K5E-TFC	208-230/3/60	43.0	239	2	800	4.2	58.0	100
	T4D	ZB76K5E-TFD	460/3/60	20.7	125	2	800	2.2	28.1	45
	T5D	ZB76K5E-TFE	575/3/60	14.6	80	2	800	1.8	20.1	30
TEZA110H8-*	T3D	ZB95K5E-TWC	208-230/3/60	52.9	298	2	1560	7.2	73.3	125
	T4D	ZB95K5E-TFD	460/3/60	25.0	150	2	1560	3.4	34.7	50
	T5D	ZB95K5E-TFE	575/3/60	20.8	123	2	1560	2.8	28.8	45
TEZA150H8-*	T3D	ZB114K5E-TWC	208-230/3/60	63.0	321	2	1560	7.2	86.0	125
	T4D	ZB114K5E-TFD	460/3/60	27.9	179	2	1560	3.4	38.3	60
	T5D	ZB114K5E-TWE	575/3/60	22.4	132	2	1560	2.8	30.8	50

* I = Indoor, H = Outdoor. Above listed RLA value is based on UL rating method and may differ from published compressor RLA data.
** SMARTSPEED EC Motor Standard

table continues on next page >>>

Standard Models *(cont'd)*

Model TEZA		Compressor Model No.	Power Supply	Compressor		Condenser Fan Motor			Unit	
				RLA	LRA	Quantity	Watts	FLA	MCA	MOP
TEZA008L8-*	S2D	ZF03KAE-PFV	208-230/1/60	6.4	42.6	1	100**	1.0	9.0	15
	T3D	ZF03KAE-TF5	208-230/3/60	4.1	31.7	1	100**	1.0	6.1	15
TEZA010L8-*	S2D	ZF04KAE-PFV	208-230/1/60	7.4	40	1	100**	1.0	10.3	15
	T3D	ZF04KAE-TF5	208-230/3/60	6.6	55	1	100**	1.0	9.3	15
TEZA015L8-*	S2D	ZF05KAE-PFV	208-230/1/60	8.7	55	1	100**	1.0	11.9	20
	T3D	ZF05KAE-TF5	208-230/3/60	7.5	58	1	100**	1.0	10.4	15
TEZA020L8-*	S2D	ZF07KAE-PFV	208-230/1/60	13.9	75	1	100**	1.0	18.4	30
	T3D	ZF07KAE-TF5	208-230/3/60	8.6	58	1	100**	1.0	11.8	20
TEZA025L8-*	S2D	ZF08K4E-PFV	208-230/1/60	16.4	73	1	240	1.1	21.6	35
	T3D	ZF08K4E-TF5	208-230/3/60	9.6	63	1	240	1.1	13.1	20
	T4D	ZF08K4E-TFD	460/3/60	5.0	31	1	240	0.6	6.9	15
TEZA030L8-*	S2D	ZF09K4E-PFV	208-230/1/60	15.4	88	1	240	1.1	20.4	35
	T3D	ZF09K4E-TF5	208-230/3/60	9.9	77	1	240	1.1	13.5	20
	T4D	ZF09K4E-TFD	460/3/60	5.0	39	1	240	0.6	6.9	15
	T5D	ZF09K4E-TFE	575/3/60	4.3	31	1	240	0.5	5.9	15
TEZA035L8-*	S2D	ZF11K4E-PFV	208-230/1/60	20.7	109	1	240	1.1	27.0	45
	T3D	ZF11K4E-TF5	208-230/3/60	12.7	88	1	240	1.1	17.0	25
	T4D	ZF11K4E-TFD	460/3/60	6.4	44	1	240	0.6	8.6	15
	T5D	ZF11K4E-TFE	575/3/60	4.6	34	1	240	0.5	6.3	15
TEZA045L8-*	S2D	ZF13K4E-PFV	208-230/1/60	25.0	129	1	400	2.1	33.4	50
	T3D	ZF13K4E-TF5	208-230/3/60	13.8	99	1	400	2.1	19.4	30
	T4D	ZF13K4E-TFD	460/3/60	7.1	49.5	1	400	1.1	10.0	15
	T5D	ZF13K4E-TFE	575/3/60	7.1	40	1	400	0.9	9.8	15
TEZA055L8-*	S2D	ZF15K4E-PFV	208-230/1/60	27.9	169	1	400	2.1	37.0	60
	T3D	ZF15K4E-TF5	208-230/3/60	18.9	123	1	400	2.1	25.7	40
	T4D	ZF15K4E-TFD	460/3/60	8.9	62	1	400	1.1	12.2	20
	T5D	ZF15K4E-TFE	575/3/60	6.4	50	1	400	0.9	8.9	15
TEZA060L8-*	T3D	ZF18K4E-TF5	208-230/3/60	21.8	156	1	400	2.1	29.4	50
	T4D	ZF18K4E-TFD	460/3/60	9.0	75	1	400	1.1	12.4	20
	T5D	ZF18K4E-TFE	575/3/60	7.9	54	1	400	0.9	10.8	15
TEZA075L8-*	T3D	ZF25K4E-TF5	208-230/3/60	26.7	224	1	400	2.1	35.5	60
	T4D	ZF25K4E-TFD	460/3/60	11.9	99	1	400	1.1	16.0	25
	T5D	ZF25K4E-TFE	575/3/60	9.1	82.4	1	400	0.9	12.3	20
TEZA085L8-*	T3D	ZF28K4E-TFC	208-230/3/60	30.4	199	1	400	2.1	40.1	70
	T4D	ZF28K4E-TFD	460/3/60	14.4	121	1	400	1.1	19.1	30
	T5D	ZF28K4E-TFE	575/3/60	11.4	68.9	1	400	0.9	15.2	25
TEZA100L8-*	T3D	ZF34K5E-TFC	208-230/3/60	37.1	239	1	400	2.1	48.5	80
	T4D	ZF34K5E-TFD	460/3/60	17.9	100	1	400	1.1	23.5	40
	T5D	ZF34K5E-TFE	575/3/60	14.3	100	1	400	0.9	18.8	30
TEZA130L8-*	T3D	ZF41K5E-TFC	208-230/3/60	42.1	248	2	800	4.2	56.8	90
	T4D	ZF41K5E-TFD	460/3/60	19.3	125	2	800	2.2	26.3	45
	T5D	ZF41K5E-TFE	575/3/60	15.6	100	2	800	1.8	21.3	35
TEZA150L8-*	T3D	ZF49K5E-TFC	208-230/3/60	50.7	339	2	800	4.2	67.6	100
	T4D	ZF49K5E-TFD	460/3/60	20.2	139	2	800	2.2	27.5	45
	T5D	ZF49K5E-TFE	575/3/60	18.2	123	2	800	1.8	24.6	40
TEZA170L8-*	T3D	ZF54K5E-TFC	208-230/3/60	58.7	423	2	1560	7.2	80.6	125
	T4D	ZF54K5E-TFD	460/3/60	28.6	185	2	1560	3.4	39.2	60
	T5D	ZF54K5E-TFE	575/3/60	22.9	145	2	1560	2.8	31.4	50

* I = Indoor, H = Outdoor. Above listed RLA value is based on UL rating method and may differ from published compressor RLA data.
** **SMART**SPEED® EC Motor Standard

Models with Optional SMARTSPEED™ EC Motors

Model TEZA		Compressor Model No.	Power Supply	Compressor		ECM Condenser Fan Motor			Unit	
				RLA	LRA	Quantity	Watts	FLA	MCA	MOP
TEZA010H8-*	S2D	ZS09KAE-PFV	208-230/1/60	10.0	40.3	1	175	2.0	14.5	20
	T3D	ZS09KAE-TF5	208-230/3/60	8.0	55.4	1	175	2.0	12.0	20
	T4D	ZS09KAE-TFD	460/3/60	3.8	28	1	175	1.0	5.8	15
TEZA011H8-*	S2D	ZS11KAE-PFV	208-230/1/60	12.6	55	1	175	2.0	17.8	30
	T3D	ZS11KAE-TF5	208-230/3/60	10.4	58	1	175	2.0	15.0	25
	T4D	ZS11KAE-TFD	460/3/60	4.3	28	1	175	1.0	6.4	15
TEZA015H8-*	S2D	ZS13KAE-PFV	208-230/1/60	12.0	56	1	175	2.0	17.0	25
	T3D	ZS13KAE-TF5	208-230/3/60	9.7	58	1	175	2.0	14.1	20
	T4D	ZS13KAE-TFD	460/3/60	4.8	29	1	175	1.0	7.0	15
	T5D	ZS13KAE-TFE	575/3/60	3.6	24.5	1	175	0.8	5.3	15
TEZA020H8-*	S2D	ZS15KAE-PFV	208-230/1/60	15.7	68	1	175	2.0	21.6	35
	T3D	ZS15KAE-TF5	208-230/3/60	10.6	58	1	175	2.0	15.3	25
	T4D	ZS15KAE-TFD	460/3/60	5.4	29	1	175	1.0	7.8	15
	T5D	ZS15KAE-TFE	575/3/60	3.9	24	1	175	0.8	5.7	15
TEZA025H8-*	S2D	ZS19KAE-PFV	208-230/1/60	18.0	75	1	315	3.5	26.0	40
	T3D	ZS19KAE-TF5	208-230/3/60	13.7	73	1	315	3.5	20.6	30
	T4D	ZS19KAE-TFD	460/3/60	6.5	38	1	315	1.8	9.9	15
	T5D	ZS19KAE-TFE	575/3/60	4.3	28	1	315	1.4	6.8	15
TEZA030H8-*	S2D	ZS21KAE-PFV	208-230/1/60	23.2	112	1	315	3.5	32.5	50
	T3D	ZS21KAE-TF5	208-230/3/60	15.2	93	1	315	3.5	22.5	35
	T4D	ZS21KAE-TFD	460/3/60	6.9	48	1	315	1.8	10.4	15
	T5D	ZS21KAE-TFE	575/3/60	5.8	33	1	315	1.4	8.7	15
TEZA035H8-*	S2D	ZS26KAE-PFV	208-230/1/60	23.6	104	1	315	3.5	33.0	50
	T3D	ZS26KAE-TF5	208-230/3/60	15.5	93	1	315	3.5	22.9	35
	T4D	ZS26KAE-TFD	460/3/60	6.9	48	1	315	1.8	10.4	15
	T5D	ZS26KAE-TFE	575/3/60	6.4	38	1	315	1.4	9.4	15
TEZA040H8-*	S2D	ZS29KAE-PFV	208-230/1/60	26.1	137	1	315	3.5	36.1	60
	T3D	ZS29KAE-TF5	208-230/3/60	20.5	114	1	315	3.5	29.1	45
	T4D	ZS29KAE-TFD	460/3/60	9.4	58	1	315	1.8	13.6	20
	T5D	ZS29KAE-TFE	575/3/60	5.8	43	1	315	1.4	8.7	15
TEZA045H8-*	S2D	ZS33KAE-PFV	208-230/1/60	25.6	146	1	315	3.5	35.5	60
	T3D	ZS33KAE-TF5	208-230/3/60	22.3	114	1	315	3.5	31.4	50
	T4D	ZS33KAE-TFD	460/3/60	10.0	52	1	315	1.8	14.3	20
	T5D	ZS33KAE-TFE	575/3/60	6.9	39.5	1	315	1.4	10.0	15
TEZA050H8-*	S2D	ZB38KCE-PFV	208-230/1/60	31.1	175	1	315	3.5	42.4	70
	T3D	ZB38KCE-TF5	208-230/3/60	22.1	128	1	315	3.5	31.1	50
	T4D	ZB38KCE-TFD	460/3/60	9.6	63	1	315	1.8	13.8	20
	T5D	ZB38KCE-TFE	575/3/60	7.1	50	1	315	1.4	10.3	15
TEZA060H8-*	T3D	ZB45KCE-TF5	208-230/3/60	22.5	156	1	315	3.5	31.6	50
	T4D	ZB45KCE-TFD	460/3/60	11.5	75	1	315	1.8	16.2	25
	T5D	ZB45KCE-TFE	575/3/60	7.9	54	1	315	1.4	11.3	15
TEZA061H8-*	T3D	ZB48KCE-TF5	208-230/3/60	25.4	164	1	315	3.5	35.3	60
	T4D	ZB48KCE-TFD	460/3/60	13.6	100	1	315	1.8	18.8	30
	T5D	ZB48KCE-TFE	575/3/60	10.1	78	1	315	1.4	14.0	20
TEZA070H8-*	T3D	ZB57KCE-TF5	208-230/3/60	35.5	224	2	630	7.0	51.4	80
	T4D	ZB57KCE-TFD	460/3/60	15.2	99	2	630	3.6	22.6	35
	T5D	ZB57KCE-TFE	575/3/60	11.6	82.4	2	630	2.8	17.3	25
TEZA076H8-*	T3D	ZB66K5E-TFC	208-230/3/60	39.3	225	2	630	7.0	56.1	90
	T4D	ZB66K5E-TFD	460/3/60	17.3	114	2	630	3.6	25.2	40
	T5D	ZB66K5E-TFE	575/3/60	14.3	80	2	630	2.8	20.7	35
TEZA085H8-*	T3D	ZB76K5E-TFC	208-230/3/60	43.0	239	2	630	7.0	60.8	100
	T4D	ZB76K5E-TFD	460/3/60	20.7	125	2	630	3.6	29.5	50
	T5D	ZB76K5E-TFE	575/3/60	14.6	80	2	630	2.8	21.1	35
TEZA110H8-*	T3D	ZB95K5E-TWC	208-230/3/60	52.9	298	2	1180	10.6	76.7	125
	T4D	ZB95K5E-TFD	460/3/60	25.0	150	2	1180	5.8	37.1	60
	T5D	ZB95K5E-TFE	575/3/60	20.8	123	2	1180	4.2	30.2	50
TEZA150H8-*	T3D	ZB114K5E-TWC	208-230/3/60	63.0	321	2	1180	10.6	89.4	150
	T4D	ZB114K5E-TFD	460/3/60	27.9	179	2	1180	5.8	40.7	60
	T5D	ZB114K5E-TWE	575/3/60	22.4	132	2	1180	4.2	32.2	50

* I = Indoor, H = Outdoor. Above listed RLA value is based on UL rating method and may differ from published compressor RLA data.

table continues on next page >>>

Models with Optional SMARTSPEED® EC Motors *(cont'd)*

Model TEZA		Compressor Model No.	Power Supply	Compressor		ECM Condenser Fan Motor			Unit	
				RLA	LRA	Quantity	Watts	FLA	MCA	MOP
TEZA025L8-*	S2D	ZF08K4E-PFV	208-230/1/60	16.4	73	1	175	2.0	22.5	35
	T3D	ZF08K4E-TF5	208-230/3/60	9.6	63	1	175	2.0	14.0	20
	T4D	ZF08K4E-TFD	460/3/60	5.0	31	1	175	1.0	7.3	15
TEZA030L8-*	S2D	ZF09K4E-PFV	208-230/1/60	15.4	88	1	175	2.0	21.3	35
	T3D	ZF09K4E-TF5	208-230/3/60	9.9	77	1	175	2.0	14.4	20
	T4D	ZF09K4E-TFD	460/3/60	5.0	39	1	175	1.0	7.3	15
	T5D	ZF09K4E-TFE	575/3/60	4.3	31	1	175	0.8	6.2	15
TEZA035L8-*	S2D	ZF11K4E-PFV	208-230/1/60	20.7	109	1	175	2.0	27.9	45
	T3D	ZF11K4E-TF5	208-230/3/60	12.7	88	1	175	2.0	17.9	30
	T4D	ZF11K4E-TFD	460/3/60	6.4	44	1	175	1.0	9.0	15
	T5D	ZF11K4E-TFE	575/3/60	4.6	34	1	175	0.8	6.6	15
TEZA045L8-*	S2D	ZF13K4E-PFV	208-230/1/60	25.0	129	1	315	3.5	34.8	60
	T3D	ZF13K4E-TF5	208-230/3/60	13.8	99	1	315	3.5	20.8	30
	T4D	ZF13K4E-TFD	460/3/60	7.1	49.5	1	315	1.8	10.7	15
	T5D	ZF13K4E-TFE	575/3/60	7.1	40	1	315	1.4	10.3	15
TEZA055L8-*	S2D	ZF15K4E-PFV	208-230/1/60	27.9	169	1	315	3.5	38.4	60
	T3D	ZF15K4E-TF5	208-230/3/60	18.9	123	1	315	3.5	27.1	45
	T4D	ZF15K4E-TFD	460/3/60	8.9	62	1	315	1.8	12.9	20
	T5D	ZF15K4E-TFE	575/3/60	6.4	50	1	315	1.4	9.4	15
TEZA060L8-*	T3D	ZF18K4E-TF5	208-230/3/60	21.8	156	1	315	3.5	30.8	50
	T4D	ZF18K4E-TFD	460/3/60	9.0	75	1	315	1.8	13.1	20
	T5D	ZF18K4E-TFE	575/3/60	7.9	54	1	315	1.4	11.3	15
TEZA075L8-*	T3D	ZF25K4E-TF5	208-230/3/60	26.7	224	1	315	3.5	36.9	60
	T4D	ZF25K4E-TFD	460/3/60	11.9	99	1	315	1.8	16.7	25
	T5D	ZF25K4E-TFE	575/3/60	9.1	82.4	1	315	1.4	12.8	20
TEZA085L8-*	T3D	ZF28K4E-TFC	208-230/3/60	30.4	199	1	315	3.5	41.5	70
	T4D	ZF28K4E-TFD	460/3/60	14.4	121	1	315	1.8	19.8	30
	T5D	ZF28K4E-TFE	575/3/60	11.4	68.9	1	315	1.4	15.7	25
TEZA100L8-*	T3D	ZF34K5E-TFC	208-230/3/60	37.1	239	1	315	3.5	49.9	80
	T4D	ZF34K5E-TFD	460/3/60	17.9	100	1	315	1.8	24.2	40
	T5D	ZF34K5E-TFE	575/3/60	14.3	100	1	315	1.4	19.3	30
TEZA130L8-*	T3D	ZF41K5E-TFC	208-230/3/60	42.1	248	2	630	7.0	59.6	100
	T4D	ZF41K5E-TFD	460/3/60	19.3	125	2	630	3.6	27.7	45
	T5D	ZF41K5E-TFE	575/3/60	15.6	100	2	630	2.8	22.3	35
TEZA150L8-*	T3D	ZF49K5E-TFC	208-230/3/60	50.7	339	2	630	7.0	70.4	120
	T4D	ZF49K5E-TFD	460/3/60	20.2	139	2	630	3.6	28.9	45
	T5D	ZF49K5E-TFE	575/3/60	18.2	123	2	630	2.8	25.6	40
TEZA170L8-*	T3D	ZF54K5E-TFC	208-230/3/60	58.7	423	2	1180	10.6	84.0	125
	T4D	ZF54K5E-TFD	460/3/60	28.6	185	2	1180	5.4	41.2	70
	T5D	ZF54K5E-TFE	575/3/60	22.9	145	2	1180	4.2	32.8	50

* I = Indoor, H = Outdoor. Above listed RLA value is based on UL rating method and may differ from published compressor RLA data.

Annual Walk-In Energy Factor Ratings - High/Medium Temperature

If a numerical value is listed in the table below, the following statement applies to that corresponding model: "This refrigeration system is designed and certified for use in walk-in cooler applications."

Model TEZA		Power Supply	Outdoor Models				Indoor Models			
			R404A R507	R407A	R448A R449A	R407C	R404A R507	R407A	R448A R449A	R407C
TEZA007H8-*	S2D	208-230/1/60	7.6	7.6	7.6	-	-	-	-	-
	T3D	208-230/3/60	7.6	7.6	7.6	-	-	-	-	-
TEZA008H8-*	S2D	208-230/1/60	7.6	7.6	7.6	-	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	-	5.61	5.61	5.61	5.61
TEZA009H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA010H8-*	S2D	208-230/1/60	7.6	7.6	7.6	-	-	-	-	-
	T3D	208-230/3/60	7.6	7.6	7.6	-	-	-	-	-
	T4D	460/3/60	7.6	7.6	7.6	-	-	-	-	-
TEZA011H8-*	S2D	208-230/1/60	7.6	7.6	7.6	-	-	5.61	5.61	-
	T3D	208-230/3/60	7.6	7.6	7.6	-	-	5.61	5.61	-
	T4D	460/3/60	7.6	7.6	7.6	-	-	5.61	5.61	-
TEZA015H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA020H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	-	-	-	-
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	-	-	-	-
	T4D	460/3/60	7.6	7.6	7.6	7.6	-	-	-	-
	T5D	575/3/60	7.6	7.6	7.6	7.6	-	-	-	-
TEZA025H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA030H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA035H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA040H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA045H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA050H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
TEZA060H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA061H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	-	-	5.61	5.61	-
TEZA070H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA076H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA085H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61
TEZA110H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA150H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61

— = Non-compliant model

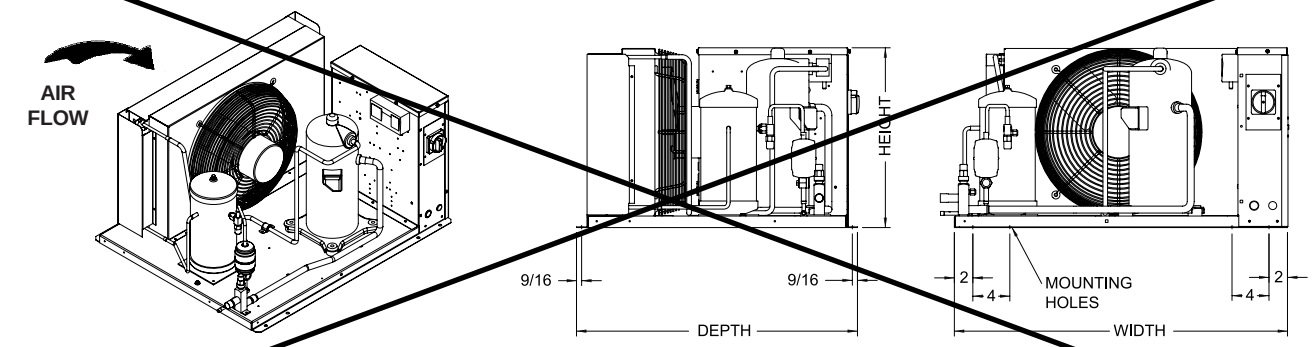
Annual Walk-In Energy Factor Ratings - Low Temperature

If a numerical value is listed in the table below, the following statement applies to that corresponding model: "This refrigeration system is designed and certified for use in walk-in freezer applications."

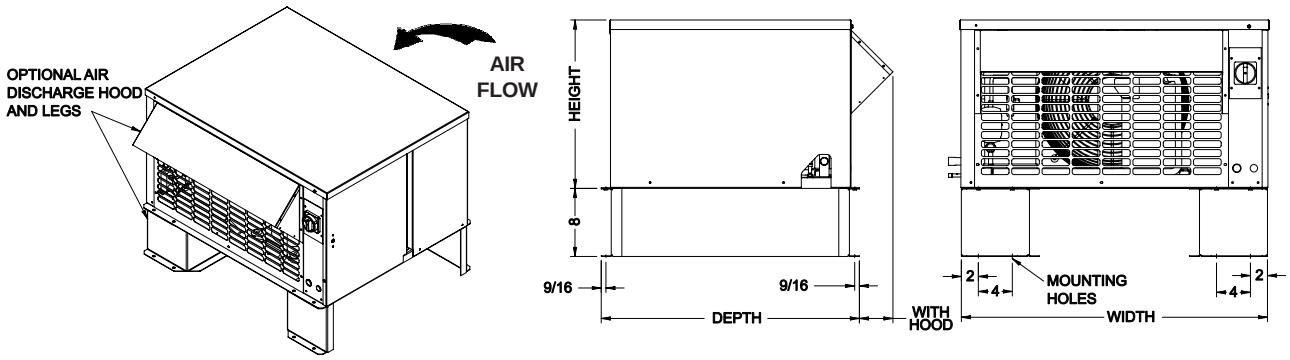
Model TEZA		Power Supply	Outdoor Models			Indoor Models		
			R404A R507	R407A	R448A R449A	R404A R507	R407A	R448A R449A
TEZA008L8-*	S2D	208-230/1/60	2.88	-	-	2.03	-	-
	T3D	208-230/3/60	2.88	-	-	2.03	-	-
TEZA010L8-*	S2D	208-230/1/60	2.93	2.91	2.92	2.10	-	-
	T3D	208-230/3/60	2.93	2.91	2.92	2.10	-	-
TEZA015L8-*	S2D	208-230/1/60	2.98	2.96	2.97	2.17	2.13	2.15
	T3D	208-230/3/60	2.98	2.96	2.97	2.17	2.13	2.15
TEZA020L8-*	S2D	208-230/1/60	3.1	3.08	3.08	-	-	-
	T3D	208-230/3/60	3.1	3.08	3.08	-	-	-
TEZA025L8-*	S2D	208-230/1/60	3.15	-	3.14	2.40	-	2.39
	T3D	208-230/3/60	3.15	3.13	3.14	2.40	-	2.39
	T4D	460/3/60	3.15	3.13	3.14	2.40	-	2.39
TEZA030L8-*	S2D	208-230/1/60	3.15	-	3.15	2.40	-	2.40
	T3D	208-230/3/60	3.15	3.15	3.15	2.40	-	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	-	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	-	2.40
TEZA035L8-*	S2D	208-230/1/60	3.15	-	3.15	-	-	-
	T3D	208-230/3/60	3.15	3.15	3.15	2.40	-	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	-	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	-	2.40
TEZA045L8-*	S2D	208-230/1/60	3.15	-	3.15	2.40	-	-
	T3D	208-230/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	2.40	2.40
TEZA055L8-*	S2D	208-230/1/60	3.15	-	3.15	-	2.40	2.40
	T3D	208-230/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	2.40	2.40
TEZA060L8-*	T3D	208-230/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	2.40	2.40
TEZA075L8-*	T3D	208-230/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	2.40	2.40
TEZA085L8-*	T3D	208-230/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	2.40	2.40
TEZA100L8-*	T3D	208-230/3/60	3.15	-	3.15	-	2.40	2.40
	T4D	460/3/60	3.15	-	3.15	-	2.40	2.40
	T5D	575/3/60	3.15	-	3.15	-	2.40	2.40
TEZA130L8-*	T3D	208-230/3/60	3.15	-	3.15	2.40	-	2.40
	T4D	460/3/60	3.15	-	3.15	2.40	-	2.40
	T5D	575/3/60	3.15	-	3.15	2.40	-	2.40
TEZA150L8-*	T3D	208-230/3/60	3.15	-	3.15	-	-	-
	T4D	460/3/60	3.15	-	3.15	-	-	-
	T5D	575/3/60	3.15	-	3.15	-	-	-
TEZA170L8-*	T3D	208-230/3/60	-	-	3.15	-	-	-
	T4D	460/3/60	-	-	3.15	-	-	-
	T5D	575/3/60	-	-	3.15	-	-	-

— = Non-compliant model

Drawing A: 1 Fan Models, Chassis 1 and 2

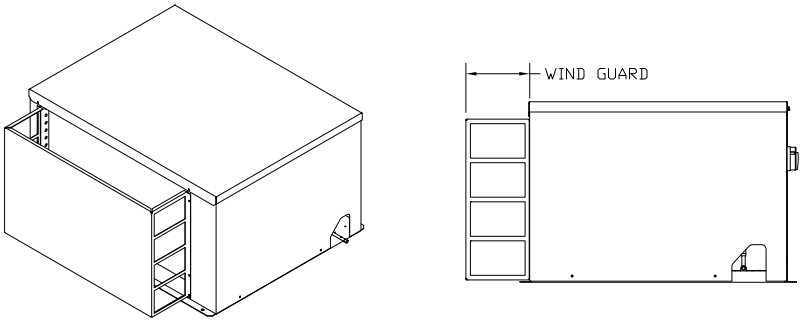


INDOOR DIMENSIONS



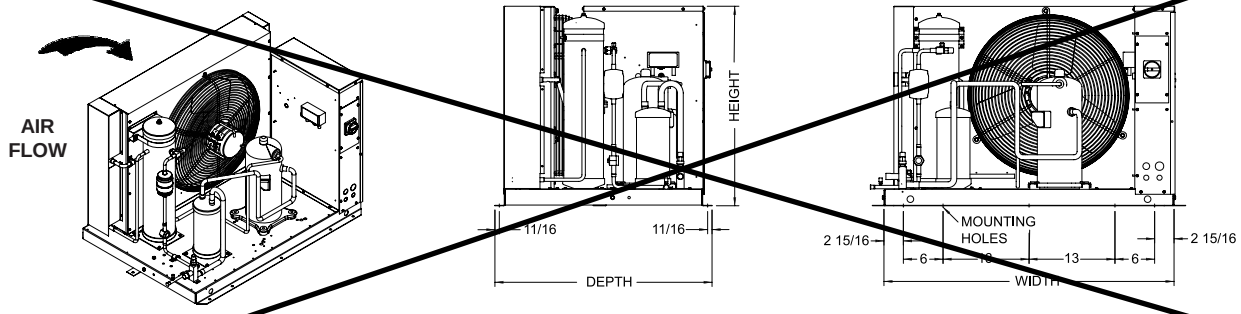
OUTDOOR DIMENSIONS

NOTE: Discharge hood, legs and wind guard are optional components

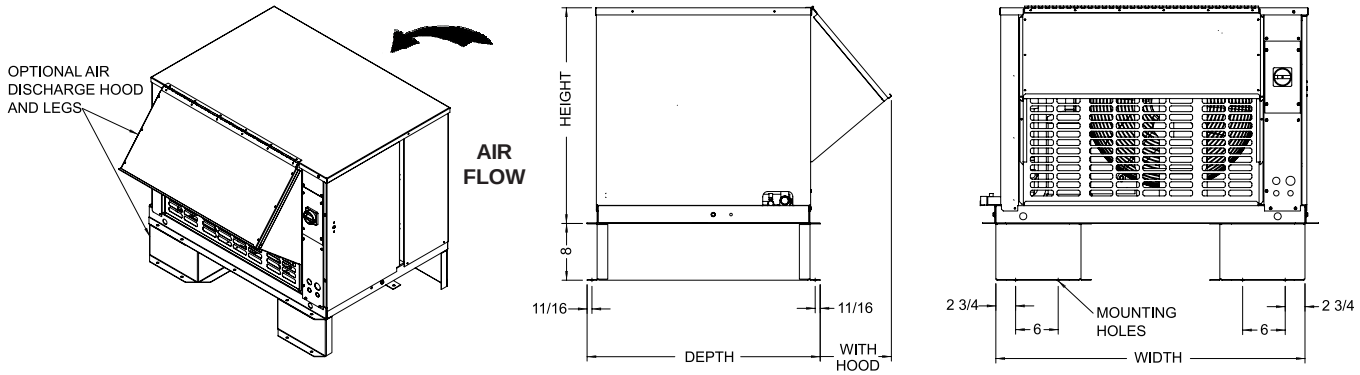


**REFER TO PAGE 29 FOR
DIMENSIONAL DATA FOR SPECIFIC MODELS**

Drawing B: 1 Fan Models, Chassis 3 and 4

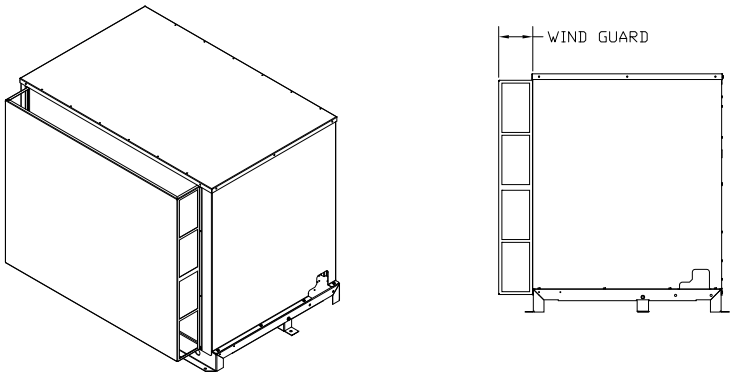


INDOOR DIMENSIONS



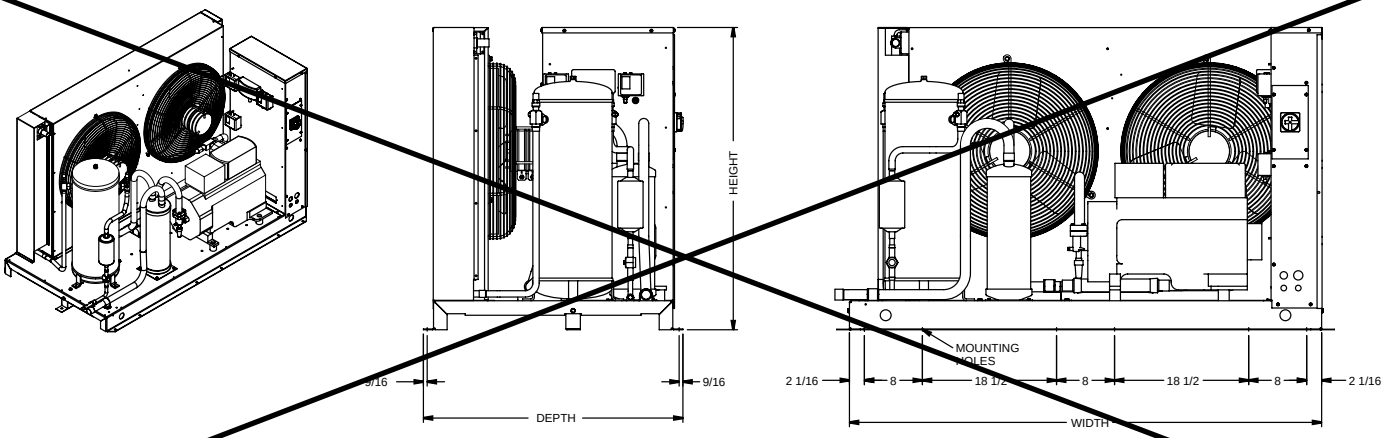
OUTDOOR DIMENSIONS

NOTE: Discharge hood, legs and wind guard are optional components

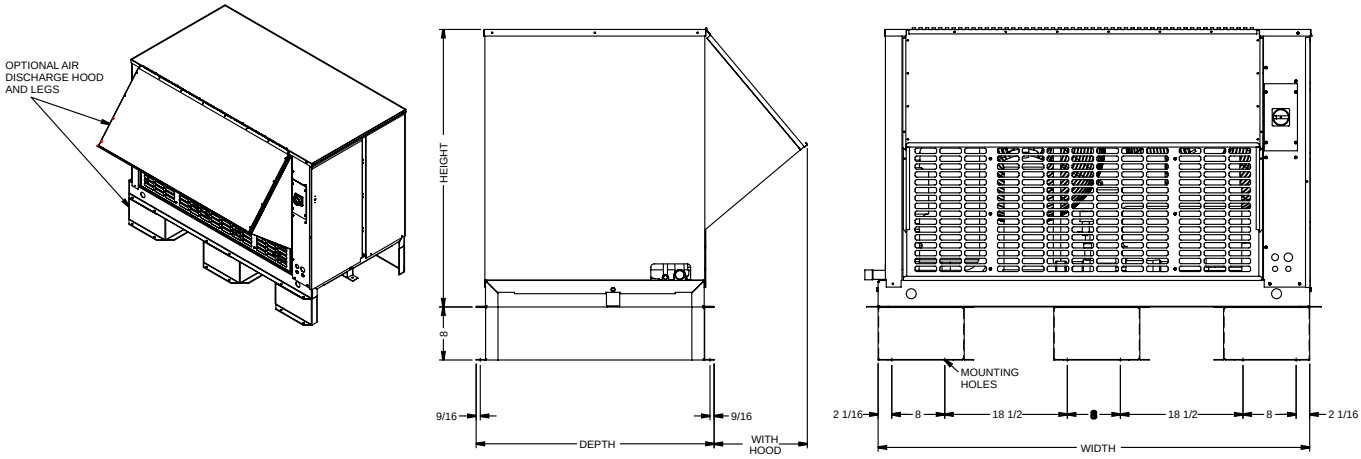


REFER TO PAGE 29 FOR DIMENSIONAL DATA FOR SPECIFIC MODELS

Drawing C: 2 Fan Models, Chassis 5

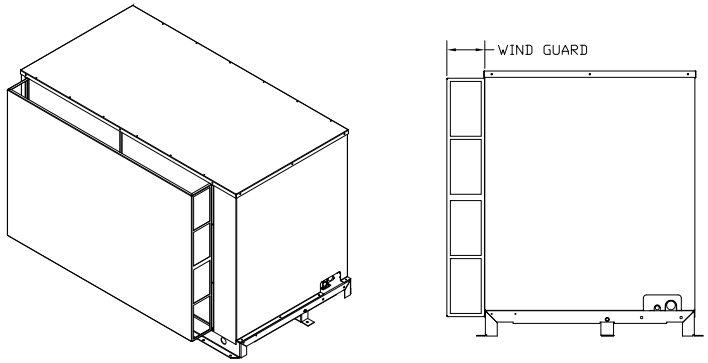


INDOOR DIMENSIONS



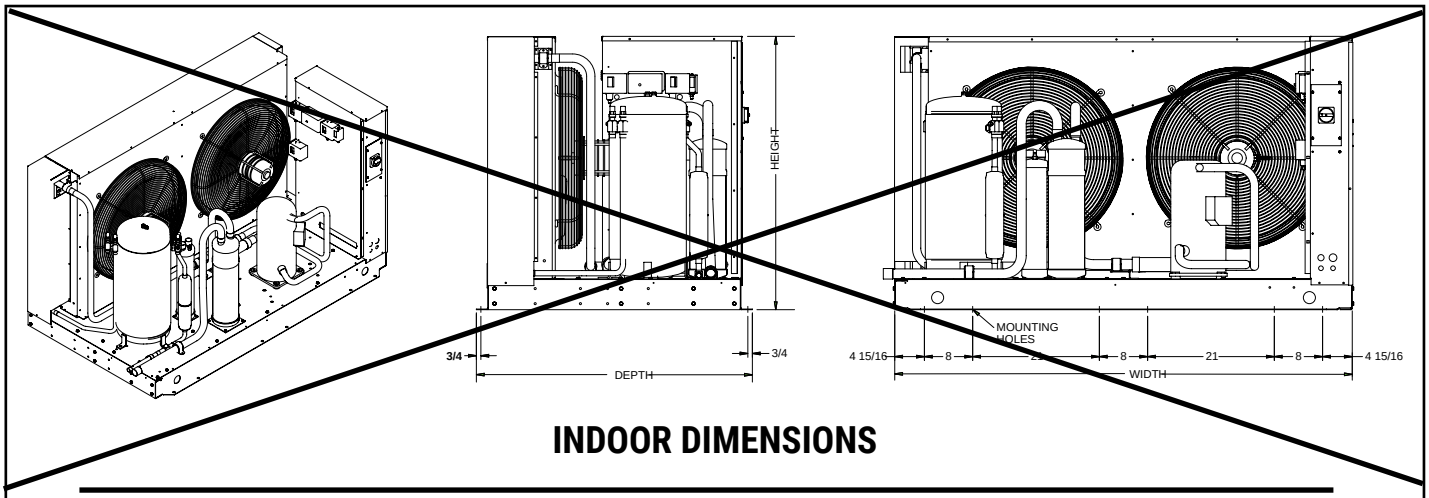
OUTDOOR DIMENSIONS

NOTE: Discharge hood, legs and wind guard are optional components

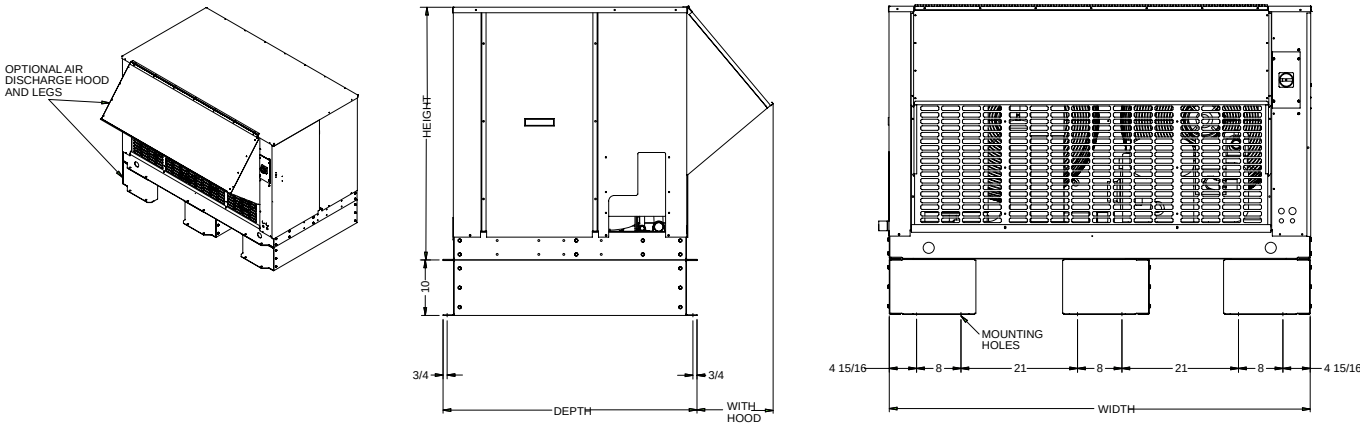


REFER TO PAGE 29 FOR DIMENSIONAL DATA FOR SPECIFIC MODELS

Drawing D: 2 Fan Models, Chassis 6

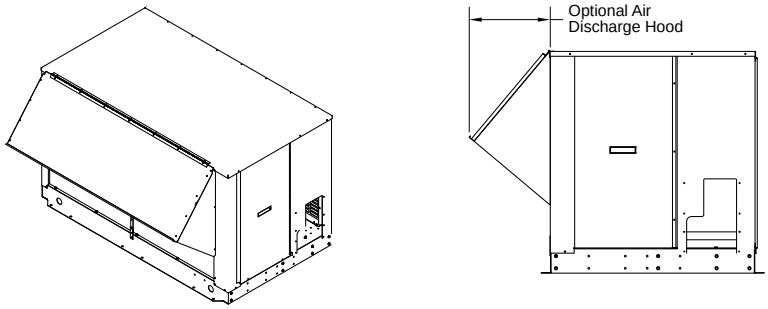


INDOOR DIMENSIONS



OUTDOOR DIMENSIONS

NOTE: Discharge hood, legs and wind guard are optional components



REFER TO PAGE 29 FOR DIMENSIONAL DATA FOR SPECIFIC MODELS

Model TEZA	Chassis (see details below)	Outdoor Models								Indoor Models					
		Width		Depth				Height		Width		Depth		Height	
				Base		with Hood									
		Inches	*mm*	Inches	*mm*	Inches	*mm*	Inches	*mm*	Inches	*mm*	Inches	*mm*	Inches	*mm*
TEZA007H8	1	24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA008H8		24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA009H8		24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA010H8	2	36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA011H8		36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA015H8		36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA020H8		36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA025H8	3	43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 1/16	*767*
TEZA030H8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA035H8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA040H8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA045H8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA050H8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA060H8	4	52 1/8	*1324*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	52 1/8	*1324*	35 7/8	*911*	41 11/16	*1059*
TEZA061H8		52 1/8	*1324*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	52 1/8	*1324*	35 7/8	*911*	41 11/16	*1059*
TEZA070H8	5	65 1/8	*1654*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	65 1/8	*1654*	35 7/8	*911*	41 11/16	*1059*
TEZA076H8		65 1/8	*1654*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	65 1/8	*1654*	35 7/8	*911*	41 11/16	*1059*
TEZA085H8		65 1/8	*1654*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	65 1/8	*1654*	35 7/8	*911*	41 11/16	*1059*
TEZA110H8	6	75 7/8	*1927*	45 3/4	*1162*	59	*1511*	45 1/2	*1156*	75 7/8	*1927*	45 3/4	*1162*	45 17/32	*1156*
TEZA150H8		75 7/8	*1927*	45 3/4	*1162*	59	*1511*	45 1/2	*1156*	75 7/8	*1927*	45 3/4	*1162*	45 17/32	*1156*
TEZA008L8	1	24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA010L8		24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA015L8		24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA020L8		24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA025L8	2	36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA030L8		36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA035L8		36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA045L8	3	43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA055L8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA060L8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA075L8	4	52 1/8	*1324*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	52 1/8	*1324*	35 7/8	*911*	41 11/16	*1059*
TEZA085L8		52 1/8	*1324*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	52 1/8	*1324*	35 7/8	*911*	41 11/16	*1059*
TEZA100L8		52 1/8	*1324*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	52 1/8	*1324*	35 7/8	*911*	41 11/16	*1059*
TEZA130L8	5	65 1/8	*1654*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	65 1/8	*1654*	35 7/8	*911*	41 11/16	*1059*
TEZA150L8		65 1/8	*1654*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	65 1/8	*1654*	35 7/8	*911*	41 11/16	*1059*
TEZA170L8	6	75 7/8	*1927*	45 3/4	*1162*	59	*1511*	45 1/2	*1156*	75 7/8	*1927*	45 3/4	*1162*	45 17/32	*1156*

Chassis	Drawing	See Page #
1	A	25
2	A	25
3	B	26
4	B	26
5	C	27
6	D	28

Model TEZA	Unit Connections				R404A Receiver Capacity 90% Full *		Approx. Shipping Weight			
	Suction (OD)		Liquid (OD)				Outdoor Models		Indoor Models	
	Inches	*mm*	Inches	*mm*	Lbs.	*Kgs*	Lbs.	*Kgs*	Lbs.	*Kgs*
TEZA007H8	5/8	*16*	3/8	*10*	5.4	*2.4*	183	*83*	161	*73*
TEZA008H8	5/8	*16*	3/8	*10*	5.4	*2.4*	188	*85*	167	*76*
TEZA009H8	5/8	*16*	3/8	*10*	5.4	*2.4*	188	*85*	167	*76*
TEZA010H8	5/8	*16*	3/8	*10*	11	*4.9*	285	*129*	265	*120*
TEZA011H8	5/8	*16*	3/8	*10*	11	*4.9*	285	*129*	265	*120*
TEZA015H8	7/8	*22*	3/8	*10*	11	*4.9*	285	*129*	265	*120*
TEZA020H8	7/8	*22*	3/8	*10*	11	*4.9*	300	*136*	280	*127*
TEZA025H8	7/8	*22*	1/2	*13*	22	*10.0*	405	*184*	370	*168*
TEZA030H8	7/8	*22*	1/2	*13*	22	*10.0*	410	*186*	375	*170*
TEZA035H8	7/8	*22*	1/2	*13*	22	*10.0*	415	*188*	380	*172*
TEZA040H8	1 1/8	*29*	1/2	*13*	22	*10.0*	420	*191*	390	*177*
TEZA045H8	1 1/8	*29*	1/2	*13*	22	*10.0*	425	*193*	390	*177*
TEZA050H8	1 1/8	*29*	1/2	*13*	22	*10.0*	425	*193*	390	*177*
TEZA060H8	1 1/8	*29*	5/8	*16*	30	*13.8*	470	*213*	430	*195*
TEZA061H8	1 1/8	*29*	5/8	*16*	30	*13.6*	510	*231*	465	*211*
TEZA070H8	1 3/8	*35*	5/8	*16*	54	*24.5*	625	*283*	570	*259*
TEZA076H8	1 3/8	*35*	5/8	*16*	54	*24.5*	635	*288*	580	*263*
TEZA085H8	1 3/8	*35*	5/8	*16*	54	*24.5*	645	*293*	590	*268*
TEZA110H8	1 3/8	*35*	7/8	*22*	76	*34.5*	745	*338*	690	*313*
TEZA150H8	1 5/8	*41*	7/8	*22*	76	*34.5*	845	*383*	790	*358*
TEZA008L8	5/8	*16*	3/8	*10*	5.4	*2.4*	205	*93*	185	84
TEZA010L8	5/8	*16*	3/8	*10*	5.4	*2.4*	205	*93*	185	*84*
TEZA015L8	5/8	*16*	3/8	*10*	5.4	*2.4*	210	*95*	190	*86*
TEZA020L8	7/8	*22*	3/8	*10*	11	*4.9*	315	*143*	290	*132*
TEZA025L8	7/8	*22*	3/8	*10*	14	*6.3*	335	*152*	310	*141*
TEZA030L8	7/8	*22*	3/8	*10*	14	*6.3*	425	*193*	390	*177*
TEZA035L8	7/8	*22*	1/2	*13*	14	*6.3*	430	*195*	400	*181*
TEZA045L8	1 1/8	*29*	1/2	*13*	22	*10.0*	435	*197*	400	*181*
TEZA055L8	1 1/8	*29*	1/2	*13*	22	*10.0*	440	*200*	400	*181*
TEZA060L8	1 1/8	*29*	1/2	*13*	22	*10.0*	485	*220*	450	*204*
TEZA075L8	1 3/8	*35*	5/8	*16*	30	*13.8*	495	*225*	460	*209*
TEZA085L8	1 3/8	*35*	5/8	*16*	30	*13.6*	525	*238*	480	*218*
TEZA100L8	1 3/8	*35*	5/8	*16*	30	*13.6*	545	*247*	500	*227*
TEZA130L8	1 3/8	*35*	5/8	*16*	54	*24.5*	725	*329*	670	*304*
TEZA150L8	1 5/8	*35*	5/8	*16*	54	*24.5*	745	*338*	690	*313*
TEZA170L8	1 5/8	*41*	7/8	*22*	76	*34.5*	955	*433*	900	*408*

*** NOTE ON ALTERNATE REFRIGERANTS:**

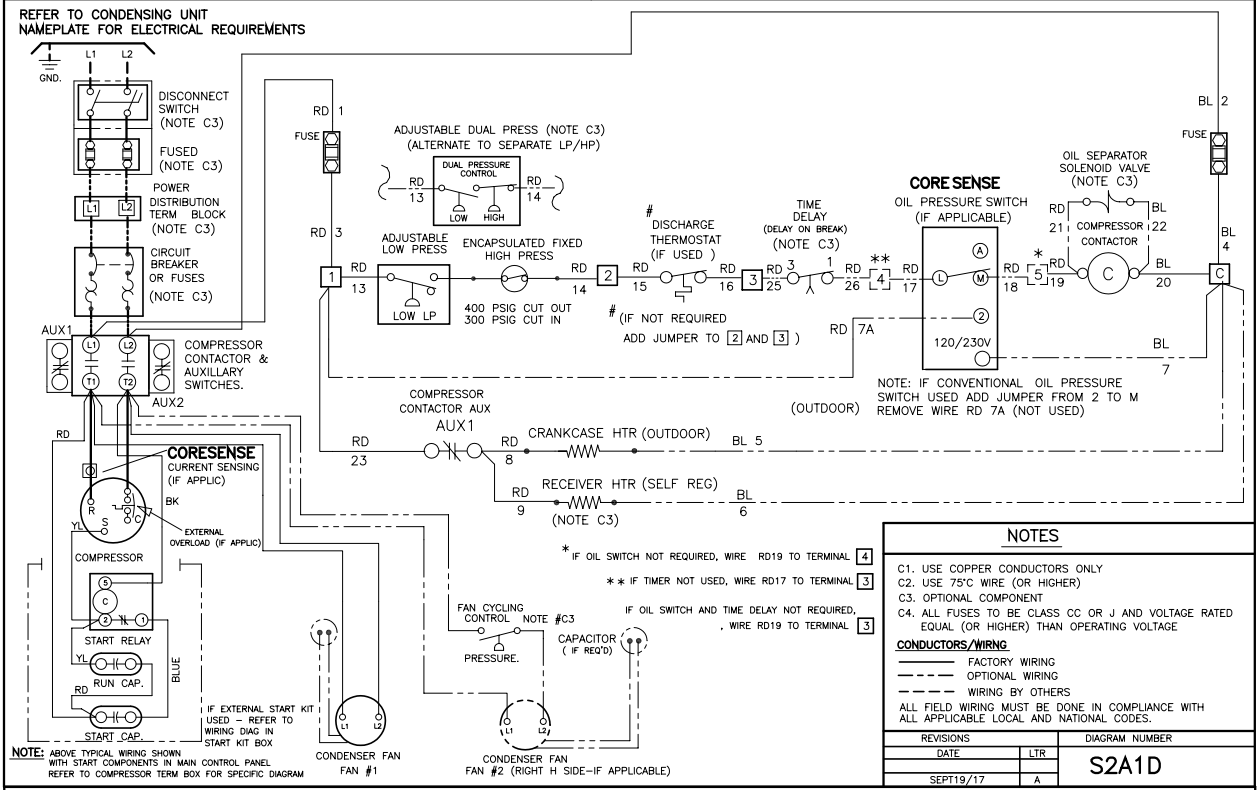
* PUBLISHED RECEIVER CAPACITY IS BASED ON R404A ON MODELS USING "8" AS REFRIGERANT CODE.
FOR ALTERNATE REFRIGERANTS, MULTIPLY R404A VALUE BY THE APPROPRIATE VALUE BELOW:

R407A	R407C	R448A	R449A	R507	R22
1.10	1.10	1.05	1.05	1.00	1.15

208-230/1/60 Unit with 230V Air Defrost Evaporator

CONDENSING UNIT WIRING DIAGRAM

– 208/230V–1–60 or 200/220V–1–50 Hz
– OPTIONAL CORESENSE OIL PROTECTION
– STANDARD CTRL CIRCUIT–WITH DISCH T'STAT (IF REQUIRED)



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

CONDUCTORS/WIRING

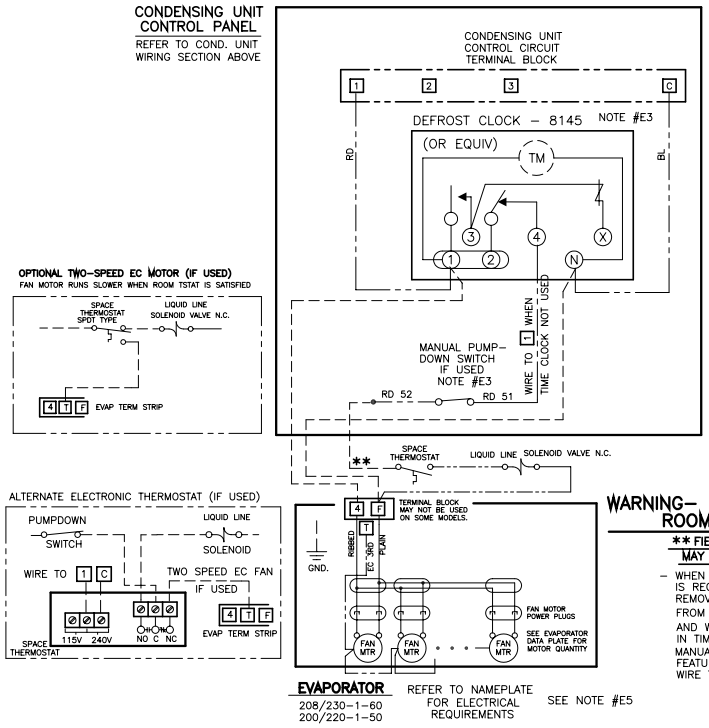
——— FACTORY WIRING
– – – – OPTIONAL WIRING
– – – – WIRING BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	S2A1D
SEPT19/17	A	

TYPICAL EVAPORATOR WIRING: FOR SINGLE AIR DEFROST EVAPORATOR– SINGLE POINT

FOR USE WITH: 208/230–1–60, 200/220–1–50 OR 208/230–3–60, 200/220–3–50 CONDENSING UNITS WITH OR WITHOUT DEFROST TIME CLOCK AND FOR TOTAL EVAP FAN AMPS NOT EXCEEDING 12A



WARNING– FOR PRE–INSTALLED ROOM T'STATS

**** FIELD MODIFICATION MAY BE REQUIRED**

– WHEN DEFROST TIME CLOCK IS REQUIRED, REMOVE THERMOSTAT WIRE FROM TERMINAL 4 IN UNIT COOLER, AND WIRE TO TERMINAL ④ IN TIME CLOCK, OR IF MANUAL PUMP DOWN SWITCH FEATURE IS ALSO REQUIRED, WIRE TO SWITCH AS SHOWN

NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN COND. UNIT, EVAPORATOR, OR SUPPLIED BY OTHERS.
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS

◯ –COMPONENT TERMINAL – MARKED
⬡ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
○ –COMPONENT TERMINAL – UNMARKED (UNIDENTIFIABLE)
☐ –TERMINAL BLOCK TERMINAL
● –WIRE SPLICE

CONDUCTORS/WIRING

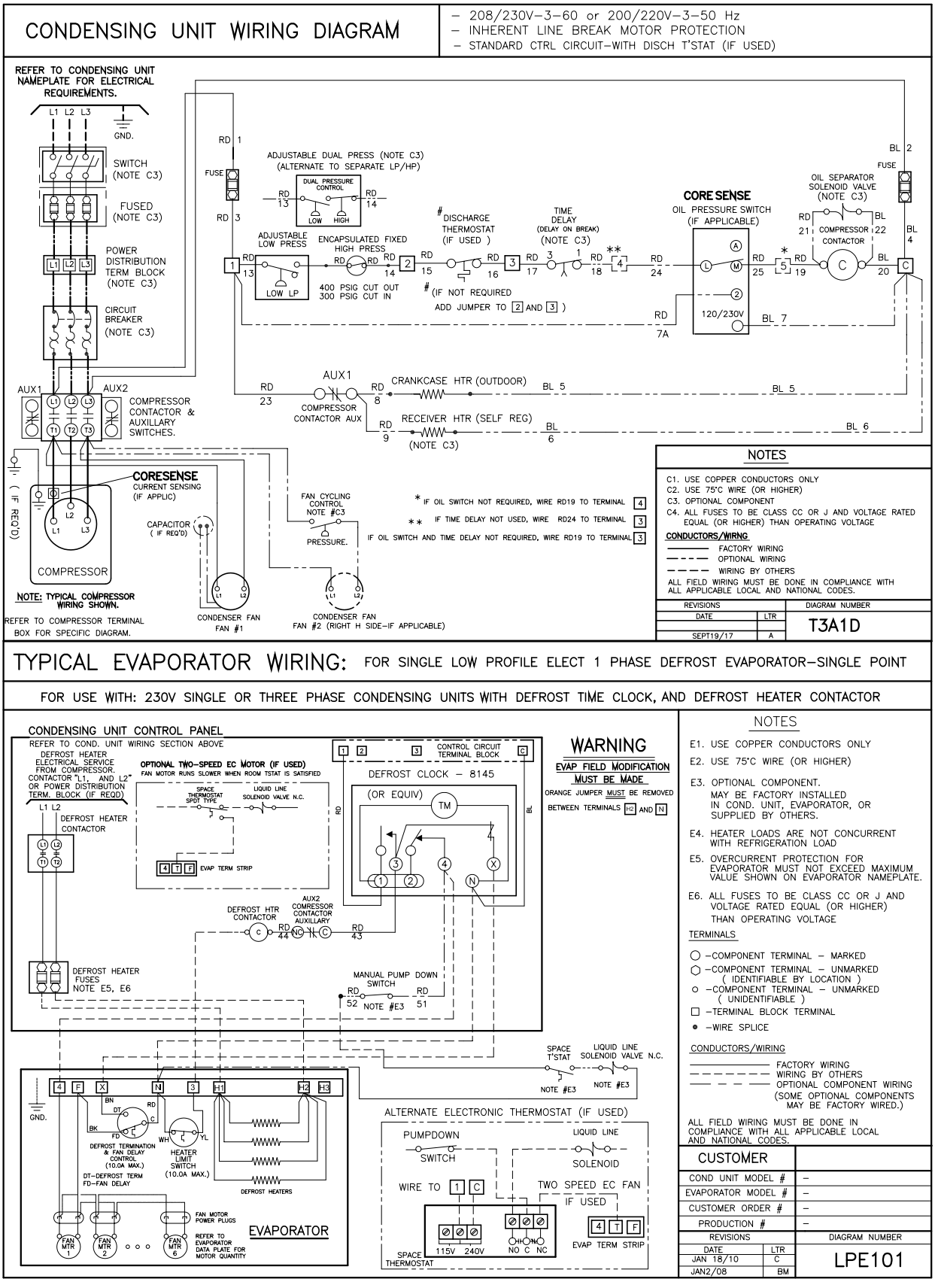
——— FACTORY WIRING
– – – – – – WIRING BY OTHERS
—— – – —— OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	KA101
JAN 18 / 10	D	
MAR26/03	A	

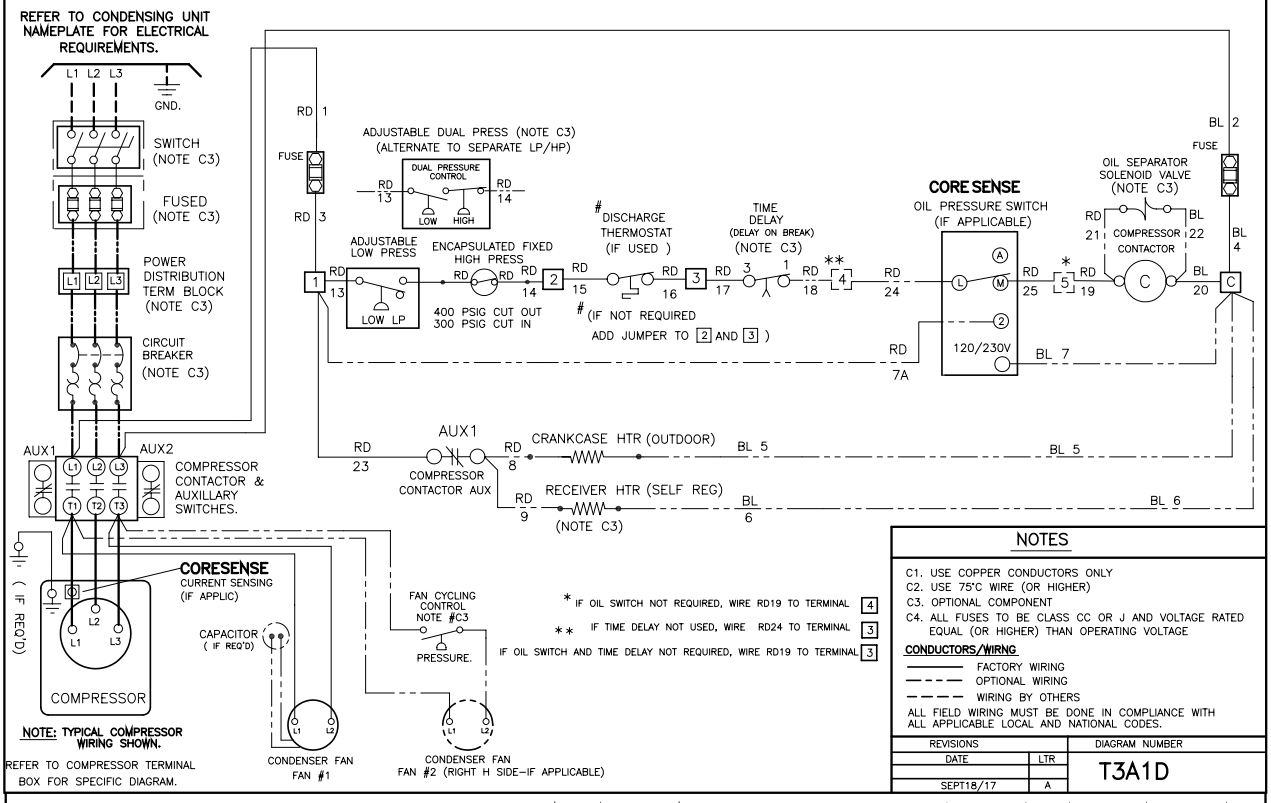
208-230/3/60 Unit with 230V Electric Defrost Evaporator



208-230/3/60 Unit with Two (2) 230V Electric Defrost Evaporators

CONDENSING UNIT WIRING DIAGRAM

- 208/230V–3–60 or 200/220V–3–50 Hz
- INHERENT LINE BREAK MOTOR PROTECTION
- STANDARD CTRL CIRCUIT–WITH DISCH T'STAT (IF USED)



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

CONDUCTORS/WIRNG

——— FACTORY WIRING
– – – – OPTIONAL WIRING
– – – – WIRING BY OTHERS

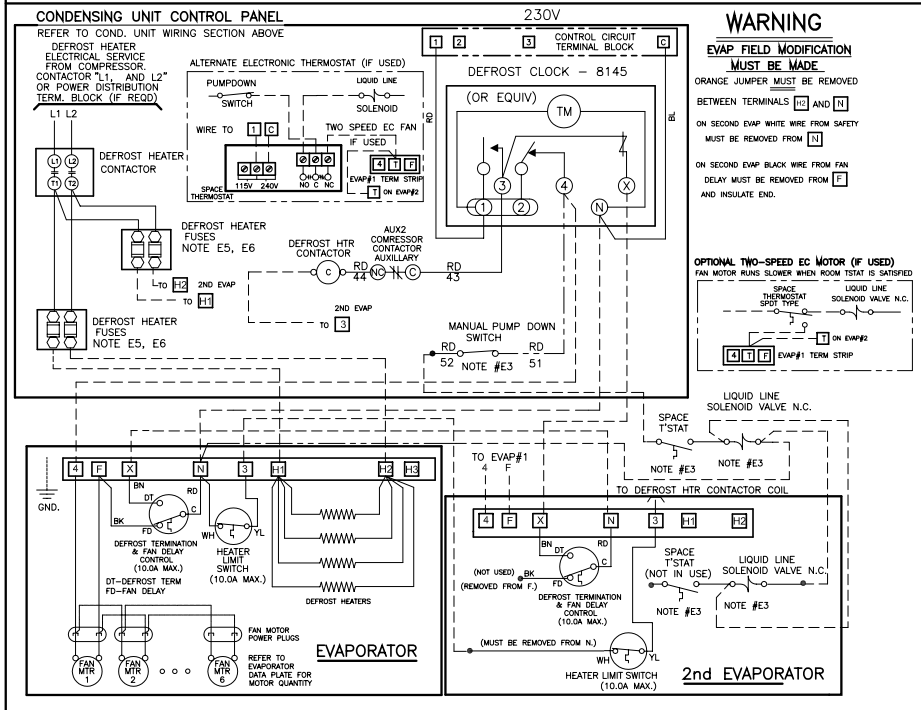
ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	T3A1D
SEPT18/17	A	

TYPICAL EVAPORATOR WIRING:

FOR TWO SINGLE LOW PROFILE ELECT DEF 230V 1 PH. EVAPORATORS–SINGLE POINT MAX TOTAL EVAP FAN AMPS–10A

FOR USE WITH: 230V SINGLE OR THREE PHASE CONDENSING UNITS WITH DEFROST TIME CLOCK, AND DEFROST HEATER CONTACTOR



NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN COND. UNIT, EVAPORATOR, OR SUPPLIED BY OTHERS.
E4. HEATER LOADS ARE NOT CONCURRENT WITH REFRIGERATION LOAD
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS

○ –COMPONENT TERMINAL – MARKED
⬡ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
○ –COMPONENT TERMINAL – UNMARKED (UNIDENTIFIABLE)
□ –TERMINAL BLOCK TERMINAL
• –WIRE SPLICE

CONDUCTORS/WIRING

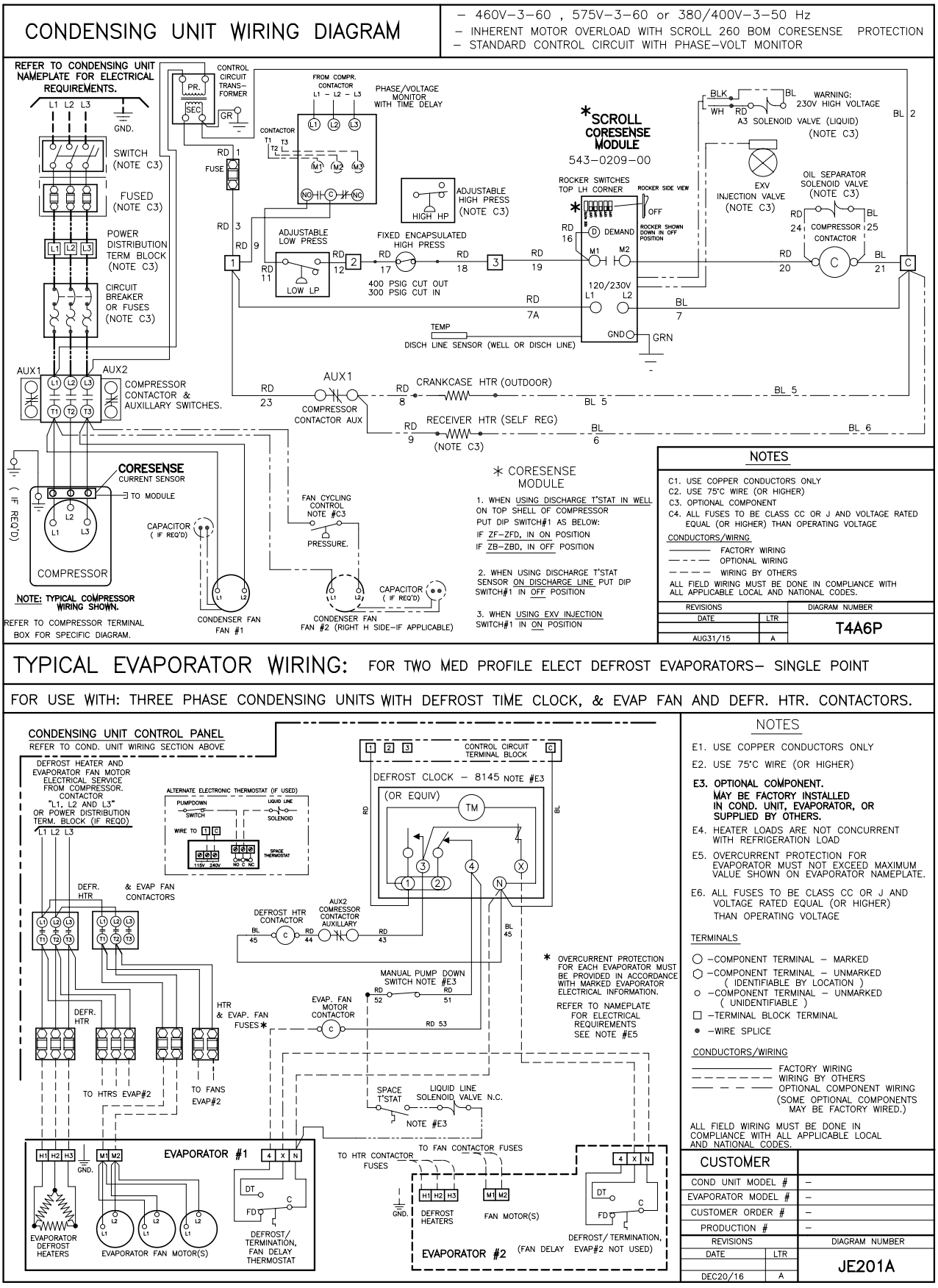
——— FACTORY WIRING
– – – – – – WIRING BY OTHERS
——— – – ——— OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	LPE201
JAN 18/10	E	
FEB21/08	BM	

460/360 or 575/3/60 Unit with Two (2) 460V or 575V Electric Defrost Evaporators



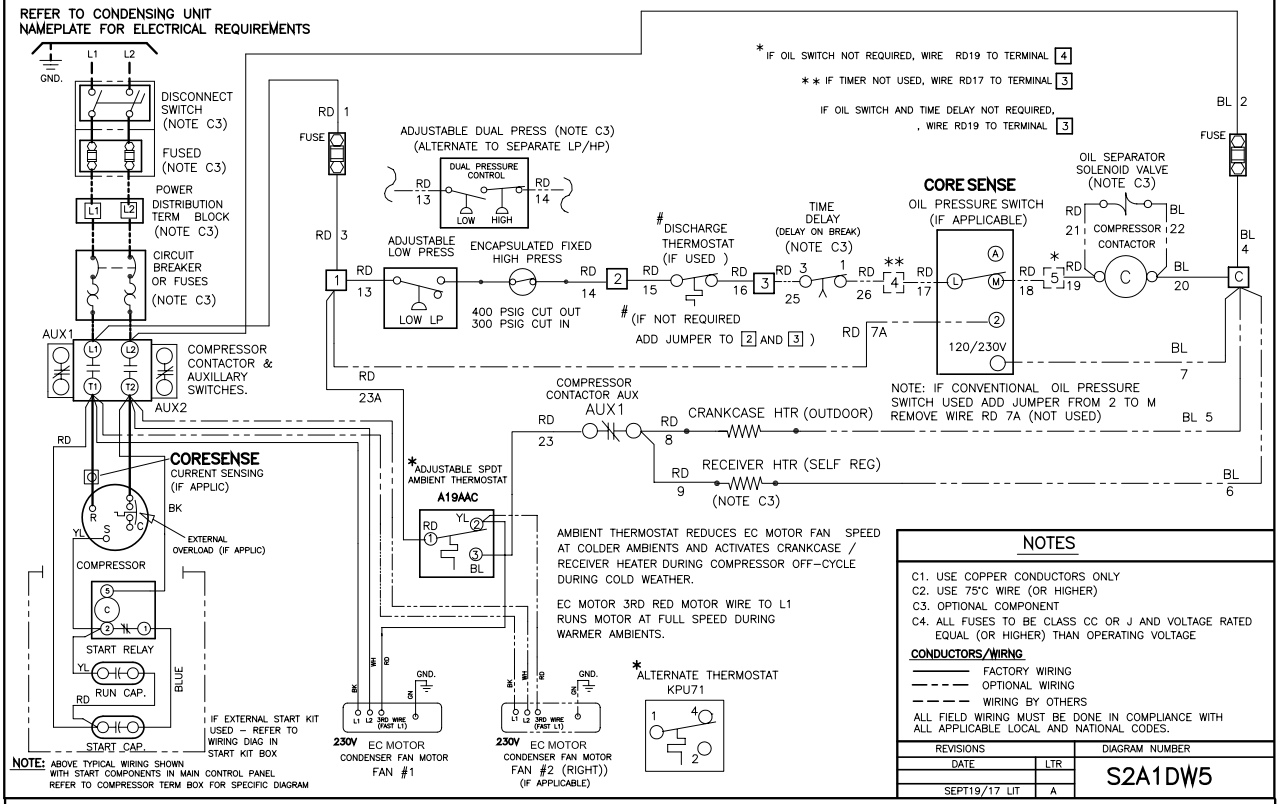
TYPICAL EVAPORATOR WIRING: FOR TWO MED PROFILE ELECT DEFROST EVAPORATORS– SINGLE POINT

FOR USE WITH: THREE PHASE CONDENSING UNITS WITH DEFROST TIME CLOCK, & EVAP FAN AND DEFR. HTR. CONTACTORS.

208-230/1/60 Unit with SMARTSPEED™ with 230V Air Defrost Evaporator

CONDENSING UNIT WIRING DIAGRAM

- 208/230V–1–60 or 200/220V–1–50 Hz
- OPTIONAL CORESENSE OIL PROTECTION
- STD CTRL CIRCUIT–WITH DISCH T'STAT (IF USED) AND TWO SPEED EC COND FAN MOTOR



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

CONDUCTORS/WIRING

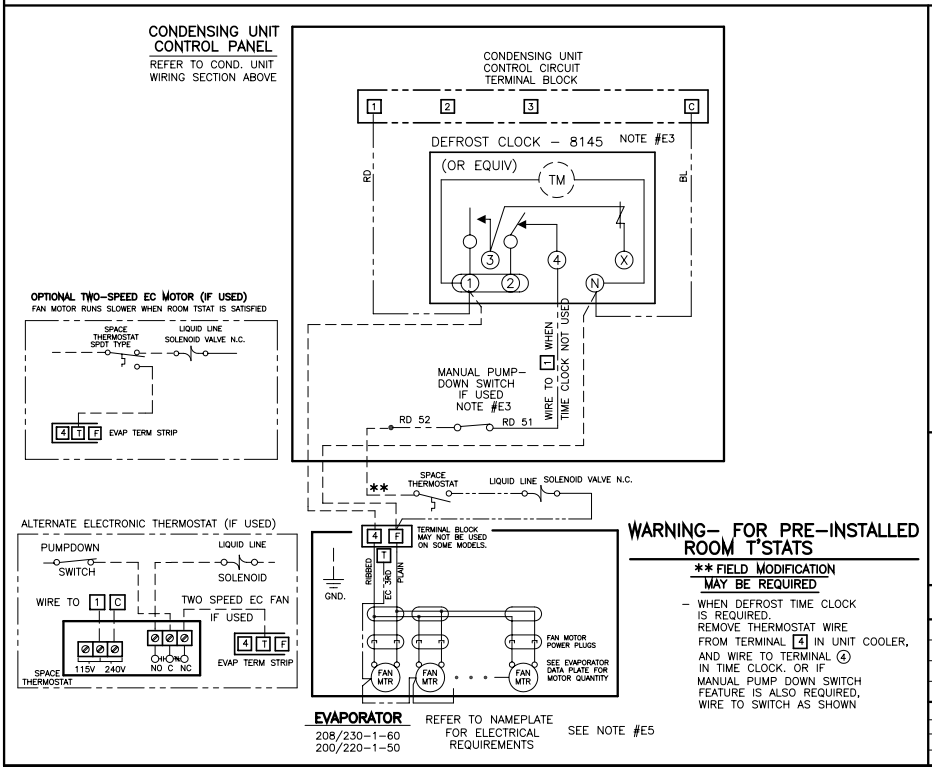
- FACTORY WIRING
- OPTIONAL WIRING
- WIRING BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	S2A1DW5
SEPT19/17 LIT	A	

TYPICAL EVAPORATOR WIRING: FOR SINGLE AIR DEFROST EVAPORATOR– SINGLE POINT

FOR USE WITH: 208/230–1–60, 200/220–1–50 OR 208/230–3–60, 200/220–3–50 CONDENSING UNITS WITH OR WITHOUT DEFROST TIME CLOCK AND FOR TOTAL EVAP FAN AMPS NOT EXCEEDING 12A



WARNING– FOR PRE–INSTALLED ROOM T'STATS

**** FIELD MODIFICATION MAY BE REQUIRED**

– WHEN DEFROST TIME CLOCK IS REQUIRED. REMOVE THERMOSTAT WIRE FROM TERMINAL 4 IN UNIT COOLER, AND WIRE TO TERMINAL 4 IN TIME CLOCK. OR IF MANUAL PUMP DOWN SWITCH FEATURE IS ALSO REQUIRED, WIRE TO SWITCH AS SHOWN

NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN COND. UNIT, EVAPORATOR, OR SUPPLIED BY OTHERS.
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS

- ○ –COMPONENT TERMINAL – MARKED
- ⬡ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
- ○ –COMPONENT TERMINAL – UNMARKED (UNIDENTIFIABLE)
- □ –TERMINAL BLOCK TERMINAL
- ● –WIRE SPLICE

CONDUCTORS/WIRING

- FACTORY WIRING
- WIRING BY OTHERS
- OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

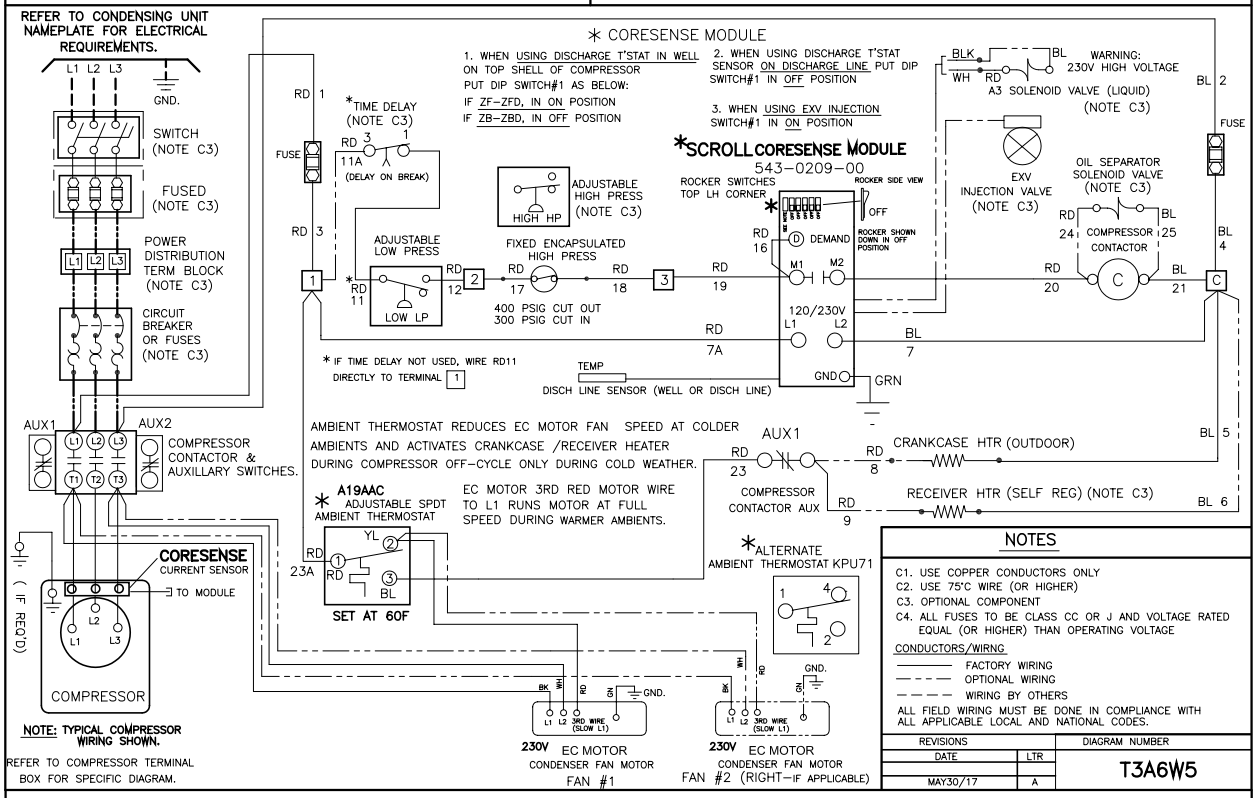
CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	KA101
JAN 18 / 10	D	
MAR26/03	A	

208-230/3/60 Unit with SMARTSPEED™ with 230V Air Defrost Evaporator

CONDENSING UNIT WIRING DIAGRAM

- 208/230V–3–60 or 200/220V–3–50 Hz
- INHERENT MOTOR OVERLOAD WITH SCROLL 260 BOM CORESENSE PROTECTION
- STANDARD CONTROL CIRCUIT WITH TWO–SPEED COND FAN



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

CONDUCTORS/WIRNG
——— FACTORY WIRING
– – – – OPTIONAL WIRING
– – – – WIRING BY OTHERS

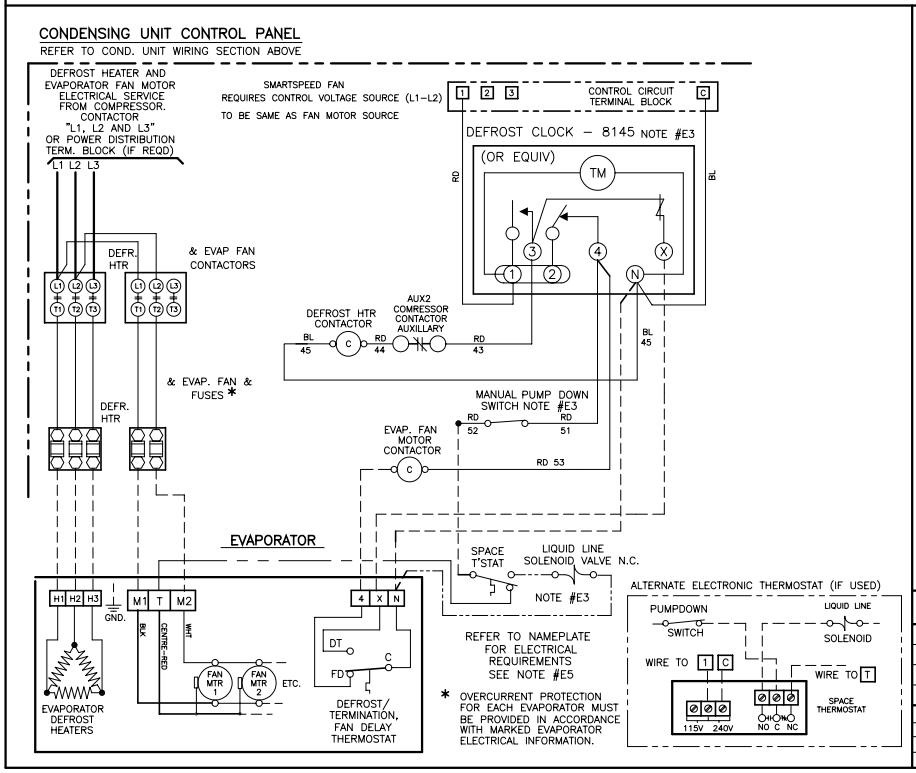
ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	T3A6W5
MAY30/17	A	

TYPICAL EVAPORATOR WIRING:

FOR (1) ONE, THREE PHASE MED PROFILE ELECT DEFROST EVAPORATOR – SINGLE POINT WITH SMARTSPEED

FOR USE WITH: THREE PHASE CONDENSING UNITS WITH DEFROST TIME CLOCK, & EVAP FAN AND DEFR. HTR. CONTACTORS.



NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN COND. UNIT, EVAPORATOR, OR SUPPLIED BY OTHERS.
E4. HEATER LOADS ARE NOT CONCURRENT WITH REFRIGERATION LOAD
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS
○ –COMPONENT TERMINAL – MARKED
⬡ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
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CONDUCTORS/WIRING
——— FACTORY WIRING
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—— – – —— OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

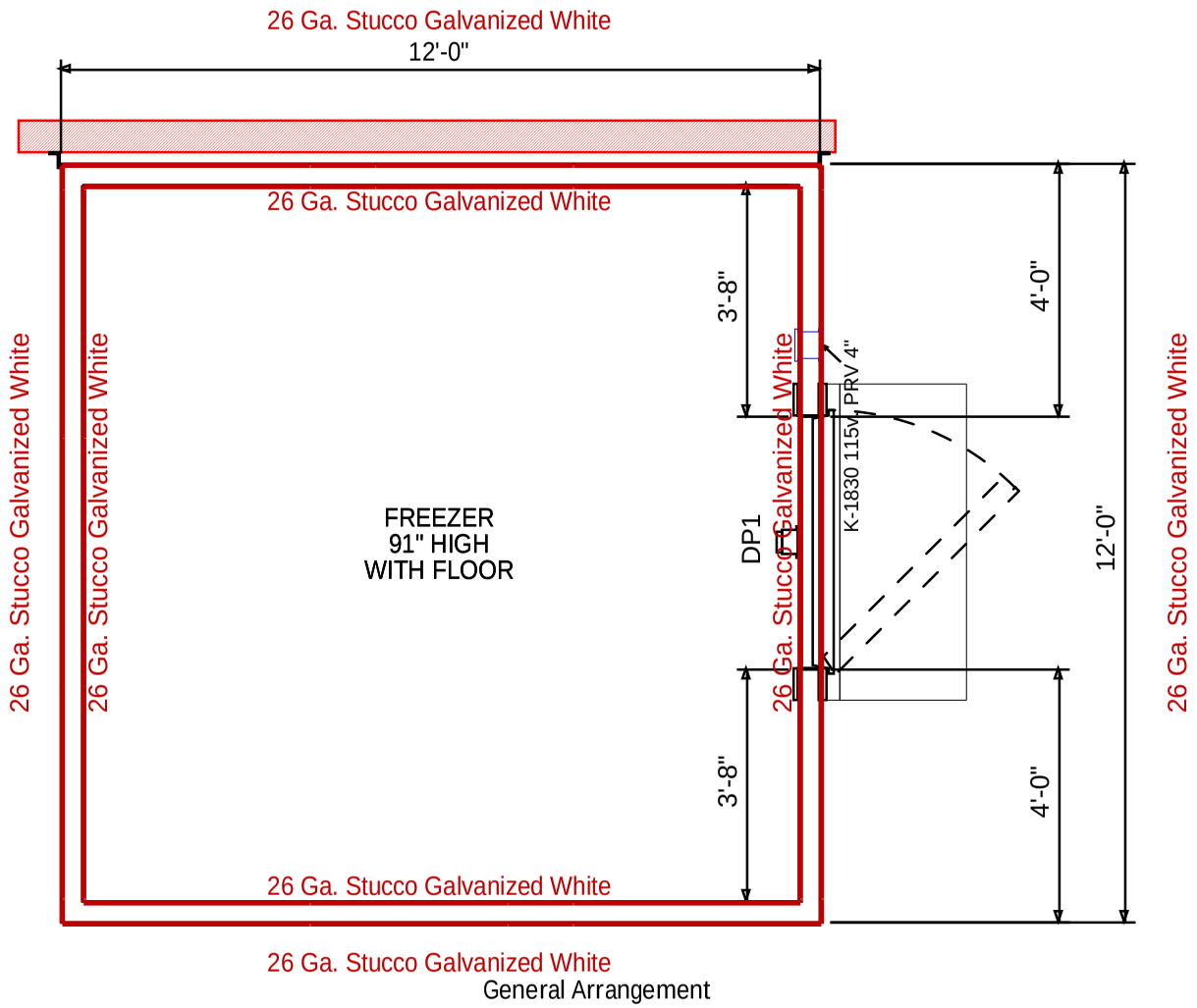
CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	JE101A–EC
JUNE22/15	B	
MAY24/13	A	

System	
Model Number	Date of Start-Up
Serial Number	Service Contractor
Refrigerant	Phone
Electrical Supply	E-mail

PRODUCT SUPPORT	*web:* **www.t-rp.com/tez** *email:* **smcu@t-rp.com** *call:* **1-844-893-3222 x521**
TROUBLESHOOTING	*email:* **troubleshooting@t-rp.com** *call:* **1-844-893-3222 x529**
SERVICE PARTS	*web:* **www.t-rp.com/parts** *email:* **parts@t-rp.com** *call:* **1-844-893-3222 x504**
WARRANTY	*web:* **www.t-rp.com/warranty** *email:* **warranty@t-rp.com** *call:* **1-844-893-3222 x507**
ORDERS	*email:* **orders@t-rp.com** *call:* **1-844-893-3222 x501**
SHIPPING	*email:* **shipping@t-rp.com** *call:* **1-844-893-3222 x503**

Trenton Refrigeration
Brantford, ON • Longview, TX
1-800-463-9517 info@t-rp.com www.t-rp.com



General Arrangement

-SPECIFICATION-

Box Height: Freezer 7'-7" (6'-11" Interior)

Insulation: 4" thick AK-XPS4 Extruded foam UL classified core flame spread 15, Smoke rating less than 165

Compartment 1 - Freezer

DP1 - (1) Plug Door - No Floor. 48" x 76" Door opening, 26 Ga. Stucco Embossed Acrylume finish.(FREEZER)
With Lights, switch & thermometer, PRV NARROW DOOR JAMB (2 1/2" Dia.) FOR 4" WALLS, 120 VAC. 11825000004 For 1600 FT³ Mounted on Walls, External Ramp 24" deep x 48" wide

Refrigeration:
Refrigeration Supplied By Others
Recommended minimum duty 9341 Btu/hr at 95°F ambient

Wall Panels
Interior Finish: 26 Ga. Stucco Galvanized White
Exterior Finish: 26 Ga. Stucco Galvanized White

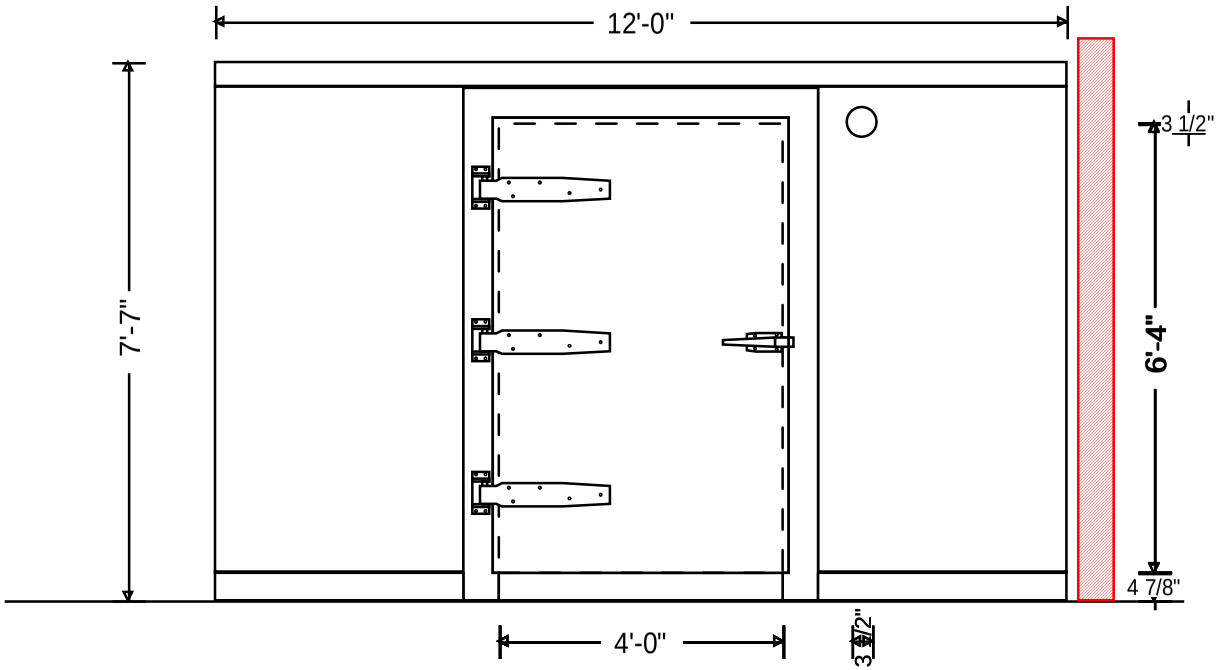
Customer Approval:

_____

Quote No : 23-22613 Revision : 2	Project : York County Museum	Date : 08/01/2023
Customer : United Refrigeration, Inc	Page 1 of 3	

114121- WALK-IN FREEZER

EXHIBIT A



Wall Elevation

-SPECIFICATION-Continued

Ceiling Panels

Interior Finish: 26 Ga. Stucco Galvanized White

Exterior Finish: 26 Ga. Stucco Galvanized White

Floor Panels

NSF Floor panel rated for 700 LBS/ SQ. FT.

22 Ga. Stainless Steel Integral

Application: Foot Traffic - No Rolling Carts

Accessories Shipped Loose

(144) Rain roof membrane w/ 10 ft. long with termination bars with1 screw every 12inch (per sq.ft.)

(1) 48" LED LIGHT STRIP FIXTURE 96 LUMENS /WATT 120VAC, 0.33 AMPS - TEMP RANGE: -30°F-104°F, SHIP LOOSE RECOMMENDED ONE FIXTURE EVERY 144 SQ. FT. AT 12' HIGH

(1) DOOR HOOD FROM 43" TO 78" LONG ACRYLUME STUCCO EMBOSSED, WITH 5 TEK SCREWS (LOOSE)

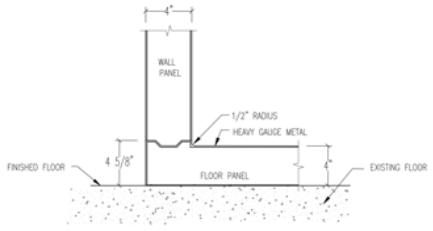
(9) PERIMETER REINFORCEMENT FLOOR ANGLE (.050 THICK ALUMINUM) 1 1/2" X 6 " X 48" EACH SECTION - SUPPLIED WITH STAILESS STEEL TEK SCREWS, TO SECURE WALL AND FLOOR. CONCRETE ANCHORS (BY OTHERS)

Customer Approval:

_____

Quote No : 23-22613 Revision : 2	Project : York County Museum	Date : 08/01/2023
Customer : United Refrigeration, Inc	Page 2 of 3	

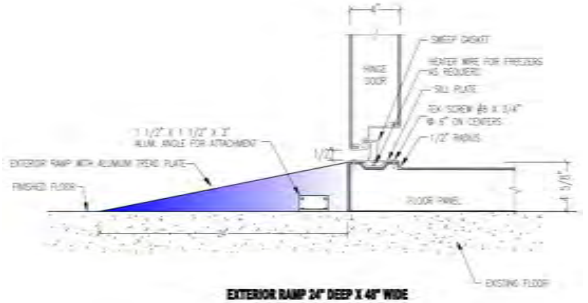
114121- WALK-IN FREEZER EXHIBIT A



FLOOR & WALL DETAIL (700 LBS / FT², DIST. LOAD)

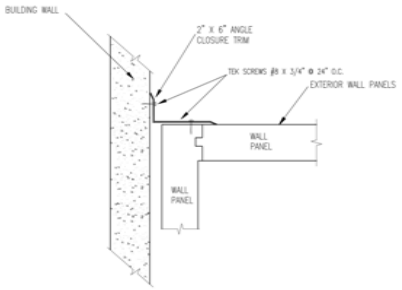
1B: NSF FLOOR 22 GAUGE SMOOTH STAINLESS STEEL INTEGRAL. NOT REINFORCED. RATED FOR 700 LBS/ SQ FT. (APPLICATION: FOOT TRAFFIC–NO ROLLING CARTS)

NOTE: IMPORTANT REQUIREMENT FOR INSTALLATION IS TO HAVE A PERFECTLY LEVEL FLOOR.



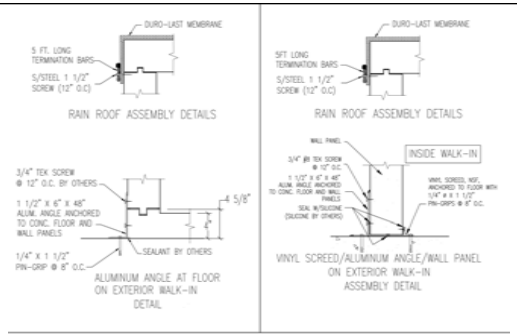
EXTERIOR RAMP 24" DEEP X 48" WIDE

244: EXTERIOR RAMP 24" DEEP X 48" WIDE OPENING



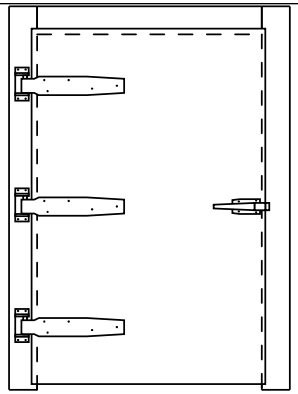
EXTERIOR ANGLE CLOSURE TRIM STRIP 2" X 6"

279 : EXTERIOR ANGLE CLOSURE TRIM 2" X 6" X 10' MAX. LENGTH WHITE STUCCO EMBOSSED FOR WALLS EACH



RAIN ROOF MEMBRANE

9462: RAIN ROOF MEMBRANE W/ 10 FT. LONG WITH TERMINATION BARS WITH1 SCREW EVERY 12INCH (PER SQ.FT.)



DP1

114121- WALK-IN FREEZER EXHIBIT A

Quote No : 23-22613 Revision : 2	Project : York County Museum
Customer : United Refrigeration, Inc	Date : 08/01/2023 Page 3 of 3

amerikooler™ taking cool further™

114121- WALK-IN FREEZER EXHIBIT A

TPLP New Generation "D"

Pre-Assembled Low Profile Evaporators

PRODUCT DATA & INSTALLATION

Bulletin T30-TPLPD-PDI-2E
Part #1109294

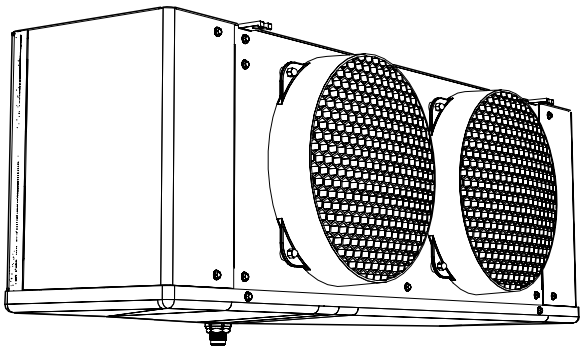
PRODUCT SUPPORT
web: **www.t-rp.com/tplp**
email: **evaps@t-rp.com**
call: **1-844-893-3222 x520**
scan:

Air & Electric Defrost

Medium Temperature Applications: 35°F
Low Temperature Applications: -10°F

Electrical: 115/1/60, 208-230/1/60, 208-230/3/60

INCLUDES MODELS FOR DOE & NRCAN
AWEF-COMPLIANT APPLICATIONS



INCLUDES RATINGS FOR LOW GWP REFRIGERANTS

SMARTSPEED™ FAN MOTOR TECHNOLOGY
STANDARD ON ALL MODELS

ESP+
see page 12 for details

CONTENTS

NOMENCLATURE

TPLP - PRE-ASSEMBLED EVAPORATORS

TP LP 3 16 L E S2 D R8 - ESP

Pre-Assembled

Low Profile Evaporator

Number of Fans

Nominal Capacity:
x 1000 @ 10°F TD, Btu/H, R404A

Application Range:
M = Medium to High Temp 6 FPI (25°F / -4°C) Evap Temp)
L = Low Temp 6 FPI (-20°F / -29°C) Evap Temp)
V = Low Temp 4 FPI (-20°F / -29°C) Evap Temp)

Defrost:
A = Air E = Electric

Designation:
ESP = ESP+

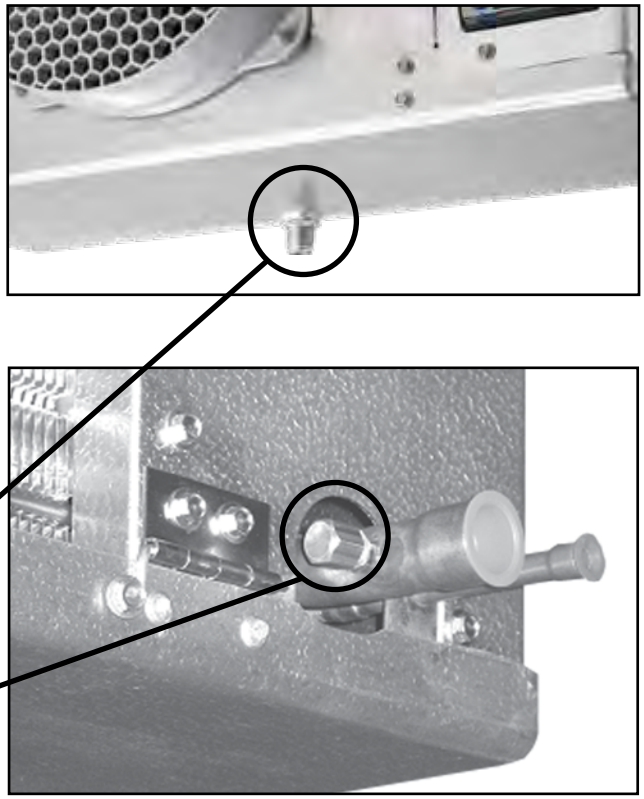
Refrigerant Designation:
R2 = R407A / R407C / R448A / R449A
R6 = R404A
R8 = R407A / R407C / R448A / R449A, R404A
(R8 applies to ESP+ models only)

Design Generation

Voltage:
S1 = 115/1/60
S2 = 208-230/1/60 T3 = 208-230/3/60

STANDARD FEATURES

- EC motors with patented SmartSpeed® Technology
- Compatible with Low GWP Refrigerants
- High efficiency and high strength fan guard
- Front access
- Internally enhanced tubing
- Convenient mounting brackets
- Ample electrical and header compartments
- Positive slope, hinged drain pan
- Centrally located, universal drain connection
- Large 3/4” ID (3/4” MPT) drain hole
- Schrader valve on suction header, located outside of cabinet



ESP+ (R8) MODELS

Include factory installed:

- ESP+ Adaptive Defrost Control
- ESP+ Remote Display
- EEV Electronic Expansion Valve
- Solenoid Valve

ELECTRO-MECHANICAL (R2 and R6) MODELS

Include factory installed:

- TX Valve
- Solenoid Valve
- Thermostat

R407A **R448A** **R449A**

Low Temperature - 6 FPI Models

Model TPLP	Qty. Fans	Evaporator Temperature Selection Capacity BTU/h					Air Flow		Refrig. Charge R407A **	
		0°F *(-18°C)*	-10°F *(-23°C)*	-20°F *(-29°C)*	-30°F *(-34°C)*	-40°F *(-40°C)*	CFM	L/S	LB.	*KG*
104L	1	**4310**	**4190**	**4070**	**3740**	**3460**	**750**	*350*	**0.7**	*0.3*
105L		**5190**	**5050**	**4900**	**4510**	**4170**	**705**	*330*	**1.1**	*0.5*
106L		**6710**	**6520**	**6330**	**5820**	**5380**	**680**	*320*	**1.5**	*0.7*
207L	2	**7590**	**7370**	**7160**	**6590**	**6090**	**1500**	*710*	**1.3**	*0.6*
209L		**9950**	**9670**	**9390**	**8640**	**7980**	**1410**	*670*	**1.4**	*0.6*
211L		**11980**	**11600**	**11300**	**10400**	**9610**	**1360**	*640*	**2.0**	*0.9*
314L	3	**14730**	**14300**	**13900**	**12800**	**11800**	**2115**	*1000*	**3.0**	*1.4*
316L		**17170**	**16700**	**16200**	**14900**	**13800**	**2040**	*960*	**4.0**	*1.8*
418L	4	**19500**	**19000**	**18400**	**16900**	**15600**	**2820**	*1330*	**3.3**	*1.5*
421L		**22470**	**21800**	**21200**	**19500**	**18000**	**2720**	*1280*	**3.9**	*1.8*
526L	5	**27670**	**26900**	**26100**	**24000**	**22200**	**3400**	*1600*	**6.5**	*2.9*
631L	6	**32970**	**32000**	**31100**	**28600**	**26400**	**4080**	*1930*	**7.8**	*3.5*

- Capacities at other TD within a range of 8 to 15 °F *(4.4 to 8.3°C)* are directly proportional to TD, or use formula:
Capacity = Rated capacity ÷ 10 x TD.
** For R448A/R449A, use conversion factor 0.96

R404A **R507**

Low Temperature - 6 FPI Models

Model TPLP	Qty. Fans	Evaporator Temperature Selection Capacity BTU/h					Air Flow		Refrig. Charge R404A R507	
		0°F *(-18°C)*	-10°F *(-23°C)*	-20°F *(-29°C)*	-30°F *(-34°C)*	-40°F *(-40°C)*	CFM	L/S	LB.	*KG*
104L	1	**4210**	**4090**	**3970**	**3650**	**3370**	**750**	*350*	**0.6**	*0.3*
105L		**5070**	**4920**	**4780**	**4400**	**4060**	**705**	*330*	**1.0**	*0.5*
106L		**6540**	**6360**	**6170**	**5680**	**5240**	**680**	*320*	**1.4**	*0.6*
207L	2	**7400**	**7190**	**6980**	**6420**	**5930**	**1500**	*710*	**1.2**	*0.5*
209L		**9710**	**9430**	**9160**	**8430**	**7790**	**1410**	*670*	**1.3**	*0.6*
211L		**11660**	**11330**	**11000**	**10120**	**9350**	**1360**	*640*	**1.8**	*0.8*
314L	3	**14420**	**14000**	**13600**	**12500**	**11560**	**2115**	*1000*	**2.8**	*1.3*
316L		**16750**	**16300**	**15800**	**14500**	**13430**	**2040**	*960*	**3.7**	*1.7*
418L	4	**18970**	**18400**	**17900**	**16500**	**15220**	**2820**	*1330*	**3.0**	*1.4*
421L		**21840**	**21200**	**20600**	**19000**	**17510**	**2720**	*1280*	**3.6**	*1.6*
526L	5	**27140**	**26400**	**25600**	**23600**	**21760**	**3400**	*1600*	**6.0**	*2.7*
631L	6	**32220**	**31300**	**30400**	**28000**	**25840**	**4080**	*1930*	**7.2**	*3.3*

The above capacities were rated based on nominal 10°F TD
Capacities at other TD within a range of 8 to 15 °F *(4.4 to 8.3°C)* are directly proportional to TD, or use formula:
Capacity = Rated capacity ÷ 10 x TD.

R407A R448A R449A

Low Temperature - 4 FPI Models

Model TPLP	Qty. Fans	Evaporator Temperature Selection Capacity BTU/h					Air Flow		Refrig. Charge R407A **	
		0°F *(-18°C)*	-10°F *(-23°C)*	-20°F *(-29°C)*	-30°F *(-34°C)*	-40°F *(-40°C)*	CFM	L/S	LB.	*KG*
103V	1	**3880**	**3770**	**3660**	**3370**	**3110**	**750**	*350*	**0.7**	*0.3*
104V		**4610**	**4480**	**4350**	**4000**	**3700**	**705**	*330*	**1.1**	*0.5*
106V		**5880**	**5720**	**5550**	**5110**	**4720**	**680**	*320*	**1.5**	*0.7*
207V	2	**7070**	**6870**	**6670**	**6140**	**5670**	**1500**	*710*	**1.3**	*0.6*
208V		**8590**	**8340**	**8100**	**7450**	**6890**	**1410**	*670*	**1.4**	*0.6*
211V		**11200**	**10900**	**10600**	**9750**	**9010**	**1360**	*640*	**2.0**	*0.9*
313V	3	**13400**	**13000**	**12600**	**11600**	**10700**	**2115**	*1000*	**3.0**	*1.4*
316V		**16500**	**16100**	**15600**	**14400**	**13300**	**2040**	*960*	**4.0**	*1.8*
418V	4	**18800**	**18200**	**17700**	**16300**	**15000**	**2820**	*1330*	**3.3**	*1.5*
421V		**22300**	**21600**	**21000**	**19300**	**17900**	**2720**	*1280*	**3.9**	*1.8*
524V	5	**25300**	**24600**	**23900**	**22000**	**20300**	**3400**	*1600*	**6.5**	*2.9*
627V	6	**28400**	**27600**	**26800**	**24700**	**22800**	**4080**	*1930*	**7.8**	*3.5*

- Capacities at other TD within a range of 8 to 15 °F *(4.4 to 8.3°C)* are directly proportional to TD, or use formula:
Capacity = Rated capacity ÷ 10 x TD.
** For R448A/R449A, use conversion factor 0.96

R404A R507

Low Temperature - 4 FPI Models

Model TPLP	Qty. Fans	Evaporator Temperature Selection Capacity BTU/h					Air Flow		Refrig. Charge R404A R507	
		0°F *(-18°C)*	-10°F *(-23°C)*	-20°F *(-29°C)*	-30°F *(-34°C)*	-40°F *(-40°C)*	CFM	L/S	LB.	*KG*
103V	1	**3640**	**3530**	**3430**	**3160**	**2920**	**750**	*350*	**0.6**	*0.3*
104V		**4300**	**4180**	**4060**	**3740**	**3450**	**705**	*330*	**1.0**	*0.5*
106V		**5500**	**5350**	**5190**	**4770**	**4410**	**680**	*320*	**1.4**	*0.6*
207V	2	**6600**	**6420**	**6230**	**5730**	**5300**	**1500**	*710*	**1.2**	*0.5*
208V		**8020**	**7800**	**7570**	**6960**	**6430**	**1410**	*670*	**1.3**	*0.6*
211V		**10460**	**10170**	**9870**	**9080**	**8390**	**1360**	*640*	**1.8**	*0.8*
313V	3	**12400**	**12100**	**11700**	**10760**	**9950**	**2115**	*1000*	**2.8**	*1.3*
316V		**15370**	**14900**	**14500**	**13300**	**12330**	**2040**	*960*	**3.7**	*1.7*
418V	4	**17600**	**17100**	**16600**	**15300**	**14110**	**2820**	*1330*	**3.0**	*1.4*
421V		**20880**	**20300**	**19700**	**18100**	**16750**	**2720**	*1280*	**3.6**	*1.6*
524V	5	**23640**	**23000**	**22300**	**20500**	**18960**	**3400**	*1600*	**6.0**	*2.7*
627V	6	**26610**	**25900**	**25100**	**23100**	**21340**	**4080**	*1930*	**7.2**	*3.3*

The above capacities were rated based on nominal 10°F TD
Capacities at other TD within a range of 8 to 15 °F *(4.4 to 8.3°C)* are directly proportional to TD, or use formula:
Capacity = Rated capacity ÷ 10 x TD.

115/1/60: Air Defrost Models

Model TPLP	FPI	FAN MOTORS					
		Qty.	Standard SMARTSPEED EC Motors				
			HP	FLA Total	Watts	MCA (A)	Max. Fuse (AMPS)
104MA-S1D	6	1	1/15	1.0	60	1.3	15
106MA-S1D		1	1/15	1.0	60	1.3	15
107MA-S1D		1	1/15	1.0	60	1.3	15
209MA-S1D		2	1/15	2.0	120	2.3	15
211MA-S1D		2	1/15	2.0	120	2.3	15
214MA-S1D		2	1/15	2.0	120	2.3	15
317MA-S1D		3	1/15	3.0	180	3.3	15
320MA-S1D		3	1/15	3.0	180	3.3	15
422MA-S1D		4	1/15	4.0	240	4.3	15
427MA-S1D		4	1/15	4.0	240	4.3	15
534MA-S1D		5	1/15	5.0	300	5.3	15
640MA-S1D		6	1/15	6.0	360	6.3	15

208-230/1/60: Air Defrost Models

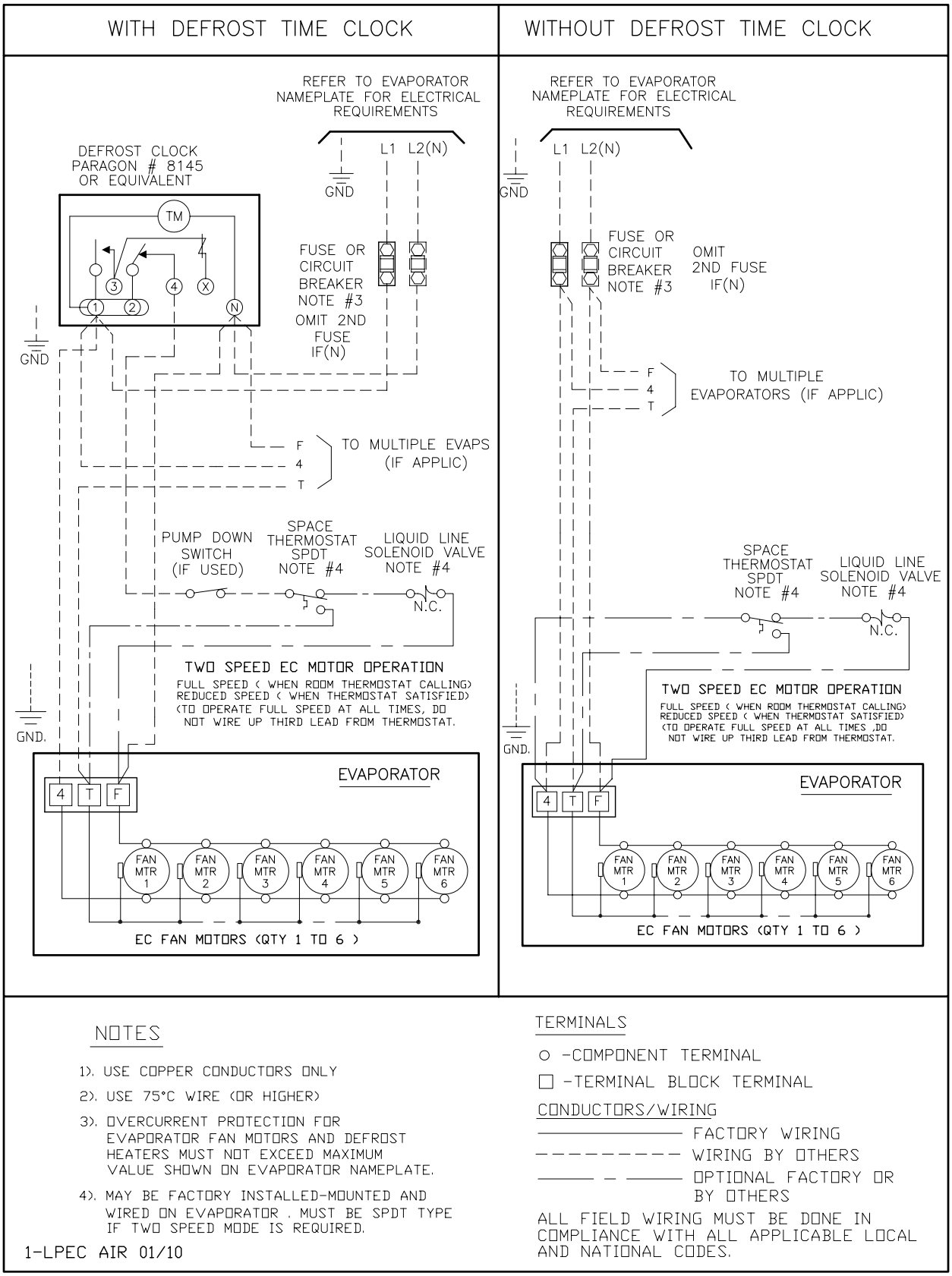
Model TPLP	FPI	FAN MOTORS					
		Qty.	Standard SMARTSPEED EC Motors				
			HP	FLA Total	Watts	MCA (A)	Max. Fuse (AMPS)
104MA-S2D	6	1	1/15	0.6	60	0.8	15
106MA-S2D		1	1/15	0.6	60	0.8	15
107MA-S2D		1	1/15	0.6	60	0.8	15
209MA-S2D		2	1/15	1.2	120	1.4	15
211MA-S2D		2	1/15	1.2	120	1.4	15
214MA-S2D		2	1/15	1.2	120	1.4	15
317MA-S2D		3	1/15	1.8	180	2.0	15
320MA-S2D		3	1/15	1.8	180	2.0	15
422MA-S2D		4	1/15	2.4	240	2.6	15
427MA-S2D		4	1/15	2.4	240	2.6	15
534MA-S2D		5	1/15	3.0	300	3.2	15
640MA-S2D		6	1/15	3.6	360	3.8	15

208-230/1/60 & 208-230/3/60: Electric Defrost Models

Model TPLP	FPI	FAN MOTORS						Total WATTS	DEFROST HEATERS					
		Qty.	Standard SMARTSPEED EC Motors						208-230/1/60			208-230/3/60		
			HP	FLA Total	Watts	MCA (A)	Max. Fuse (AMPS)		Total AMPS	MCA (A)	Max. Fuse (AMPS)	Total AMPS	MCA (A)	Max. Fuse (AMPS)
104ME-*	6	1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
106ME-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
107ME-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
209ME-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
211ME-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
214ME-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
317ME-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
320ME-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
422ME-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
427ME-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
534ME-*		5	1/15	3.0	300	3.2	15	4400	19.1	23.9	25	12.0	15.0	20
640ME-*		6	1/15	3.6	360	3.8	15	5230	22.7	28.4	30	15.0	18.0	20
104LE-*	6	1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
105LE-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
106LE-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
207LE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
209LE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
211LE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
314LE-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
316LE-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
418LE-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
421LE-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
526LE-*		5	1/15	3.0	300	3.2	15	4400	19.1	23.9	25	12.0	15.0	20
631LE-*		6	1/15	3.6	360	3.8	15	5230	22.7	28.4	30	15.0	18.0	20
103VE-*	4	1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
104VE-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
106VE-*		1	1/15	0.6	60	0.8	15	1060	4.6	5.8	15	3.0	3.8	15
207VE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
208VE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
211VE-*		2	1/15	1.2	120	1.4	15	1890	8.2	10.3	15	5.3	6.7	15
313VE-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
316VE-*		3	1/15	1.8	180	2.0	15	2730	11.9	14.8	15	7.7	10.0	15
418VE-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
421VE-*		4	1/15	2.4	240	2.6	15	3560	15.5	19.3	20	10.0	12.0	15
524VE-*		5	1/15	3.0	300	3.2	15	4400	19.1	23.9	25	12.0	15.0	20
627VE-*		6	1/15	3.6	360	3.8	15	5230	22.7	28.4	30	15.0	18.0	20

*** = S2 or T3. Refer to nomenclature for details.**

115/1/60, 208-230/1/60: Air Defrost Models



NOTES

1). USE COPPER CONDUCTORS ONLY

2). USE 75°C WIRE (OR HIGHER)

3). OVERCURRENT PROTECTION FOR EVAPORATOR FAN MOTORS AND DEFROST HEATERS MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.

4). MAY BE FACTORY INSTALLED-MOUNTED AND WIRED ON EVAPORATOR . MUST BE SPDT TYPE IF TWO SPEED MODE IS REQUIRED.

1-LPEC AIR 01/10

TERMINALS

○ -COMPONENT TERMINAL

□ -TERMINAL BLOCK TERMINAL

CONDUCTORS/WIRING

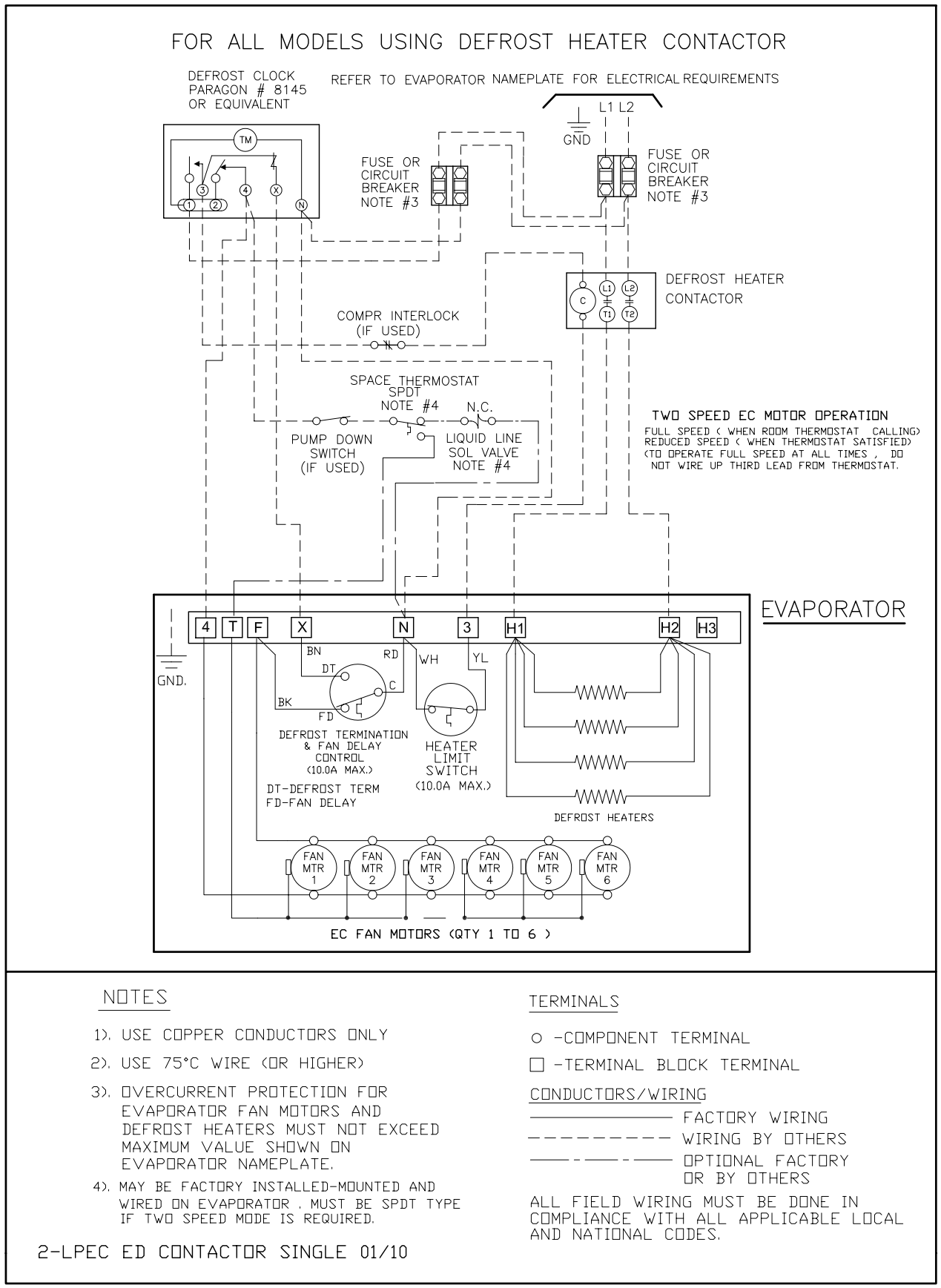
——————— FACTORY WIRING

– – – – – – – – – WIRING BY OTHERS

——— – ——— OPTIONAL FACTORY OR BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

208-230/1/60: Electric Defrost Models



NOTES

1). USE COPPER CONDUCTORS ONLY

2). USE 75°C WIRE (OR HIGHER)

3). OVERCURRENT PROTECTION FOR EVAPORATOR FAN MOTORS AND DEFROST HEATERS MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.

4). MAY BE FACTORY INSTALLED-MOUNTED AND WIRED ON EVAPORATOR . MUST BE SPDT TYPE IF TWO SPEED MODE IS REQUIRED.

2-LPEC ED CONTACTOR SINGLE 01/10

TERMINALS

○ -COMPONENT TERMINAL

□ -TERMINAL BLOCK TERMINAL

CONDUCTORS/WIRING

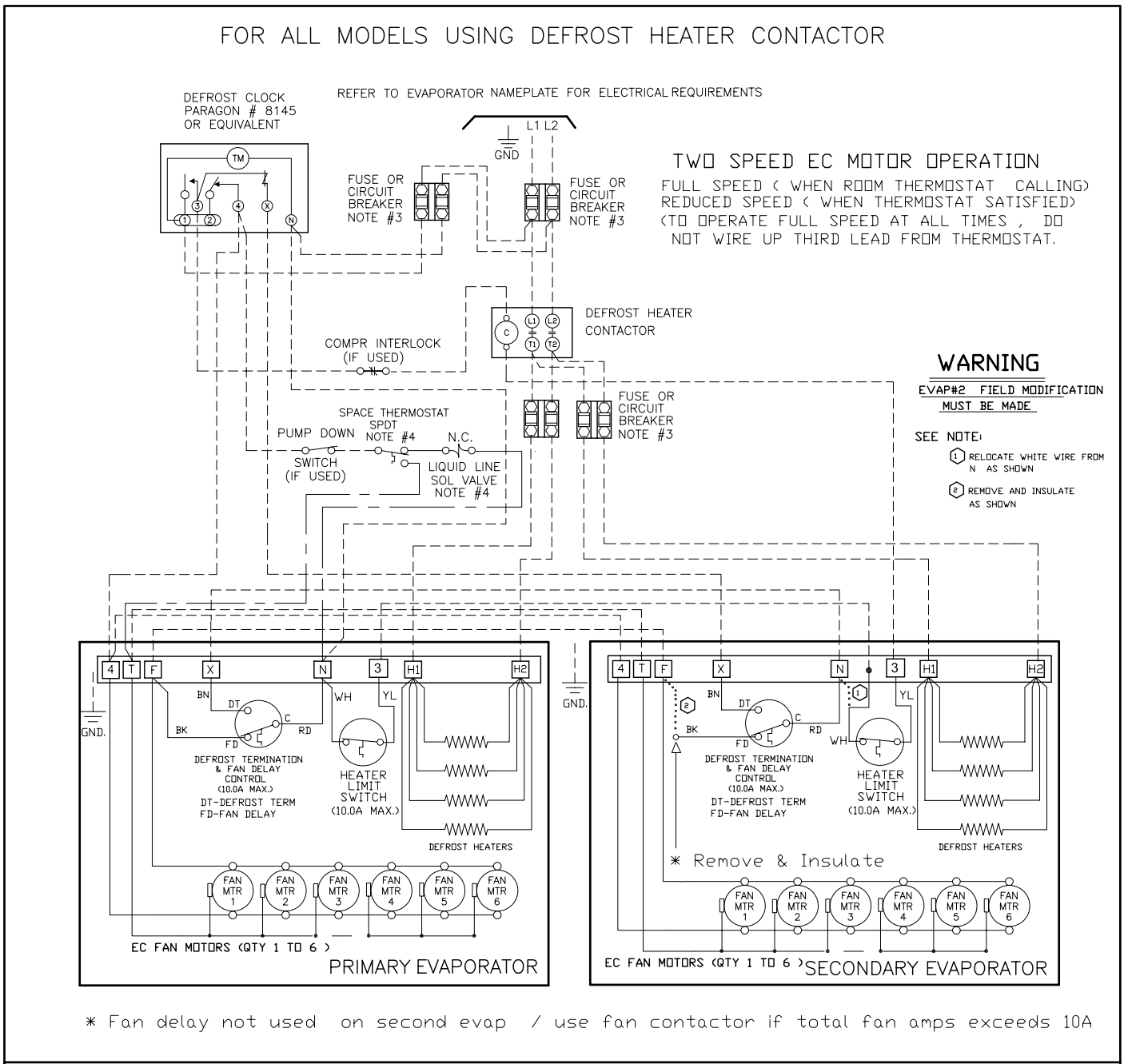
———————— FACTORY WIRING

– – – – – – – – – WIRING BY OTHERS

———-———-——— OPTIONAL FACTORY OR BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

208-230/1/60: Electric Defrost Models with Multiple Evaporators



NOTES

1). USE COPPER CONDUCTORS ONLY

2). USE 75°C WIRE (OR HIGHER)

3). OVERCURRENT PROTECTION FOR EVAPORATOR FAN MOTORS AND DEFROST HEATERS MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.

4). MAY BE FACTORY INSTALLED-MOUNTED AND WIRED ON EVAPORATOR . MUST BE SPDT TYPE IF TWO SPEED MODE IS REQUIRED.

3-LPEC ED CONTACTOR MULTI 01/10

TERMINALS

○ -COMPONENT TERMINAL

□ -TERMINAL BLOCK TERMINAL

CONDUCTORS/WIRING

———————— FACTORY WIRING

- - - - - - - - - - - - WIRING BY OTHERS

——— – ——— OPTIONAL FACTORY OR BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

ESP+ INTUITIVE EVAPORATOR CONTROL TECHNOLOGY

What is ESP+?
Trenton Refrigeration's ESP+ intuitive evaporator control technology is designed to replace traditional electro-mechanical refrigeration controls typically used on medium and low temperature applications. By combining award winning adaptive technology along with an electronic expansion valve, Trenton Refrigeration continues Leading The Way with innovative, state-of-the-art designs.

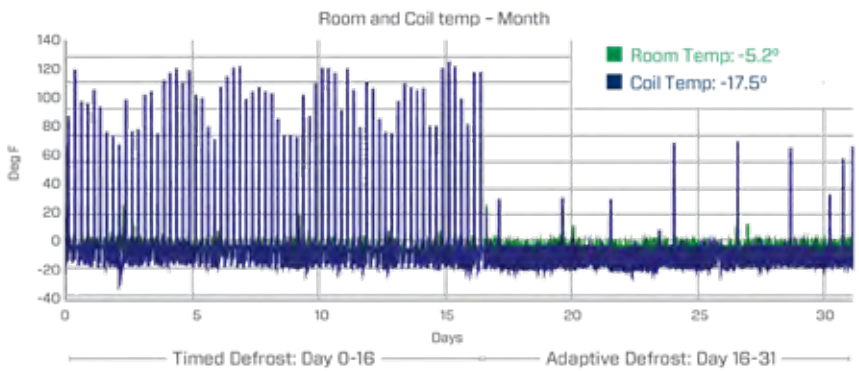
Installing an evaporator utilizing the ESP+ intuitive evaporator control technology is simple. Two pipes, two wires and you're done. No interconnecting control wiring between the evaporator and the condensing unit is required.

- Quick simple installation
- Improved evaporator performance by minimizing excessive frost on the evaporator
- Eliminates ice build up on surfaces and product
- Energy savings through evaporator fan management
- Energy savings with reduction in the number of defrost cycles
- Defrost heater management
- Improved system diagnostics and service through advanced alarm notification text/email
- Remote monitoring & system control
- User friendly interface
- Precise temperature control for prolonged product shelf life
- Improved product integrity with less potential for spoilage
- Downloadable data provides system history for prior 30 days
- Remotely view and change system parameters and alarm settings
- Manually control system
- Easily troubleshoot issues

ESP+ controls:
- Box Temperature - Superheat - Liquid Line Solenoid
- Defrost Initiation - Defrost Termination - Fan Motors
- Defrost Heater (Electric Defrost Models)

Plus - User can access operating data directly from the system interface

15-20% System Energy Savings over a Properly Commissioned System!



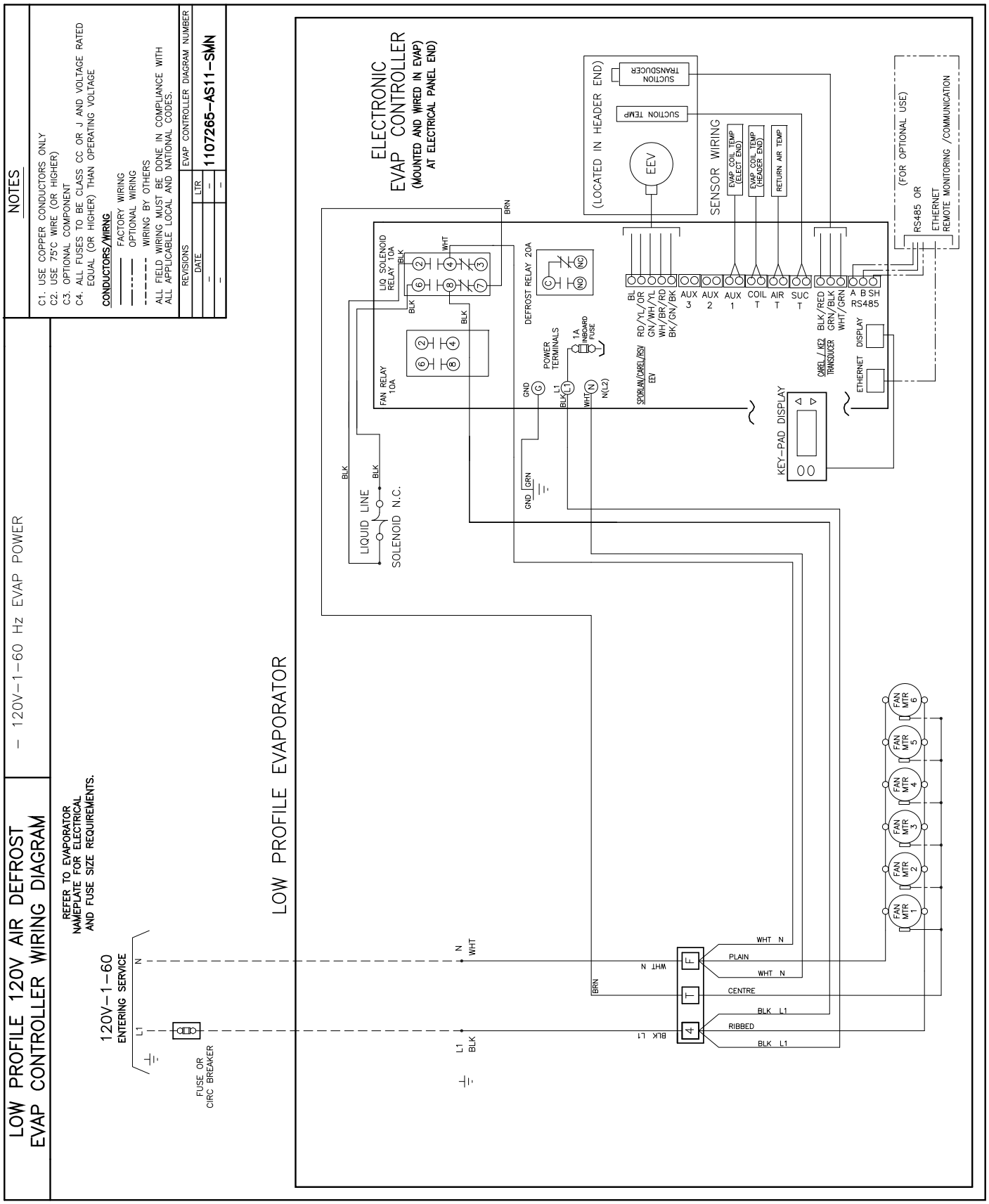
86% Fewer Defrost Cycles*

- Enhanced system performance
- Energy Savings
- Improved product integrity

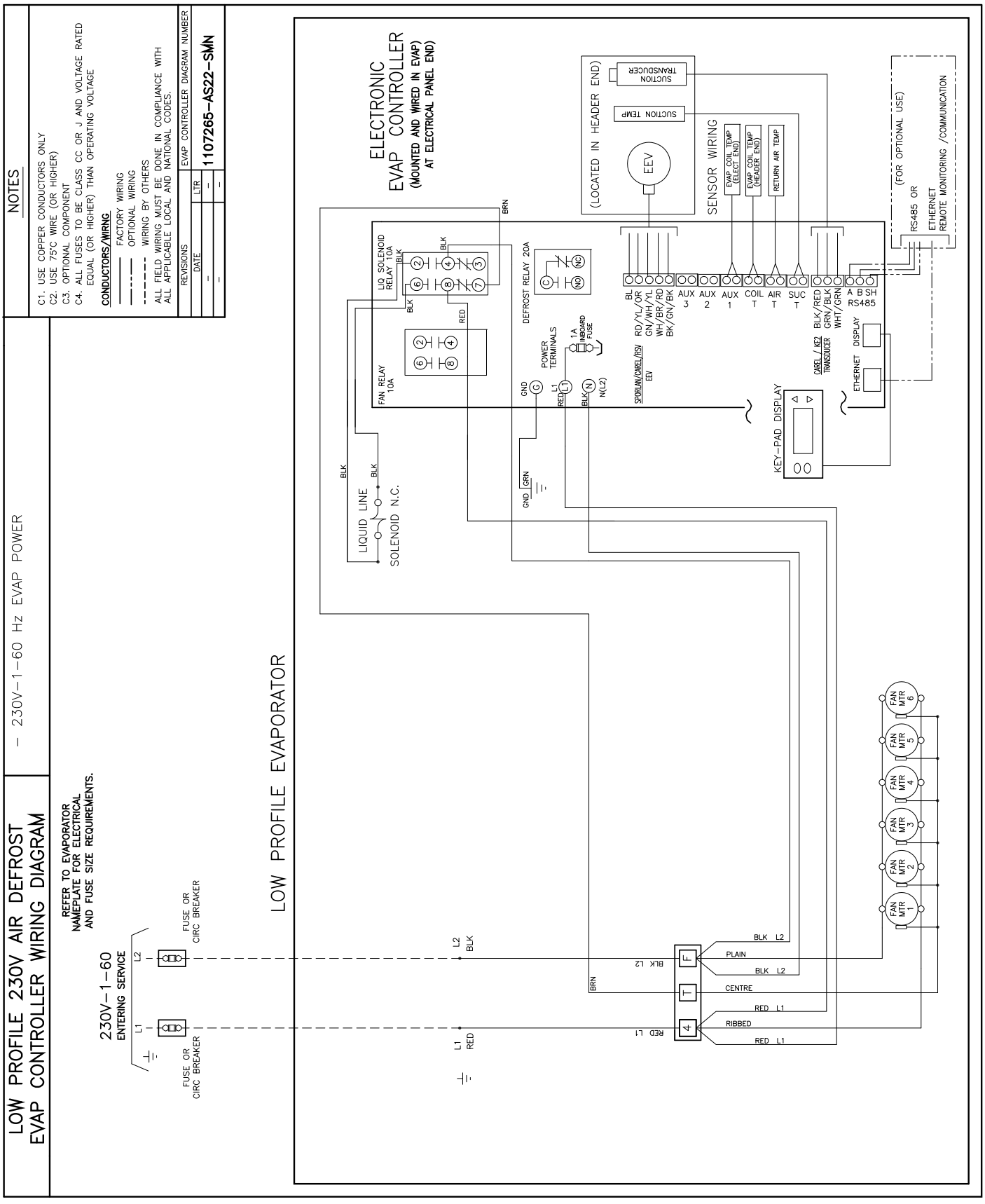
* Data may vary depending on application

Visit www.t-rp.com/esp for details

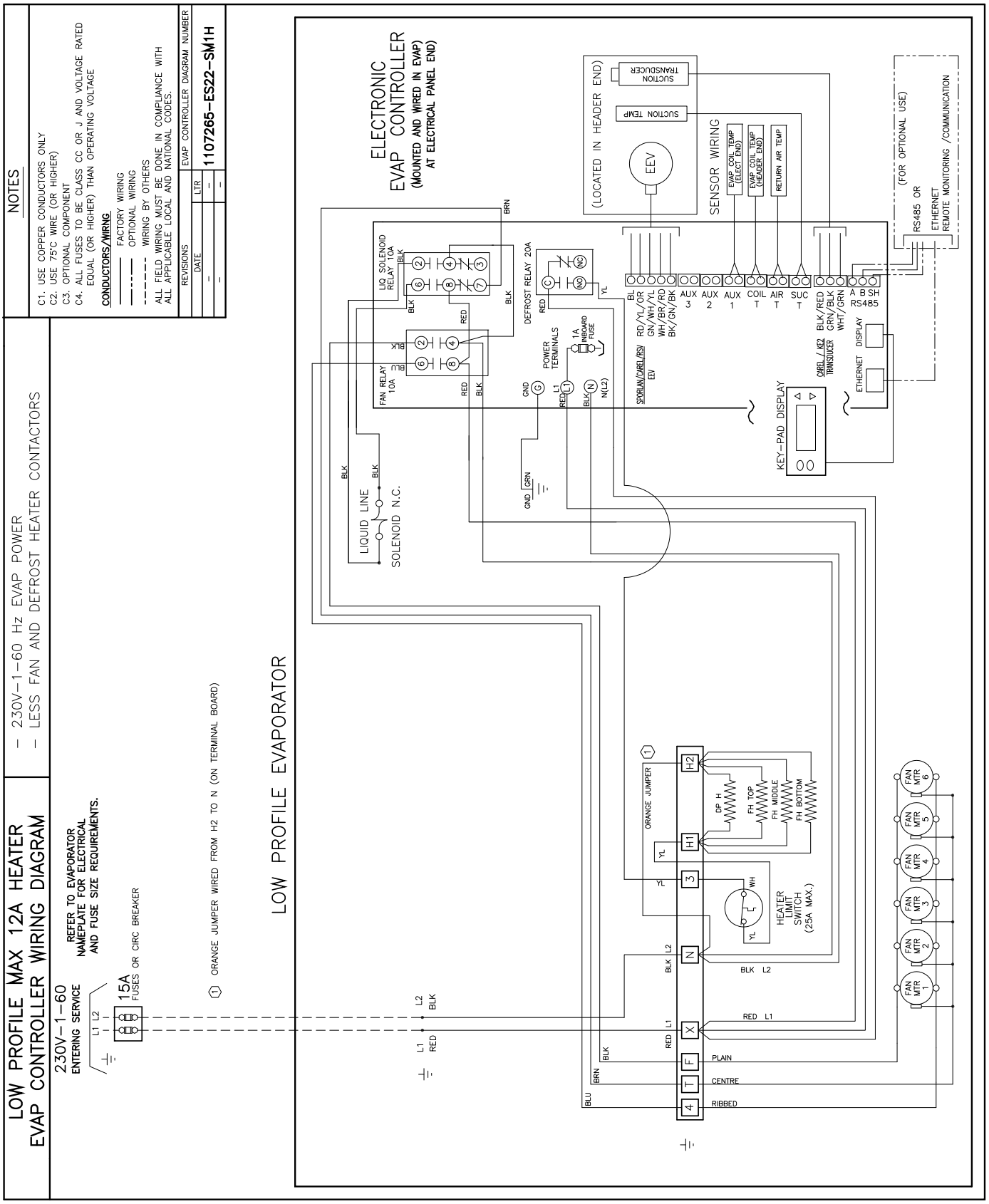
115/1/60: Air Defrost Models with ESP+



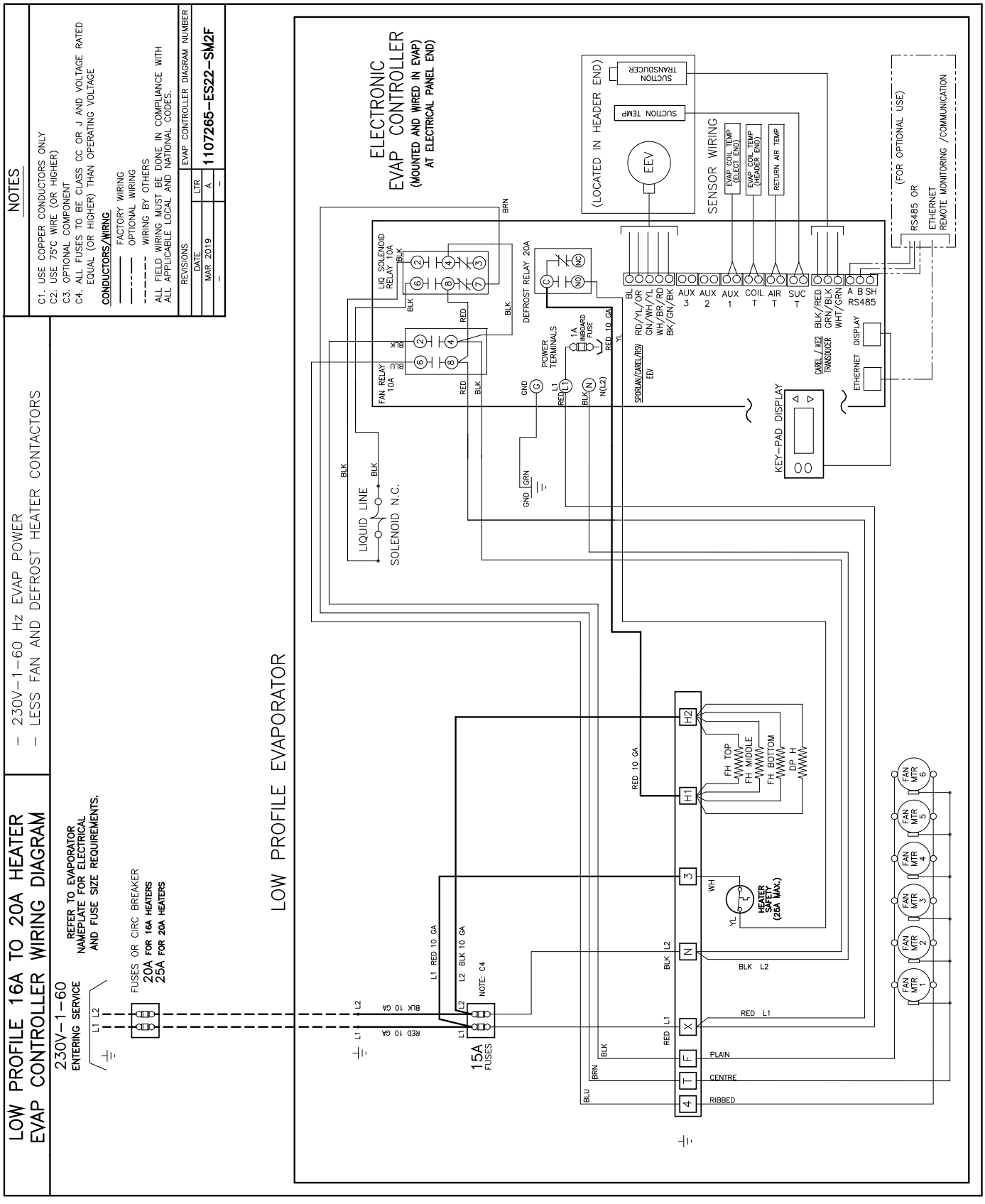
208-230/1/60: Air Defrost Models with ESP+



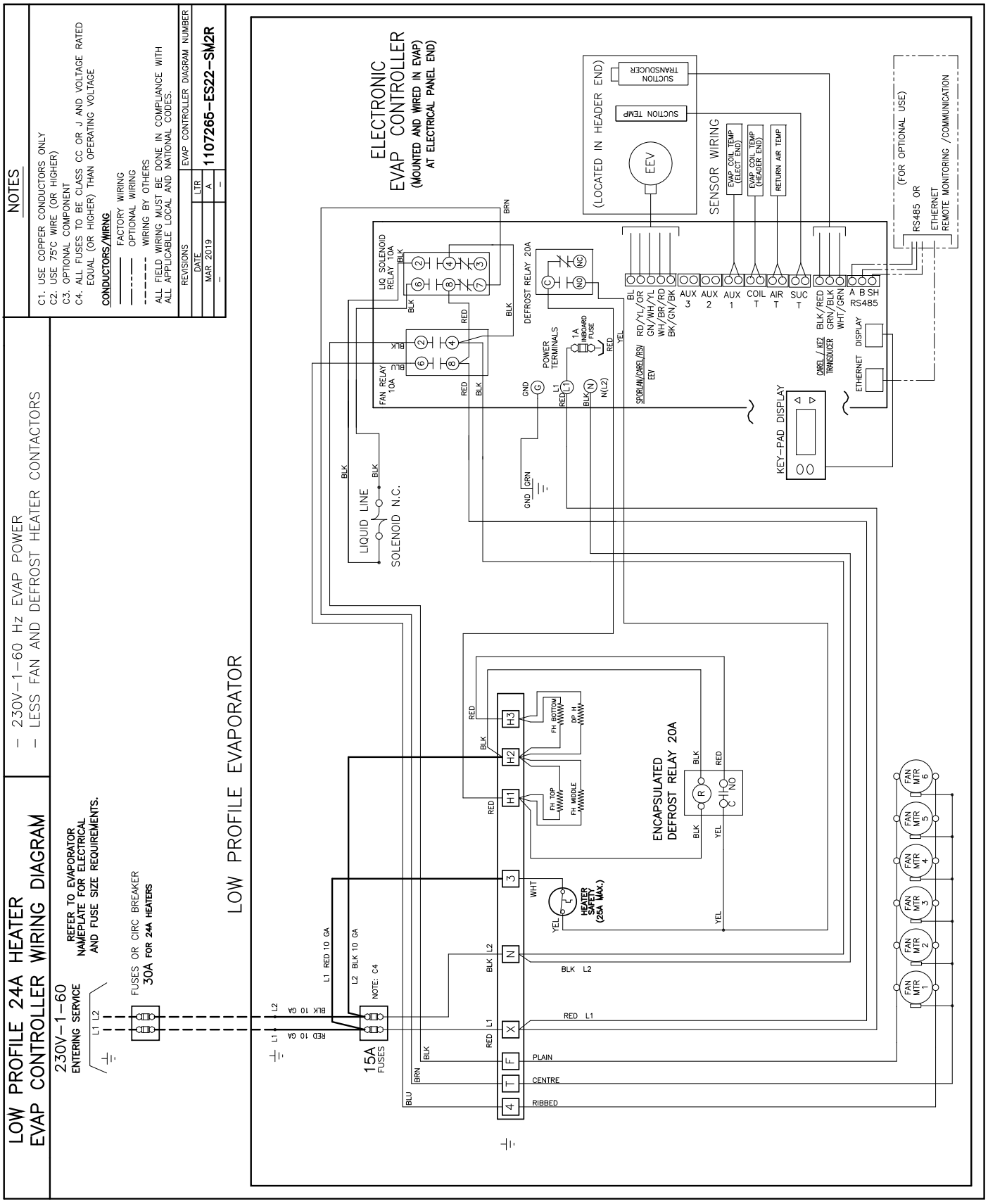
208-230/1/60: 1-3 Fan Electric Defrost Models with ESP+ Max.12A



208-230/1/60: 4-5 Fan Electric Defrost Models with ESP+ 16A to 20A



208-230/1/60: 6 Fan Electric Defrost Models with ESP+24A



Annual Walk-In Energy Factor Ratings - Medium Temperature

If a numerical value is listed in the table below, the following statement applies to that corresponding model: "This refrigeration system is designed and certified for use in walk-in cooler applications."

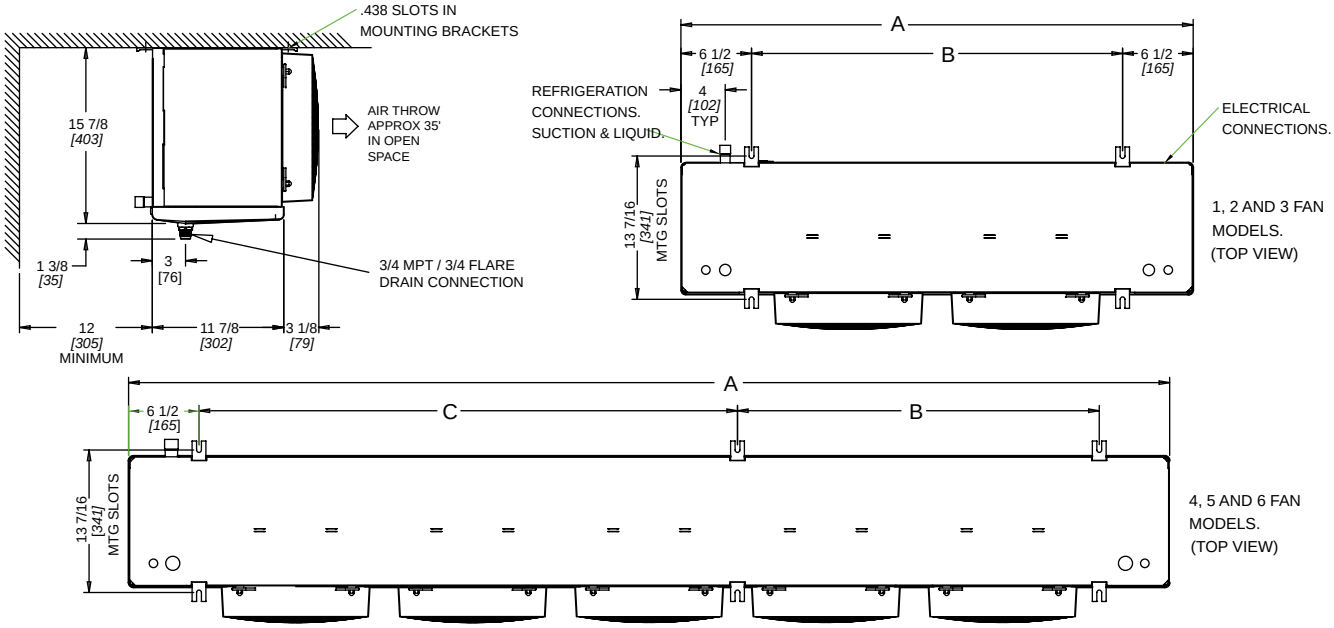
Model TPLP	R404A R507	R407A R407C	R448A R449A
104M	9.00	9.00	9.00
106M	9.00	9.00	9.00
107M	9.00	9.00	9.00
209M	9.00	9.00	9.00
211M	9.00	9.00	9.00
214M	9.00	9.00	9.00
317M	9.00	9.00	9.00
320M	9.00	9.00	9.00
422M	9.00	9.00	9.00
427M	9.00	9.00	9.00
534M	9.00	9.00	9.00
640M	9.00	9.00	9.00

Annual Walk-In Energy Factor Ratings - Low Temperature

If a numerical value is listed in the table below, the following statement applies to that corresponding model: "This refrigeration system is designed and certified for use in walk-in freezer applications."

Model TPLP	R404A R507	R407A	R448A R449A
104L	3.96	3.96	3.96
105L	3.97	3.97	3.97
106L	3.99	3.99	3.99
207L	3.99	3.99	3.99
209L	4.02	4.02	4.02
211L	4.04	4.04	4.04
314L	4.07	4.07	4.07
316L	4.10	4.10	4.10
418L	4.13	4.13	4.13
421L	4.15	4.15	4.15
526L	4.15	4.15	4.15
631L	4.15	4.15	4.15

Model TPLP	R404A R507	R407A	R448A R449A
103V	3.95	3.95	3.95
104V	3.96	3.96	3.96
106V	3.98	3.98	3.98
207V	3.99	3.99	3.99
208V	4.01	4.01	4.01
211V	4.04	4.04	4.04
313V	4.06	4.06	4.06
316V	4.10	4.10	4.10
418V	4.13	4.13	4.13
421V	4.15	4.15	4.15
524V	4.15	4.15	4.15
627V	4.15	4.15	4.15



MODEL TPLP	NO. OF FANS	A		B		C		SUCTION CONNECTION (ID) SWEAT
		IN	*mm*	IN	*mm*	IN	*mm*	
104M	1	30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
106M		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
107M		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
209M	2	46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
211M		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
214M		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
317M	3	62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	7/8
320M		62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	7/8
422M	4	78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
427M		78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
534M	5	94 1/4	*2394*	32 5/8	*829*	48 5/8	*1235*	1 3/8
640M	6	110 1/4	*2800*	48 5/8	*1235*	48 5/8	*1235*	1 3/8
104L	1	30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
105L		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
106L		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
207L	2	46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
209L		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
211L		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
314L	3	62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	7/8
316L		62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	1 1/8
418L	4	78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
421L		78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
526L	5	94 1/4	*2394*	32 5/8	*829*	48 5/8	*1235*	1 3/8
631L	6	110 1/4	*2800*	48 5/8	*1235*	48 5/8	*1235*	1 3/8
103V	1	30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
104V		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
106V		30 1/4	*768*	17 1/4	*438*	N/A	*N/A*	5/8
207V	2	46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
208V		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
211V		46 1/4	*1175*	33 1/4	*845*	N/A	*N/A*	7/8
313V	3	62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	7/8
316V		62 1/4	*1581*	49 1/4	*1251*	N/A	*N/A*	1 1/8
418V	4	78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
421V		78 1/4	*1988*	32 5/8	*829*	32 5/8	*829*	1 1/8
524V	5	94 1/4	*2394*	32 5/8	*829*	48 5/8	*1235*	1 3/8
627V	6	110 1/4	*2800*	48 5/8	*1235*	48 5/8	*1235*	1 3/8

Air Defrost Models

MODEL NUMBER TPLP							SHIPPING WEIGHT	
							LB.	*kg*
104MA	N/A	N/A	N/A	N/A	N/A	N/A	45	*20*
106MA							47	*21*
107MA							49	*22*
209MA	209MT	209MG	207LG	207LT	207VG	207VT	70	*32*
211MA	211MT	211MG	209LG	209LT	208VG	208VT	74	*33*
214MA	214MT	214MG	211LG	211LT	211VG	211VT	78	*35*
317MA	317MT	317MG	314LG	314LT	313VG	313VT	101	*46*
320MA	320MT	320MG	316LG	316LT	316VG	316VT	107	48
422MA	422MT	422MG	418LG	418LT	418VG	418VT	117	*53*
427MA	427MT	427MG	421LG	421LT	421VG	421VT	135	*61*
534MA	534MT	534MG	526LG	526LT	524VG	524VT	163	*74*
640MA	640MT	640MG	631LG	631LT	627VG	627VT	192	*87*

Electric Defrost Models

MODEL NUMBER TPLP			SHIPPING WEIGHT	
			LB.	*kg*
104ME	104LE	103VE	49	*22*
106ME	105LE	104VE	51	*23*
107ME	106LE	106VE	53	*24*
209ME	207LE	207VE	76	*35*
211ME	209LE	208VE	80	*36*
214ME	211LE	211VE	84	*38*
317ME	314LE	313VE	109	*49*
320ME	316LE	316VE	115	52
422ME	418LE	418VE	127	*58*
427ME	421LE	421VE	145	*66*
534ME	526LE	524VE	176	*80*
640ME	631LE	627VE	207	*94*

FACTORY INSTALLED THERMAL EXPANSION VALVE SELECTIONS

Medium Temperature Models

Model TPLP	R404A R507		R407A R407C R448A R449A	
	SPORLAN	SOLENOID VALVES	SPORLAN	SOLENOID VALVES
104MA-S1D	EBQSE-AA-C	3	EBQVE-AAA-C	3
106MA-S1D	EBQSE-A-C	3	EBQVE-AA-C	3
107MA-S1D	EBQSE-A-C	3	EBQVE-AA-C	3
209MA-S1D	EBQSE-A-C	3	EBQVE-A-C	3
211MA-S1D	EBQSE-B-C	3	EBQVE-A-C	3
214MA-S1D	EBQSE-B-C	5	EBQVE-A-C	3
317MA-S1D	EBQSE-B-C	5	EBQVE-A-C	3
320MA-S1D	EBQSE-B-C	5	EBQVE-B-C	5
422MA-S1D	EBQSE-C-C	6	EBQVE-B-C	5
427MA-S1D	EBQSE-C-C	6	EBQVE-B-C	5
534MA-S1D	EBSSE-6-C	6	EBQVE-C-C	6
640MA-S1D	EBSSE-6-C	6	EBQVE-C-C	6

Above selections based on: 1) 100°F (38°C) vapor free liquid entering expansion valve, 2) 110°F (43°C) condensing temperature, 3) 9-12°F (4.4-6.7C) evaporator TD

Low Temperature 6FPI Models

Model TPLP	R404A R507		R407A R448A R449A	
	SPORLAN	SOLENOID VALVES	SPORLAN	SOLENOID VALVES
104LE-S2D	EBQSE-AA-ZP	3	EBQVE-AA-ZP	3
105LE-S2D	EBQSE-A-ZP	3	EBQVE-AA-ZP	3
106LE-S2D	EBQSE-A-ZP	3	EBQVE-AA-ZP	3
207LE-S2D	EBQSE-A-ZP	3	EBQVE-A-ZP	3
209LE-S2D	EBQSE-A-ZP	3	EBQVE-A-ZP	3
211LE-S2D	EBQSE-B-ZP	3	EBQVE-A-ZP	3
314LE-S2D	EBQSE-B-ZP	5	EBQVE-B-ZP	3
316LE-S2D	EBQSE-C-ZP	5	EBQVE-B-ZP	5
418LE-S2D	EBQSE-C-ZP	5	EBQVE-B-ZP	5
421LE-S2D	EBQSE-C-ZP	6	EBQVE-C-ZP	5
526LE-S2D	EBSSE-6-ZP	6	EBQVE-C-ZP	5
631LE-S2D	EBSSE-6-ZP	6	EBQVE-C-ZP	6

Above selections based on: 1) 100°F (38°C) vapor free liquid entering expansion valve, 2) 110°F (43°C) condensing temperature, 3) 9-12°F (4.4-6.7C) evaporator TD

Low Temperature 4FPI Models

Model TPLP	R404A R507		R407A R448A R449A	
	SPORLAN	SOLENOID VALVES	SPORLAN	SOLENOID VALVES
103VE-S2D	EBQSE-AA-ZP	3	EBQVE-AA-ZP	3
104VE-S2D	EBQSE-AA-ZP	3	EBQVE-AA-ZP	3
106VE-S2D	EBQSE-A-ZP	3	EBQVE-AA-ZP	3
207VE-S2D	EBQSE-A-ZP	3	EBQVE-A-ZP	3
208VE-S2D	EBQSE-A-ZP	3	EBQVE-A-ZP	3
211VE-S2D	EBQSE-A-ZP	3	EBQVE-A-ZP	3
313VE-S2D	EBQSE-B-ZP	5	EBQVE-B-ZP	3
316VE-S2D	EBQSE-B-ZP	5	EBQVE-B-ZP	3
418VE-S2D	EBQSE-C-ZP	5	EBQVE-B-ZP	3
421VE-S2D	EBQSE-C-ZP	6	EBQVE-B-ZP	5
524VE-S2D	EBSSE-6-ZP	6	EBQVE-C-ZP	5
627VE-S2D	EBSSE-6-ZP	6	EBQVE-C-ZP	5

Above selections based on: 1) 100°F (38°C) vapor free liquid entering expansion valve, 2) 110°F (43°C) condensing temperature, 3) 9-12°F (4.4-6.7C) evaporator TD

FACTORY INSTALLED EXPANSION VALVE SELECTIONS

Models with ESP+

Medium Temperature Air Or Electric Defrost All Refrigerants

MODEL TPLP	FACTORY INSTALLED NOZZLE	FACTORY INSTALLED EXPANSION VALVE	FACTORY INSTALLED LIQUID LINE SOLENOID VALVE
104M* **	N/A	E2V9	E3
106M* **	L1/2	E2V11	E3
107M* **	L1/2	E2V14	E3
209M* **	L3/4	E2V14	E3
211M* **	L1	E2V14	E3
214M* **	L1	E2V18	E3
317M* **	L1-1/2	E2V18	E5
320M* **	L1-1/2	E2V24	E5
422M* **	L2	E2V24	E5
427M* **	L2	E2V24	E5
534M* **	L2-1/2	E2V35	E6
640M* **	G3	E2V35	E6

*** Insert Air or Electric Defrost type. See nomenclature for details.

Low Temperature Electric Defrost 6 FPI All Refrigerants

MODEL TPLP	FACTORY INSTALLED NOZZLE	FACTORY INSTALLED EXPANSION VALVE	FACTORY INSTALLED LIQUID LINE SOLENOID VALVE
104LE	L1/2	E2V9	E3
105LE	L3/4	E2V9	E3
106LE	L1	E2V11	E3
207LE	L1	E2V11	E3
209LE	L1-1/2	E2V11	E3
211LE	L2	E2V14	E3
314LE	L2	E2V14	E5
316LE	L3	E2V18	E5
418LE	L3	E2V18	E5
421LE	G4	E2V24	E5
526LE	G4	E2V24	E6
631LE	G5	E2V24	E6

Low Temperature Electric Defrost 4 FPI All Refrigerants

MODEL TPLP	FACTORY INSTALLED NOZZLE	FACTORY INSTALLED E2V EXPANSION VALVE	FACTORY INSTALLED LIQUID LINE SOLENOID VALVE
103VE	L1/2	E2V9	E3
104VE	L3/4	E2V9	E3
106VE	L1	E2V9	E3
207VE	L1	E2V11	E3
208VE	L1-1/2	E2V11	E3
211VE	L2	E2V11	E3
313VE	L2	E2V14	E3
316VE	L2-1/2	E2V14	E5
418VE	J2-1/2	E2V18	E5
421VE	G3	E2V18	E5
524VE	G4	E2V24	E5
627VE	G5	E2V24	E6

Medium Temperature, 6 FPI

TEMP	FPI	# of Fans	Model TPLP	Voltage	1 X EVAPORATOR		2 X EVAPORATOR	
					Defrost Kit	Fuse Package	Defrost Kit	Fuse Package
ME - MEDIUM TEMPERATURE	6	1	104ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			104ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			106ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			106ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			107ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			107ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		2	209ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			209ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			211ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			211ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			214ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			214ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		3	317ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			317ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			320ME-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			320ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		4	422ME-S2D	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			422ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			427ME-S2D	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			427ME-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		5	534ME-S2D	208-230/1/60	DFK-02	FP-007	DFK-06	FP-010
			534ME-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019
		6	640ME-S2D	208-230/1/60	DFK-02	FP-020	DFK-09	FP-021
			640ME-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019

Low Temperature, 6 FPI

TEMP	FPI	# of Fans	Model TPLP	Voltage	1 X EVAPORATOR		2 X EVAPORATOR	
					Defrost Kit	Fuse Package	Defrost Kit	Fuse Package
LE - LOW TEMPERATURE	6	1	104LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			104LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			105LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			105LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			106LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			106LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		2	207LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			207LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			209LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			209LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			211LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			211LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		3	314LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			314LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			316LE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			316LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		4	418LE-S2D	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			418LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			421LE-S2D	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			421LE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		5	526LE-S2D	208-230/1/60	DFK-02	FP-007	DFK-06	FP-010
			526LE-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019
		6	631LE-S2D	208-230/1/60	DFK-02	FP-020	DFK-09	FP-021
			631LE-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019

Low Temperature, 4 FPI

TEMP	FPI	# of Fans	Model TPLP	Voltage	1 X EVAPORATOR		2 X EVAPORATOR	
					Defrost Kit	Fuse Package	Defrost Kit	Fuse Package
VE - LOW TEMPERATURE	4	1	**103VE-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			103VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			104VE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			104VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			106VE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			106VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		2	**207VE-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			207VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			208VE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			208VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			211VE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			211VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		3	**313VE-S2D**	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			313VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			316VE-S2D	208-230/1/60	DFK-02	FP-004	DFK-06	FP-008
			316VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		4	**418VE-S2D**	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			418VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
			421VE-S2D	208-230/1/60	DFK-02	FP-006	DFK-06	FP-015
			421VE-T3D	208-230/3/60	DFK-03	FP-013	DFK-07	FP-018
		5	**524VE-S2D**	208-230/1/60	DFK-02	FP-007	DFK-06	FP-010
			524VE-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019
		6	**627VE-S2D**	208-230/1/60	DFK-02	FP-020	DFK-09	FP-021
			627VE-T3D	208-230/3/60	DFK-03	FP-014	DFK-07	FP-019

For info on matched Trenton condensing units, visit www.t-rp.com/cu

Defrost Kit & Fuse Package Online Selection Tool:

www.t-rp.com/dfk

Defrost Kits

Number of Evaps.	Kit Part Number	Description
1	**DFK-01**	Time Clock, HtrCont - 1x 40A (3P), FB 1x 30A (1P)
1	**DFK-02**	Time Clock, HtrCont - 1x 40A (3P), FB 1x 30A (2P)
1	**DFK-03**	Time Clock, HtrCont - 1x 40A (3P), FB 1x 30A (3P)
1	**DFK-04**	Time Clock, HtrCont - 1x 40A (3P), FB 1x 60A (2P)
2	**DFK-05**	Time Clock, HtrCont - 1x 40A (3P), FB 2x 30A (1P)
2	**DFK-06**	Time Clock, HtrCont - 1x 40A (3P), FB 2x 30A (2P)
2	**DFK-07**	Time Clock, HtrCont - 1x 40A (3P), FB 2x 30A (3P)
2	**DFK-08**	Time Clock, HtrCont - 1x 50A (3P), FB 2x 60A (2P)
2	**DFK-09**	Time Clock, HtrCont - 1x 50A (3P), FB 2x 30A (2P)
1	**DFK-10**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P)
1	**DFK-11**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (3P)
2	**DFK-12**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 4x 30A (2P)
2	**DFK-13**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 4x 30A (3P)
1	**DFK-14**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (2P), FB 1x 30A (3P)
1	**DFK-15**	Time Clock, HtrCont - 1x40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (2P), FB 1x 60A (2P)
1	**DFK-16**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (2P), FB 1x 60A (3P)
1	**DFK-17**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (3P), FB 1x 60A (3P)
2	**DFK-18**	Time Clock, HtrCont - 1x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 2x 30A (3P)
2	**DFK-19**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 4x 30A (2P)
2	**DFK-20**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 4x 30A (3P)
1	**DFK-21**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 1x 30A (2P), FB 1x 60A (2P)
1	**DFK-22**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 1x 30A (3P), FB 1x 60A (3P)
2	**DFK-23**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 2x 30A (3P)
2	**DFK-24**	Time Clock, HtrCont - 1x 50A (3P), FanCont - 1x 40A (3P), FB 2x 30A (3P), FB 2x 60A (3P)
1	**DFK-25**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (2P), FB 2x 60A (2P)
1	**DFK-26**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 40A (3P), FB 1x 30A (3P), FB 2x 60A (3P)
2	**DFK-27**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 2x 60A (2P)
2	**DFK-28**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 2x 60A (3P)
2	**DFK-29**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (3P), FB 2x 60A (3P)
2	**DFK-30**	Time Clock, HtrCont - 2x 40A (3P), FanCont - 1x 50A (3P), FB 2x 30A (2P), FB 2x 60A (3P)
1	**DFK-31**	Time Clock, HtrCont - 2x 50A (3P), FanCont - 1x 40A (3P), FB 1x 30A (3P), FB 2x 60A (3P)
2	**DFK-32**	Time Clock, HtrCont - 2x 50A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 2x 60A (2P)
2	**DFK-33**	Time Clock, HtrCont - 2x 50A (3P), FanCont - 1x 40A (3P), FB 2x 30A (3P), FB 2x 60A (3P)
2	**DFK-34**	Time Clock, HtrCont - 4x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (2P), FB 4x 60A (2P)
2	**DFK-35**	Time Clock, HtrCont - 4x 40A (3P), FanCont - 1x 40A (3P), FB 2x 30A (3P), FB 4x 60A (3P)
2	**DFK-36**	Time Clock, HtrCont - 4x 40A (3P), FanCont - 1x 50A (3P), FB 2x 30A (2P), FB 4x 60A (2P)
2	**DFK-37**	Time Clock, HtrCont - 4x 40A (3P), FanCont - 1x 50A (3P), FB 2x 30A (3P), FB 4x 60A (3P)
2	**DFK-38**	Time Clock, HtrCont - 4x 50A (3P), FanCont - 1x 50A (3P), FB 2x 30A (3P), FB 4x 60A (3P)
1	**DFK-39**	Time Clock, HtrCont1 - 1x 40A (3P), HtrCont2 - 2x 50A (3P), FanCont - 1x 40A (3P), FB 4x 60A (3P)

NOTE: HtrCont = Heater Contactor, FanCont = Fan Contactor, FB = Fuse Block, (1P), (2P), (3P) = Number of Poles

Fuse Packages

Package Part Number	Description
FP-001	FUSES (1) 15AMP
FP-002	FUSES (1) 20AMP
FP-003	FUSES (1) 25AMP
FP-004	FUSES (2) 15AMP
FP-006	FUSES (2) 20AMP
FP-007	FUSES (2) 25AMP
FP-008	FUSES (4) 15AMP
FP-010	FUSES (4) 25AMP
FP-012	FUSES (2) 35AMP
FP-013	FUSES (3) 15AMP
FP-014	FUSES (3) 20AMP
FP-015	FUSES (4) 20AMP
FP-016	FUSES (4) 20AMP (6) 45AMP
FP-017	FUSES (4) 35AMP
FP-018	FUSES (6) 15AMP
FP-019	FUSES (6) 20AMP
FP-020	FUSES (2) 30AMP
FP-021	FUSES (4) 30AMP
FP-022	FUSES (8) 15AMP
FP-023	FUSES (2) 25AMP (3) 50AMP
FP-024	FUSES (2) 20AMP (3) 45AMP
FP-025	FUSES (6) 20AMP (6) 60AMP
FP-026	FUSES (6) 15AMP (12) 40AMP
FP-027	FUSES (6) 15AMP (6) 40AMP
FP-028	FUSES (6) 20AMP (12) 40AMP
FP-029	FUSES (6)15AMP (6) 50AMP
FP-030	FUSES (6) 15AMP (6) 45AMP
FP-031	FUSES (6) 15AMP (6) 35AMP
FP-032	FUSES (6) 15AMP (6) 30AMP
FP-033	FUSES (6) 25AMP (12) 50AMP
FP-034	FUSES (6) 20AMP (12) 35AMP
FP-035	FUSES (4) 25AMP (6) 50AMP
FP-036	FUSES (6) 25AMP (12) 60AMP
FP-037	FUSES (6) 20AMP (12) 60AMP
FP-038	FUSES (6) 20AMP (12) 50AMP
FP-039	FUSES (6) 20AMP (12) 45AMP
FP-040	FUSES (6) 15AMP (12) 45AMP
FP-041	FUSES (5) 15AMP
FP-042	FUSES (10) 15AMP
FP-043	FUSES (3) 25AMP (6) 60AMP
FP-044	FUSES (3) 20AMP (6) 60AMP
FP-045	FUSES (3) 20AMP (6) 50AMP
FP-046	FUSES (3) 25AMP (6) 45AMP
FP-047	FUSES (3) 15AMP (6) 45AMP
FP-048	FUSES (4) 15AMP (4) 45AMP
FP-049	FUSES (4) 15AMP (4) 40AMP
FP-050	FUSES (3) 15AMP (3) 60AMP
FP-051	FUSES (4) 20AMP (6) 50AMP
FP-052	FUSES (4) 15AMP (6) 45AMP
FP-053	FUSES (4) 15AMP (6) 30AMP

Package Part Number	Description
FP-054	FUSES (3)15AMP (6) 35AMP
FP-055	FUSES (2) 15AMP (2) 45AMP
FP-056	FUSES (2) 15AMP (2) 40AMP
FP-057	FUSES (2) 20AMP (3) 50AMP
FP-058	FUSES (2) 15AMP (3) 45AMP
FP-059	FUSES (2) 15AMP (3) 30AMP
FP-060	FUSES (2) 15AMP (2) 35AMP
FP-061	FUSES (2) 15AMP (2) 50AMP
FP-062	FUSES (2) 15AMP (2) 60AMP
FP-063	FUSES (2) 15AMP (3) 25AMP
FP-064	FUSES (2) 15AMP (3) 35AMP
FP-065	FUSES (2) 15AMP (3) 40AMP
FP-066	FUSES (2) 15AMP (3) 20AMP
FP-067	FUSES (4) 15AMP (4) 35AMP
FP-068	FUSES (4) 15AMP (4) 50AMP
FP-069	FUSES (4) 15AMP (4) 60AMP
FP-070	FUSES (4) 15AMP (6) 25AMP
FP-071	FUSES (4) 15AMP (6) 35AMP
FP-072	FUSES (4) 15AMP (6) 40AMP
FP-073	FUSES (4) 15AMP (6) 20AMP
FP-074	FUSES (3) 20AMP (3) 60AMP
FP-075	FUSES (3) 20AMP (6) 35AMP
FP-076	FUSES (3) 25AMP (6) 50AMP
FP-077	FUSES (3) 35AMP (9) 45AMP
FP-078	FUSES (3) 15AMP (3) 35AMP
FP-079	FUSES (3)15AMP (3) 45AMP
FP-080	FUSES (3) 15AMP (3) 50AMP
FP-081	FUSES (3) 20AMP (6) 40AMP
FP-082	FUSES (3) 15AMP (3) 40AMP
FP-083	FUSES (3) 15AMP (6) 40AMP
FP-084	FUSES (6) 15AMP (6) 60AMP
FP-085	FUSES (6) 15AMP (12) 35AMP
FP-086	FUSES (3) 35AMP (3) 45AMP (6) 60AMP
FP-087	FUSES (4) 20AMP (4) 40AMP (4) 50AMP
FP-088	FUSES (4) 15AMP (4) 35AMP (4) 40AMP
FP-089	FUSES (2) 20AMP (2) 40AMP (2) 50AMP
FP-090	FUSES (2) 15AMP (2) 35AMP (2) 40AMP
FP-091	FUSES (2) 20AMP (2) 35AMP (2) 40AMP
FP-092	FUSES (2) 25AMP (2) 40AMP (2) 50AMP
FP-093	FUSES (4) 20AMP (4) 35AMP (4) 40AMP
FP-094	FUSES (6) 15AMP (6) 25AMP
FP-095	FUSES (3) 15AMP (3) 25AMP
FP-096	FUSES (3) 15AMP (3) 30AMP
FP-097	FUSES (4) 15AMP (4) 30AMP
FP-098	FUSES (4) 15AMP (4) 25AMP
FP-099	FUSES (4) 15AMP (4) 20AMP
FP-100	FUSES (2) 15AMP (2) 20AMP
FP-101	FUSES (2) 15AMP (2) 25AMP
FP-102	FUSES (2) 15AMP (2) 30AMP
FP-103	FUSES (4) 25AMP (4) 40AMP (4) 50AMP

NOTE: FUSES 30AMP and Below - Class CC Type, FUSES 35AMP and Above - Class J Type

INSTALLATION
The installation and start-up of evaporators should only be performed by qualified refrigeration mechanics.
This equipment should be installed in accordance with all applicable codes, ordinances and local by-laws.

INSPECTION
Inspect all equipment before unpacking for visible signs of damage or loss. Check shipping list against material received to ensure shipment is complete.

IMPORTANT: Remember, you, the consignee, must make any claim necessary against the transportation company. Shipping damage or missing parts, when discovered at the outset, will prevent later unnecessary and costly delays.
If damage or loss during transport is evident, make claim to carrier, as this will be their responsibility, not the manufacturer's.
Should carton be damaged, but damage to equipment is not obvious, a claim should be filed for "concealed damage" with the carrier.

IMPORTANT: The electrical characteristics of the unit should be checked at this time to make sure they correspond to those ordered and to electrical power available at the job site.

Save all shipping papers, tags and instruction sheets for reference by installer and owner.

APPLICATION
TPLP evaporators are designed for walker-in cooler and freezer applications used with a wide range of refrigerants. For room temperatures above 35°F *(2°C)* AND evaporating temperatures above 26°F *(-3°C)*, positive defrosting means (electric) may not be required, otherwise, electric defrost defrost models should be used. Electric defrost models come with defrost termination and fan delay as standard to control the defrost cycle termination and fan delay, while defrost initiation means (e.g. defrost timer) is not included.

The coil must not be exposed to any abnormal atmospheric or acidic environments. This may result in corrosion to the cabinet and possible coil failure (leaks).

LOCATION
The unit location in the room should be selected to ensure uniform air distribution throughout the entire space to be refrigerated. Be sure that the product does not obstruct the free circulation of air. Allow a minimum of 24" clearance at each end. Do not locate evaporators over doors. Consideration should be given to the coil location in order to minimize the piping run length to the condensing unit and floor drain.

EXPANSION VALVE (TXV) PRE-SELECTED
Locate the expansion valve bulb on a horizontal length of suction line preferably 3 to 6 inches from the suction header. Locate the bulb at 4 or 8 clock position and insulate with a waterproof type of insulation. Clamp the bulb to ensure 100% contact of the bulb with the suction line.

After following the manufacturer's installation instructions and after the room has reached the desired temperature the valve superheat should be checked. This will confirm that the evaporator is operating properly and performing to maximum efficiency. The superheat should be around 6 *(3.3°C)* to 8°F *(4.4°C)* for a 10 to 12°F T.D *(5.6 to 6.7°C)*. Too high or low a super heat will result in unsatisfactory system performance and possible compressor problems.

MOUNTING
Refer to dimensional drawing for recommended mounting arrangements. Ensure adequate clearance is provided behind the coil as well as each end. The evaporators may be mounted flush with ceiling with bolts, or hanging down with rod hangers. When using rod hangers, allow adequate space between the top of the unit and the ceiling for cleaning to comply with NSF Standard 7.
Ensure that the ceiling is level since the drain pan has been sloped for drainage during the defrost cycle.

DRAIN LINE
The drain line should be run from the drain connection, sloping at least 1" *(25 mm)* per foot and should have the size at least as large as the drain connection. A P-Trap in a warm area outside the room must be provided to allow proper draining through the tubing. Connection should be made to proper drainage facilities that comply with local regulations.
To prevent freeze-up when the temperature of the refrigerated space is 35°F *(2°C)* or lower, the drain line should be heated along its run inside the cold room. The heated drain line should be insulated. It is recommended that the heater be energized at all times. A heat input of 20 watts per foot in a 28°F *(-2°C)* room and 30 watts per foot for -20°F *(-29°C)* rooms, is satisfactory. Drain line heaters are not required for constant room temperature above 35°F *(2°C)*. Always trap evaporator drain line individually to prevent vapor migration.

Ensure that the drain line has sufficient slope for proper drainage (prevention of ice build up/blockage in pan).

PIPING

Refrigeration grade piping must be used for all field refrigeration piping. Refrigerant line sizes are important and **may not** be the same size as the coil connections. Consult ASHRAE handbook or other similar reference book for proper line sizing.
Refrigerant piping and control system should be designed to prevent possible liquid slugging (from oil or refrigerant) of the compressors on start-up after the defrost cycle. Also, it should prevent oil logging and minimize refrigerant pressure drop.

WIRING

Wire system in accordance with governing standards and local codes. See data and wiring diagrams on pages 4 to 20 for typical wiring arrangement. Electrical wiring is to be sized in accordance with minimum circuit ampacity rating (MCA). Size fuses used must not exceed the Maximum Fuse Size ratings.

For ease of identifying the proper wiring terminal, unit wiring is color coded and terminal block connections are identified.

When **fan delay thermostats** (combination fan delay and defrost termination) are installed, on start-up, the fans do not operate until the coil temperature is reduced to approximately 25ºF *(-4°C)*. It is normal for the fans to cycle a few times until the room temperature is brought down. At higher evaporating temperatures this control may not close and therefore should either be by-passed temporarily or replaced with an adjustable type. (set for a higher temperature cut-in point).

MAINTENANCE

The unit should be periodically inspected for any dirt or ice build-up on the fin surface and cleaned if necessary with a soft whisk or brush. Also ensure coils inner (and outer) drain pans do not have any ice build-up from improper defrost operation. When replacing heater elements first remove heater retainer brackets and heater clips.

SYSTEM CHECK

Before Start-Up:

1. All wiring should be in accordance with local codes.
2. Refrigerant lines should be properly sized.
3. Thorough evacuation and dehydration has been performed.
4. The suction, discharge, and receiver service valves must be open.
5. The system preferably include a liquid line filter drier moisture indicator and suction filter.
6. Pour enough water into the drain pan to allow a good check on drainage and seal the trap.

After Start-Up:

1. Check the oil level to be sure the oil charge is correct.
2. On initial start up the fans do not start until coil temperature is pulled down to approximately 25°F *(-4°C)* on the coil. Also, it is normal for the fan to cycle a few times until the room temperature is pulled down.
3. If necessary, temporarily by-pass fan delay control (to run fans until room temp is lowered).
4. Be sure that the expansion valve is properly set to provide the correct amount of superheat.
5. After the box temperature is close to reaching the desired temperature, the evaporator superheat must be checked and adjustment made if necessary. In general, evaporators running with a TD of 10°F *(5.6°C*) should have a superheat reading of 6° to 8°F *(3.3°C to 4.4°C)*. For evaporators with another T.D., the general rule is that the superheat should be around 60 to 80% of T.D.
6. Heavy moisture loads are usually encountered when starting the system for the first time. This may cause a rapid build-up of frost on the evaporator. During the initial pull down, we suggest that the frost build-up be watched and defrosted manually as required.
7. Observe that the system goes through at least one complete DEFROST CYCLE.

System	
Model Number	Date of Start-Up
Serial Number	Service Contractor
Refrigerant	Phone
Electrical Supply	E-mail

PRODUCT SUPPORT	*web:* **www.t-rp.com/tplp** *email:* **evaps@t-rp.com** *call:* **1-844-893-3222 x520**
TROUBLESHOOTING	*email:* **troubleshooting@t-rp.com** *call:* **1-844-893-3222 x529**
SERVICE PARTS	*web:* **www.t-rp.com/parts** *email:* **parts@t-rp.com** *call:* **1-844-893-3222 x504**
WARRANTY	*web:* **www.t-rp.com/warranty** *email:* **warranty@t-rp.com** *call:* **1-844-893-3222 x507**
ORDERS	*email:* **orders@t-rp.com** *call:* **1-844-893-3222 x501**
SHIPPING	*email:* **shipping@t-rp.com** *call:* **1-844-893-3222 x503**

HOW CAN WE HELP YOU?

visit **www.t-rp.com/contact**

Service Parts List Label To Be Attached *HERE*

Trenton Refrigeration
Brantford, ON • Longview, TX
1-800-463-9517 info@t-rp.com www.t-rp.com

114121- WALK-IN FREEZER EXHIBIT A

TEZ New Generation "D" Condensing Units

PRODUCT DATA & SPECIFICATIONS

Bulletin T40-TEZD-PDS-9
Part # 1108862

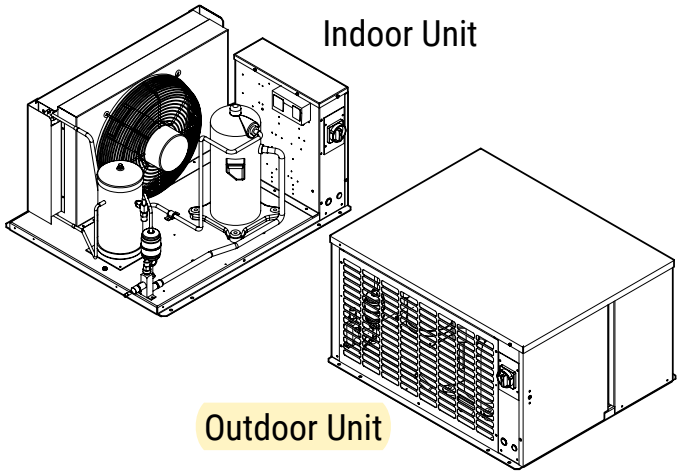
PRODUCT SUPPORT
web: **www.t-rp.com/tez**
email: **smcu@t-rp.com**
call: **1-844-893-3222 x521**
scan:

60 Hz

Indoor/Outdoor Air-Cooled Scroll Condensing Units

3/4 to 17 HP -
High and Low
Temperature Refrigeration

INCLUDES MODELS FOR DOE & NRCAN
AWEF-COMPLIANT APPLICATIONS



SMARTSPEED™ FAN MOTOR TECHNOLOGY
See Page 4 for details

LIMITROL FLOATING HEAD PRESSURE CONTROL SYSTEM
See Page 5 for details

CONTENTS

NOMENCLATURE

TEZ - SCROLL CONDENSING UNITS

TEZ A 075 H 8 - H T4 D - A

Model Series
TEZ = Excel Scroll Air Cooled Condensing Unit Line

Compressor Manufacturer
A = Copeland

Nominal HP
007 - 170 = 3/4 - 17 HP

Application Range
H = High and Med Temp
L = Low Temp

Refrigerant*
8 = R407A, R407C, R448A, R449A, R404A, R507

Pre-Selected Factory Mounted Option Packages
See detail on next page

Design Generation
D = Latest Catalog Series

Voltage*
S2 = 208/230-1-60
S3 = 230-1-60
S6 = 200/220-1-50
S7 = 200-1-50
T3 = 208/230-3-60
T4 = 460-3-60
T5 = 575-3-60
T7 = 200/220-3-50
T9 = 380/400-3-50

* subject to compressor availability

Enclosure
H = Outdoor
I = Indoor

STANDARD FEATURES

Indoor Unit:

- Compatible with Low GWP Refrigerants
- Weatherproof electrical control box with compressor contactor and fused control circuit
- Copeland scroll compressor
- High efficiency enhanced tube and fin condenser design
- SmartSpeed EC Fan Motor Technology standard on models using chassis 1 (see page 35)
- Energy efficient PSC condenser fan motor on models using chassis 2 thru 6 (see page 35)
- Receiver with fusible plug and liquid shut off valve
- Suction service valve
- Pre-formed copper tubing
- Liquid injection (low temp. models)
- Unit leak tested and shipped with helium holding charge
- Fixed high pressure switch and adjustable low pressure control
- Receiver inlet valve on 2-fan units models only
- Discharge thermostat on applicable models only
- Painted cabinet
- Time delay relay for compressor
- QuickVac Evacuation and Refrigerant Recovery Valves

Outdoor Unit: All Standard Features of Indoor Unit, Plus:

- Painted weather-resistant housing with removable hood
- Flooded head pressure control (adjustable)
- Crankcase heater
- Fan cycling control with flex hose (2 fan units)

AVAILABLE OPTIONS

- Suction accumulator with and without boil-out coil
- Discharge line check valve
- Oil separator with and without oil return filter and solenoid valve
- Receiver inlet ball valve
- Heated and Insulated receiver
- Over-sized receiver
- Sealed liquid line filter drier & sight-glass
- Ball valve - liquid line (shipped loose)
- Insulated suction lines
- Leg kits
- Discharge air hood
- Sub cooling circuit on 5 - 17 HP models
- Liquid line solenoid valve (with standard 230 volt coil) - shipped loose
- Variable speed EC motors as head pressure control (see Bulletin T40-HPC-AG or https://docs.t-rp.com/1101111.pdf for details)
- Dual pressure control with flex hoses
- Compressor circuit breaker
- Current sensing relay - for use with oil safety control (where applicable)
- Defrost heater contactor c/w fuse block
- Evaporator fan contactor c/w fuse block
- Disconnect switch
- Disconnect fusing
- Pump down toggle switch
- Lock out control circuit relay
- Mechanical time clock
- Electronic voltage / Phase monitor
- **SmartSpeed Fan Motor Technology on models using chassis 2-6 (see page 4)**
- **Limitrol+ Floating Head Pressure Control System (see page 5 or Bulletin T40-LIMITROL-AG or docs.t-rp.com/1101114.pdf for details)**

PRE-SELECTED FACTORY MOUNTED OPTION PACKAGES

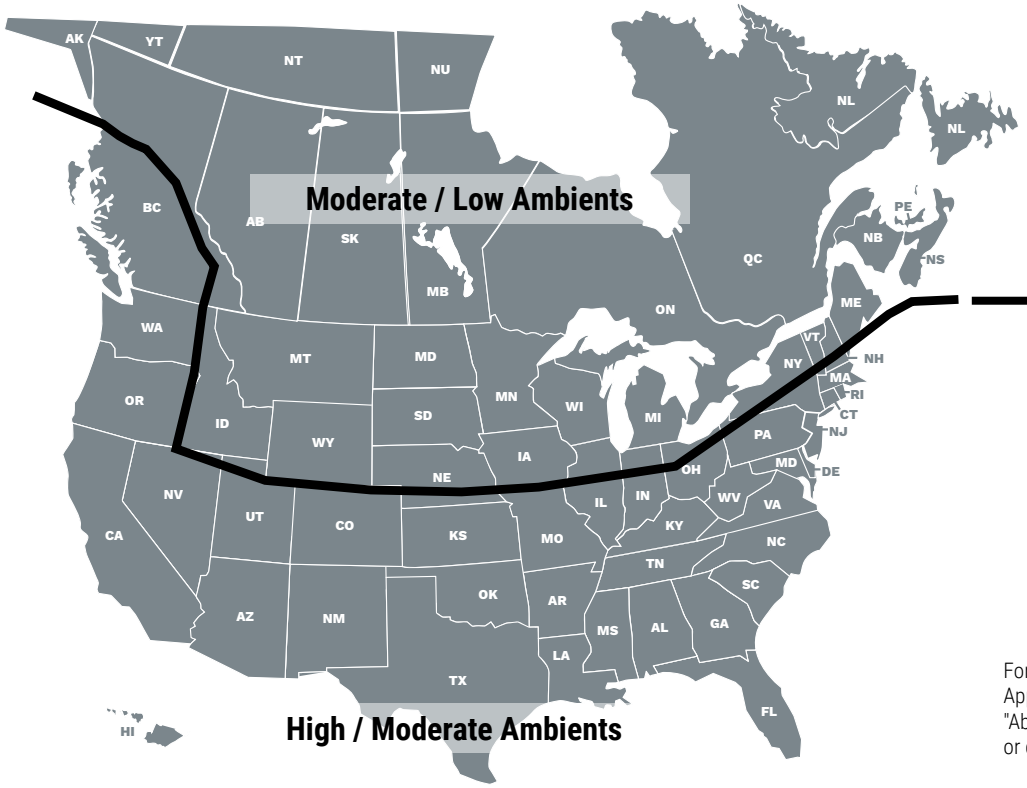
	For High / Moderate Ambients	For Moderate / Low Ambients
GOOD	**Package B**: + Liquid Line Filter Drier[1] & Sight Glass	**Package D**: + Liquid Line Filter Drier[1] & Sight Glass + Heated and Insulated Receiver
BETTER	**Package N**: + Liquid Line Filter Drier[1] & Sight Glass + Suction Accumulator w/o Heat Exchanger	**Package J**: + Liquid Line Filter Drier[1] & Sight Glass + Suction Accumulator w/o Heat Exchanger + Heated and Insulated Receiver
BEST	**Package P**: + Liquid Line Filter Drier[1] & Sight Glass + Suction Accumulator w/o Heat Exchanger + Suction Filter[2] + Non-Fused Disconnect	**Package Q**: + Liquid Line Filter Drier[1] & Sight Glass + Suction Accumulator w/o Heat Exchanger + Suction Filter[2] + Non-Fused Disconnect + Heated and Insulated Receiver

[1] Liquid Line Filter Drier: Sealed on ALL One Fan Model Units, Replaceable on ALL Two Fan Model Units.

[2] Suction Filter: Sealed on ALL One Fan Model Units, Replaceable on ALL Two Fan Model Units.

For information on Evaporator Defrost Kits and Fuse Packages, visit www.t-rp.com/dfk

RECOMMENDATIONS FOR SELECTING FACTORY MOUNTED OPTION PACKAGES



For Moderate / Low Ambients:

Good: Package D
Better: Package J
Best: Package Q

For High / Moderate Ambients:

Good: Package B
Better: Package N
Best: Package P

For further details, visit our website and see Application Bulletin TAB-0101-02-1: "About Heated And Insulated Receivers" or contact your local sales representative.

US Patent No. 9,297,567

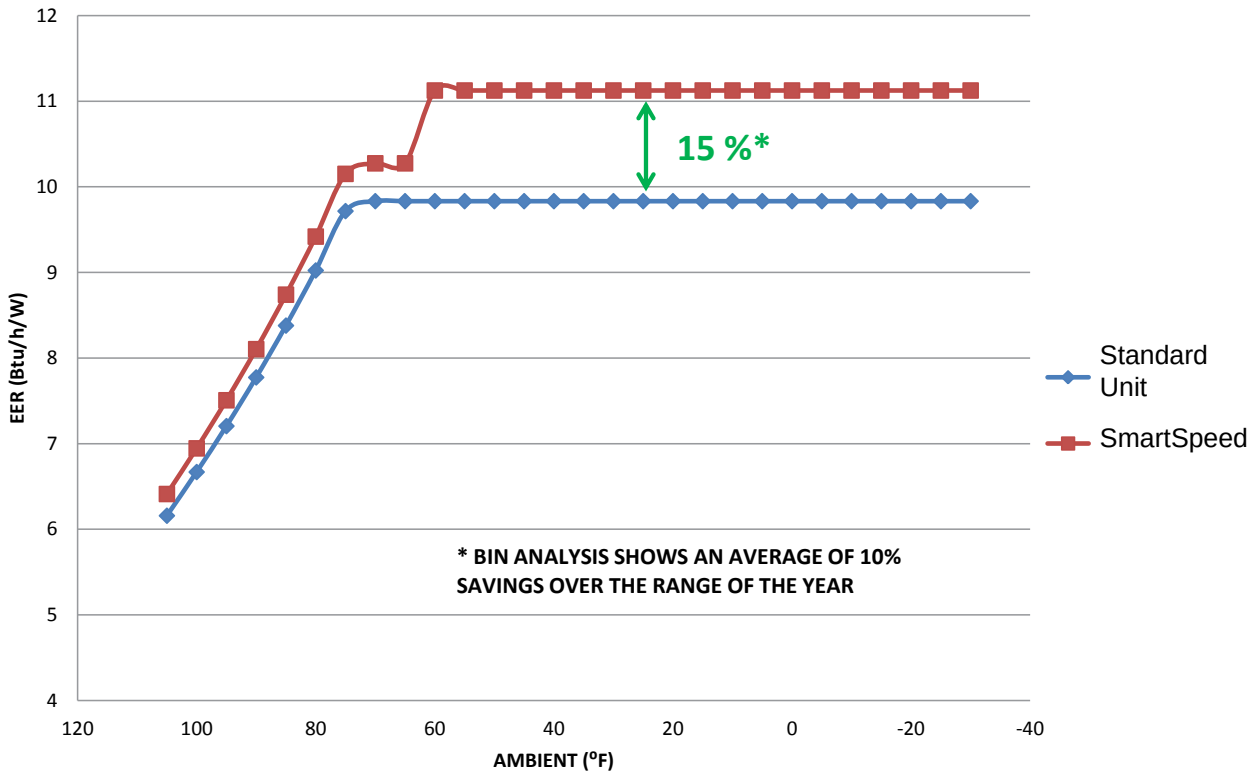
SMARTSPEED™
FAN MOTOR TECHNOLOGY

AWARD WINNING

DESIGN FEATURES

- Standard on models using chassis 1 (optional on chassis 2 thru 6)
- No special controls required. No worries about wind or cold climates.
- Ambients above 55°F - EC motor operates at full speed, crankcase heater and heated + insulated receiver disabled from control circuit
- Ambients below 55°F - EC motor operates at low speed, crankcase heater and heated + insulated receiver enabled from control circuit

Condensing Unit EER - Standard Unit vs. SmartSpeed



Refer to Pages 35-36 For Wiring Details

Condensing Unit with SmartSpeed Power Consumption Per Motor		
Chassis Size (see pages 31-35)	**Ambients above 55°F.** Fan Full Speed. Crankcase and Receiver Heaters Off.	**Ambients below 55°F.** Fan Low Speed. Crankcase and Receiver Heaters On.
1	102 W	19 W
2	168 W	37 W
3,4	362 W	76 W
5	630 W	152 W

LIMITROL+

FLOATING HEAD PRESSURE CONTROL SYSTEM

- **Reduces compressor energy consumption and run time**
- **EC motor technology further saves energy and reduces electrical requirements**
- **Lowered environmental impact through reduced refrigerant use**
- **Stable system performance in lower ambients**

What is Limitrol+? Limitrol+ combines various technologies into a responsive system that floats head pressure, saving energy and reduces environmental impact.
Unlike competitive systems, Limitrol+ combines variable speed EC motor technology, condenser portioning and various systems modifications to provide the ultimate in performance and control.
As a result, Limitrol+ functions in much colder ambients where previous systems have proven ineffective.

What does it do? Conventional head pressure control systems maintain a constant head pressure regardless of ambient temperatures. Limitrol+ intelligently responds to ambient conditions to float head pressure without sacrificing system performance at lower temperatures.

What are its applications?
- Condensing units over 5 HP
- Ideally suited and most effective in applications with fluctuating ambients
- Perfect for installations where reduced refrigerant charges are desired or required.

How much can Limitrol+ save you?

MODEL	Philadelphia, PA		New York, NY		Boston, MA		Charlotte, NC		Atlanta, GA		Los Angeles, CA		St Louis, MO		St. Paul, MN		Toronto, ON	
	%	$	%	$	%	$	%	$	%	$	%	$	%	$	%	$	%	$
5 HP Cooler	22	616	23	1,099	25	1,081	18	474	16	521	16	835	20	624	25	798	27	638
7.5 HP Cooler	21	1,008	22	1,805	23	1,707	18	843	17	954	17	1,499	19	1,053	24	1,270	25	1,000
10 HP Cooler	18	1,204	18	2,131	20	2,095	15	975	14	1,089	18	2,446	16	1,227	20	1,529	21	1,223
15 HP Cooler	19	1,852	20	3,300	21	3,170	16	1,567	15	1,767	19	3,570	17	1,916	22	2,337	22	1,834
6 HP Freezer	24	903	25	1,621	26	1,548	21	753	20	848	23	1,548	22	928	26	1,119	27	891
7.5 HP Freezer	21	994	21	1,783	23	1,726	17	800	16	891	18	1,591	19	1,012	23	1,255	24	1,004

* The above is a BIN Hour Analysis. Weather data was used from ASHRAE Weather Data Viewer and electrical rates for each city are based on June 2013 data from EIA (U.S. Energy Information Administration).
** Above numbers do not include refrigerant savings, and further cost savings can be expected.

For more information on Limitrol+ Floating Head Pressure Control System visit t-rp.com/limitrol or see Bulletin T40-LIMITROL-AG (https://docs.t-rp.com/1101114.pdf)

For more information on Head Pressure Control, please refer to our “Head Pressure Control Application Guide” Bulletin T40-HPC-AG (https://docs.t-rp.com/1101111.pdf)

R404A R507 Low Temperature

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h — Ambient Temperature					
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
	0	-17.8	5540	5310	5070	4840	4600	4360
	-5	-20.6	4940	4740	4530	4330	4120	3910
TEZA008L8	-10	-23.3	4410	4230	4050	3870	3680	3500
	-15	-26.1	3930	3770	3620	3460	3300	3140
Compressor	-20	-28.9	3500	3370	3230	3100	2960	2820
Model	-25	-31.7	3120	3010	2900	2780	2660	2540
ZF03KAE	-30	-34.4	2790	2690	2600	2500	2400	2290
	-35	-37.2	2500	2420	2330	2250	2160	2070
	-40	-40.0	2240	2170	2100	2030	1950	1880
	0	-17.8	7320	7020	6710	6400	6080	5770
	-5	-20.6	6560	6280	6000	5720	5440	5150
TEZA010L8	-10	-23.3	5850	5600	5350	5100	4850	4590
	-15	-26.1	5200	4980	4750	4530	4300	4070
Compressor	-20	-28.9	4600	4410	4210	4010	3810	3610
Model	-25	-31.7	4070	3900	3730	3550	3380	3200
ZF04KAE	-30	-34.4	3600	3450	3310	3150	3000	2850
	-35	-37.2	3200	3070	2940	2820	2680	2550
	-40	-40.0	2860	2750	2650	2540	2430	2320
	0	-17.8	8640	8280	7920	7550	7180	6800
	-5	-20.6	7810	7480	7160	6820	6490	6150
TEZA015L8	-10	-23.3	7020	6730	6430	6140	5830	5520
	-15	-26.1	6280	6020	5760	5490	5220	4940
Compressor	-20	-28.9	5590	5360	5130	4890	4650	4400
Model	-25	-31.7	4960	4750	4550	4340	4120	3900
ZF05KAE	-30	-34.4	4380	4200	4020	3840	3640	3450
	-35	-37.2	3860	3710	3550	3390	3220	3050
	-40	-40.0	3410	3280	3140	3000	2850	2700
	0	-17.8	12200	11600	11000	10400	9790	9150
	-5	-20.6	11100	10600	10100	9530	8960	8390
TEZA020L8	-10	-23.3	10100	9670	9190	8690	8190	7670
	-15	-26.1	9190	8770	8340	7910	7460	7000
Compressor	-20	-28.9	8290	7920	7550	7160	6770	6360
Model	-25	-31.7	7440	7110	6780	6440	6100	5740
ZF07KAE	-30	-34.4	6610	6330	6040	5740	5440	5120
	-35	-37.2	5810	5560	5300	5040	4770	4500
	-40	-40.0	5010	4790	4560	4330	4100	3860
	0	-17.8	15300	14600	14000	13300	12600	11900
	-5	-20.6	13900	13300	12800	12200	11500	10900
TEZA025L8	-10	-23.3	12600	12100	11600	11100	10500	9930
	-15	-26.1	11400	11000	10500	10000	9530	9010
Compressor	-20	-28.9	10300	9880	9470	9040	8600	8140
Model	-25	-31.7	9200	8860	8500	8120	7730	7320
ZF08K4E	-30	-34.4	8210	7900	7590	7250	6900	6540
	-35	-37.2	7290	7020	6730	6440	6120	5800
	-40	-40.0	6440	6200	5940	5670	5390	5100
	0	-17.8	16900	16200	15500	14700	13900	13200
	-5	-20.6	15400	14800	14100	13500	12800	12100
TEZA030L8	-10	-23.3	14000	13500	12900	12300	11700	11000
	-15	-26.1	12700	12200	11700	11200	10600	10000
Compressor	-20	-28.9	11500	11000	10600	10100	9620	9110
Model	-25	-31.7	10300	9940	9540	9120	8680	8220
ZF09K4E	-30	-34.4	9240	8900	8540	8170	7780	7380
	-35	-37.2	8210	7910	7590	7260	6920	6560
	-40	-40.0	7230	6960	6680	6390	6090	5770
	0	-17.8	20100	19100	18200	17200	16200	15200
	-5	-20.6	18400	17600	16700	15900	14900	14000
TEZA035L8	-10	-23.3	16800	16100	15300	14500	13700	12900
	-15	-26.1	15300	14600	14000	13300	12500	11800
Compressor	-20	-28.9	13800	13300	12700	12100	11400	10700
Model	-25	-31.7	12500	12000	11400	10900	10300	9720
ZF11K4E	-30	-34.4	11200	10700	10300	9800	9300	8760
	-35	-37.2	9940	9560	9170	8750	8310	7850
	-40	-40.0	8780	8460	8110	7750	7370	6960

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Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h — Ambient Temperature					
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
	0	-17.8	25100	24100	23000	21900	20800	19600
	-5	-20.6	22800	21900	20900	19900	18900	17800
TEZA045L8	-10	-23.3	20600	19700	18900	18000	17000	16100
	-15	-26.1	18500	17700	17000	16200	15300	14500
Compressor	-20	-28.9	16600	15900	15200	14500	13800	13000
Model	-25	-31.7	14700	14100	13500	12900	12300	11700
ZF13K4E	-30	-34.4	13000	12500	12000	11500	11000	10400
	-35	-37.2	11400	11000	10600	10200	9740	9320
	-40	-40.0	9990	9630	9290	8950	8620	8300
	0	-17.8	30900	29600	28300	27000	25600	24200
	-5	-20.6	28000	26900	25700	24500	23300	22000
TEZA055L8	-10	-23.3	25300	24300	23300	22200	21100	20000
	-15	-26.1	22800	21900	21000	20100	19100	18100
Compressor	-20	-28.9	20500	19700	18900	18100	17200	16300
Model	-25	-31.7	18300	17600	16900	16200	15400	14700
ZF15K4E	-30	-34.4	16300	15700	15100	14500	13800	13100
	-35	-37.2	14500	13900	13400	12800	12300	11700
	-40	-40.0	12700	12300	11800	11300	10800	10300
	0	-17.8	36100	34600	33100	31600	30000	28400
	-5	-20.6	32900	31600	30200	28900	27500	26000
TEZA060L8	-10	-23.3	29800	28700	27500	26300	25100	23800
	-15	-26.1	27000	26000	24900	23900	22800	21700
Compressor	-20	-28.9	24300	23400	22500	21600	20600	19600
Model	-25	-31.7	21800	21000	20200	19400	18600	17700
ZF18K4E	-30	-34.4	19400	18800	18100	17400	16700	15900
	-35	-37.2	17200	16600	16100	15400	14800	14200
	-40	-40.0	15100	14600	14100	13600	13000	12500
	0	-17.8	45300	43600	41800	40000	38100	36300
	-5	-20.6	41100	39500	37900	36300	34600	33000
TEZA075L8	-10	-23.3	37200	35800	34300	32900	31400	29900
	-15	-26.1	33500	32200	31000	29700	28400	27100
Compressor	-20	-28.9	30100	29000	27800	26700	25600	24500
Model	-25	-31.7	26900	25900	25000	24000	23000	22100
ZF25K4E	-30	-34.4	24000	23100	22300	21500	20700	19900
	-35	-37.2	21200	20500	19800	19200	18500	17900
	-40	-40.0	18700	18200	17600	17100	16600	16100
	0	-17.8	50400	48400	46400	44300	42200	40000
	-5	-20.6	45900	44000	42200	40300	38400	36500
TEZA085L8	-10	-23.3	41600	39900	38300	36600	34900	33200
	-15	-26.1	37500	36100	34600	33100	31700	30200
Compressor	-20	-28.9	33800	32500	31200	29900	28600	27400
Model	-25	-31.7	30200	29100	28000	26900	25800	24700
ZF28K4E	-30	-34.4	27000	26000	25100	24100	23200	22400
	-35	-37.2	23900	23100	22400	21600	20900	20200
	-40	-40.0	21200	20500	19900	19300	18700	18200
	0	-17.8	56500	54000	51500	48900	46200	43400
	-5	-20.6	51600	49400	47200	44800	42400	39900
TEZA100L8	-10	-23.3	47000	45100	43000	41000	38800	36500
	-15	-26.1	42700	40900	39100	37300	35300	33300
Compressor	-20	-28.9	38500	37000	35400	33700	32000	30200
Model	-25	-31.7	34500	33200	31800	30300	28800	27200
ZF34K5E	-30	-34.4	30800	29600	28300	27100	25700	24400
	-35	-37.2	27200	26100	25000	23900	22700	21500
	-40	-40.0	23700	22800	21800	20900	19800	18700
	0	-17.8	72400	69500	66400	63300	60100	56700
	-5	-20.6	66100	63500	60700	57900	55000	52000
TEZA130L8	-10	-23.3	60100	57800	55400	52900	50300	47600
	-15	-26.1	54500	52400	50300	48100	45700	43300
Compressor	-20	-28.9	49200	47400	45500	43500	41400	39300
Model	-25	-31.7	44200	42600	40900	39200	37300	35400
ZF41K5E	-30	-34.4	39400	38000	36600	35000	33400	31600
	-35	-37.2	34900	33700	32400	31000	29500	28000
	-40	-40.0	30600	29500	28400	27100	25800	24400

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R404A R507 Low Temperature *(cont'd)*

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA150L8 Compressor Model ZF49K5E	0	-17.8	85100	81500	77800	74000	70000	66000
	-5	-20.6	77700	74500	71100	67700	64100	60400
	-10	-23.3	70700	67800	64800	61700	58500	55100
	-15	-26.1	64000	61400	58800	56000	53100	50100
	-20	-28.9	57700	55400	53100	50600	48000	45300
	-25	-31.7	51800	49800	47700	45500	43200	40800
	-30	-34.4	46300	44500	42600	40700	38600	36500
	-35	-37.2	41100	39500	37900	36100	34300	32400
	-40	-40.0	36300	34900	33400	31900	30200	28500
TEZA170L8 Compressor Model ZF54K5E	0	-17.8	103000	99000	95100	91100	87000	82700
	-5	-20.6	93200	89800	86300	82700	79100	75200
	-10	-23.3	84100	81100	78000	74900	71600	68200
	-15	-26.1	75700	73100	70400	67600	64700	61700
	-20	-28.9	67900	65600	63200	60800	58200	55600
	-25	-31.7	60700	58700	56600	54500	52200	49800
	-30	-34.4	54000	52300	50500	48600	46600	44500
	-35	-37.2	47900	46400	44800	43100	41300	39400
	-40	-40.0	42300	40900	39500	38000	36400	34700

R407A Low Temperature

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA008L8 Compressor Model ZF03KAE	0	-17.8	4830	4650	4470	4310	4150	4000
	-5	-20.6	4310	4150	4000	3850	3720	3590
	-10	-23.3	3830	3700	3570	3450	3340	3230
	-15	-26.1	3410	3300	3190	3090	2990	2900
	-20	-28.9	3030	2940	2850	2760	2680	2600
	-25	-31.7	2710	2630	2540	2470	2390	2330
	-30	-34.4	2420	2340	2270	2210	2140	2080
	-35	-37.2	2160	2090	2030	1960	1900	1850
	-40	-40.0	1920	1860	1800	1730	1680	1630
TEZA010L8 Compressor Model ZF04KAE	0	-17.8	6590	6350	6100	5850	5590	5320
	-5	-20.6	5840	5630	5410	5180	4950	4710
	-10	-23.3	5160	4960	4770	4570	4370	4170
	-15	-26.1	4530	4360	4190	4020	3840	3660
	-20	-28.9	3960	3810	3680	3530	3370	3210
	-25	-31.7	3470	3340	3210	3090	2960	2840
	-30	-34.4	3030	2930	2820	2720	2610	2500
	-35	-37.2	2680	2590	2510	2420	2330	2240
	-40	-40.0	2390	2330	2260	2180	2110	2030
TEZA015L8 Compressor Model ZF05KAE	0	-17.8	7720	7430	7140	6850	6540	6240
	-5	-20.6	6860	6600	6340	6070	5810	5530
	-10	-23.3	6060	5830	5600	5370	5120	4880
	-15	-26.1	5320	5120	4910	4710	4500	4290
	-20	-28.9	4650	4480	4310	4130	3950	3760
	-25	-31.7	4060	3920	3760	3610	3450	3300
	-30	-34.4	3540	3410	3290	3160	3030	2900
	-35	-37.2	3090	2990	2890	2780	2680	2570
	-40	-40.0	2720	2640	2550	2480	2390	2310
TEZA020L8 Compressor Model ZF07KAE	0	-17.8	11200	10700	10200	9740	9220	8660
	-5	-20.6	10100	9680	9250	8800	8330	7830
	-10	-23.3	9080	8730	8340	7940	7520	7080
	-15	-26.1	8150	7830	7500	7140	6760	6360
	-20	-28.9	7280	7000	6710	6390	6060	5700
	-25	-31.7	6470	6230	5960	5690	5390	5070
	-30	-34.4	5700	5490	5260	5010	4750	4450
	-35	-37.2	4970	4780	4580	4360	4120	3850
	-40	-40.0	4250	4080	3910	3710	3490	3240

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Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA025L8 Compressor Model ZF08K4E	0	-17.8	14100	13500	13100	12600	12100	11400
	-5	-20.6	12600	12200	11800	11300	10800	10300
	-10	-23.3	11300	10900	10500	10100	9710	9270
	-15	-26.1	10100	9730	9390	9030	8650	8260
	-20	-28.9	8900	8620	8320	8000	7670	7320
	-25	-31.7	7830	7580	7320	7050	6750	6450
	-30	-34.4	6860	6640	6410	6160	5900	5640
	-35	-37.2	5960	5780	5570	5360	5130	4900
	-40	-40.0	5170	4990	4810	4620	4420	4220
TEZA030L8 Compressor Model ZF09K4E	0	-17.8	15500	15000	14600	14100	13400	12800
	-5	-20.6	13700	13200	12800	12300	11800	11200
	-10	-23.3	12000	11700	11200	10800	10300	9820
	-15	-26.1	10500	10200	9850	9460	9040	8580
	-20	-28.9	9230	8940	8620	8280	7920	7500
	-25	-31.7	8060	7810	7540	7250	6930	6560
	-30	-34.4	7010	6790	6570	6330	6060	5750
	-35	-37.2	6050	5880	5700	5510	5300	5050
	-40	-40.0	5160	5030	4910	4780	4620	4430
TEZA035L8 Compressor Model ZF11K4E	0	-17.8	18900	18300	17600	16900	16100	15100
	-5	-20.6	16600	16100	15500	14800	14100	13200
	-10	-23.3	14700	14200	13700	13000	12400	11700
	-15	-26.1	12900	12400	12000	11400	10800	10200
	-20	-28.9	11200	10900	10500	10000	9480	8890
	-25	-31.7	9850	9520	9170	8780	8330	7800
	-30	-34.4	8580	8310	8020	7700	7320	6880
	-35	-37.2	7420	7210	6990	6740	6440	6080
	-40	-40.0	6360	6220	6060	5880	5670	5400
TEZA045L8 Compressor Model ZF13K4E	0	-17.8	23000	22300	21500	20700	20000	19100
	-5	-20.6	20600	19800	19200	18500	17700	16900
	-10	-23.3	18300	17600	17000	16300	15600	14900
	-15	-26.1	16100	15500	14900	14300	13700	13000
	-20	-28.9	14200	13700	13000	12500	12000	11300
	-25	-31.7	12400	11900	11400	10900	10400	9860
	-30	-34.4	10800	10400	10000	9580	9140	8670
	-35	-37.2	9500	9190	8860	8530	8160	7780
	-40	-40.0	8520	8270	8040	7790	7520	7210

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R407A Low Temperature *(cont'd)*

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA055L8 Compressor Model ZF15K4E	0	-17.8	28100	27200	26300	25400	24400	23400
	-5	-20.6	25100	24400	23500	22600	21700	20800
	-10	-23.3	22400	21600	20800	20100	19200	18400
	-15	-26.1	19700	19100	18400	17600	16900	16100
	-20	-28.9	17400	16800	16200	15500	14800	14100
	-25	-31.7	15300	14800	14300	13700	13000	12300
	-30	-34.4	13500	13000	12600	12100	11400	10800
	-35	-37.2	12100	11700	11200	10700	10200	9650
	-40	-40.0	10900	10500	10200	9740	9290	8790
TEZA060L8 Compressor Model ZF18K4E	0	-17.8	33200	32100	31100	30000	29000	27800
	-5	-20.6	29800	28900	27900	26900	25900	24900
	-10	-23.3	26600	25700	24900	23900	23000	22100
	-15	-26.1	23500	22800	22100	21200	20400	19400
	-20	-28.9	20800	20200	19400	18700	18000	17100
	-25	-31.7	18400	17700	17100	16500	15800	15000
	-30	-34.4	16200	15600	15100	14500	13900	13200
	-35	-37.2	14400	13900	13400	12900	12400	11800
	-40	-40.0	12900	12500	12200	11700	11200	10700
TEZA075L8 Compressor Model ZF25K4E	0	-17.8	41400	40100	38700	37500	36100	34700
	-5	-20.6	37200	36000	34800	33500	32200	31000
	-10	-23.3	33100	32000	31000	29800	28700	27500
	-15	-26.1	29400	28500	27400	26500	25400	24300
	-20	-28.9	25900	25100	24300	23300	22400	21300
	-25	-31.7	22900	22100	21300	20500	19600	18700
	-30	-34.4	20200	19500	18800	18100	17300	16500
	-35	-37.2	17900	17300	16700	16100	15400	14700
	-40	-40.0	16100	15600	15100	14600	14000	13300
TEZA085L8 Compressor Model ZF28K4E	0	-17.8	47700	46100	44500	42900	41300	39600
	-5	-20.6	42800	41400	40000	38500	37000	35400
	-10	-23.3	38200	37000	35600	34300	32900	31400
	-15	-26.1	33900	32800	31600	30300	29100	27700
	-20	-28.9	30000	29000	27900	26800	25600	24400
	-25	-31.7	26500	25500	24600	23600	22600	21400
	-30	-34.4	23400	22600	21700	20900	20000	18900
	-35	-37.2	20800	20100	19300	18600	17700	16800
	-40	-40.0	18700	18200	17500	16900	16200	15300
TEZA100L8 Compressor Model ZF34K5E	0	-17.8	55800	53800	51800	49700	47500	45200
	-5	-20.6	50100	48300	46400	44500	42500	40300
	-10	-23.3	44700	43100	41400	39600	37700	35700
	-15	-26.1	39700	38200	36600	35100	33300	31400
	-20	-28.9	35000	33700	32300	30800	29200	27500
	-25	-31.7	30800	29600	28400	27000	25500	23900
	-30	-34.4	27100	26000	24900	23700	22400	20900
	-35	-37.2	23900	23000	22100	20900	19700	18400
	-40	-40.0	21400	20700	19700	18800	17600	16500
TEZA130L8 Compressor Model ZF41K5E	0	-17.8	70100	67900	65800	63500	61100	58700
	-5	-20.6	63000	61100	59100	57000	54800	52500
	-10	-23.3	56300	54500	52700	50800	48700	46600
	-15	-26.1	50100	48400	46700	44900	43200	41100
	-20	-28.9	44200	42800	41300	39700	37900	36100
	-25	-31.7	39100	37700	36300	34900	33300	31500
	-30	-34.4	34400	33300	32000	30700	29200	27600
	-35	-37.2	30600	29500	28400	27200	25800	24400
	-40	-40.0	27400	26500	25500	24400	23100	21700
TEZA150L8 Compressor Model ZF49K5E	0	-17.8	83400	80600	77900	75100	72000	68900
	-5	-20.6	74900	72300	69800	67200	64400	61400
	-10	-23.3	66800	64500	62200	59700	57100	54300
	-15	-26.1	59100	57100	55000	52700	50300	47700
	-20	-28.9	52200	50400	48400	46300	44100	41700
	-25	-31.7	46000	44300	42500	40600	38500	36300
	-30	-34.4	40500	39100	37500	35700	33800	31700
	-35	-37.2	36000	34700	33300	31700	29900	28000
	-40	-40.0	32600	31400	30100	28700	27100	25300

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Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA170L8 Compressor Model ZF54K5E	0	-17.8	93300	90300	87300	84200	81100	77800
	-5	-20.6	83400	80700	78100	75400	72600	69800
	-10	-23.3	74200	71900	69600	67200	64800	62400
	-15	-26.1	65800	63800	61700	59700	57600	55400
	-20	-28.9	58100	56400	54600	52800	50900	49000
	-25	-31.7	51100	49600	48000	46400	44800	43200
	-30	-34.4	44800	43500	42100	40600	39300	37800
	-35	-37.2	39200	37900	36600	35400	34100	32800
	-40	-40.0	34000	32900	31700	30600	29400	28100

R448A R449A Low Temperature

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA008L8 Compressor Model ZF03KAE	0	-17.8	5090	4910	4740	4570	4400	4230
	-5	-20.6	4540	4390	4230	4080	3940	3800
	-10	-23.3	4050	3920	3790	3650	3530	3410
	-15	-26.1	3610	3500	3390	3280	3170	3070
	-20	-28.9	3220	3130	3030	2930	2850	2750
	-25	-31.7	2880	2790	2710	2630	2540	2460
	-30	-34.4	2560	2490	2420	2340	2270	2190
	-35	-37.2	2280	2220	2140	2070	2000	1930
	-40	-40.0	2020	1950	1880	1820	1740	1680
TEZA010L8 Compressor Model ZF04KAE	0	-17.8	6900	6660	6420	6160	5910	5660
	-5	-20.6	6140	5920	5710	5490	5270	5040
	-10	-23.3	5440	5250	5060	4870	4670	4470
	-15	-26.1	4800	4630	4460	4290	4130	3960
	-20	-28.9	4210	4070	3930	3780	3630	3490
	-25	-31.7	3690	3570	3440	3320	3200	3080
	-30	-34.4	3220	3130	3020	2920	2810	2710
	-35	-37.2	2840	2750	2670	2580	2490	2400
	-40	-40.0	2510	2440	2360	2300	2230	2150
TEZA015L8 Compressor Model ZF05KAE	0	-17.8	8070	7790	7510	7210	6920	6620
	-5	-20.6	7220	6970	6710	6450	6180	5910
	-10	-23.3	6420	6200	5960	5730	5500	5260
	-15	-26.1	5670	5480	5280	5070	4860	4650
	-20	-28.9	4990	4820	4640	4460	4280	4100
	-25	-31.7	4370	4220	4070	3920	3760	3600
	-30	-34.4	3810	3690	3560	3420	3290	3150
	-35	-37.2	3330	3210	3110	2990	2880	2760
	-40	-40.0	2910	2810	2720	2630	2530	2440
TEZA020L8 Compressor Model ZF07KAE	0	-17.8	11600	11100	10600	10200	9720	9260
	-5	-20.6	10400	9990	9600	9190	8780	8370
	-10	-23.3	9330	8990	8640	8280	7930	7570
	-15	-26.1	8380	8090	7780	7480	7160	6840
	-20	-28.9	7510	7250	6980	6720	6450	6170
	-25	-31.7	6700	6480	6250	6020	5790	5550
	-30	-34.4	5940	5740	5550	5360	5160	4960
	-35	-37.2	5210	5040	4880	4700	4540	4360
	-40	-40.0	4490	4350	4200	4050	3910	3750
TEZA025L8 Compressor Model ZF08K4E	0	-17.8	14800	14400	14000	13400	12900	12400
	-5	-20.6	13300	12900	12500	12100	11700	11200
	-10	-23.3	12000	11600	11200	10800	10500	10100
	-15	-26.1	10600	10300	10000	9690	9360	9000
	-20	-28.9	9460	9190	8900	8620	8320	8010
	-25	-31.7	8360	8130	7880	7620	7360	7100
	-30	-34.4	7360	7150	6930	6710	6480	6250
	-35	-37.2	6460	6270	6070	5870	5670	5460
	-40	-40.0	5640	5460	5280	5100	4920	4740
TEZA030L8 Compressor Model ZF09K4E	0	-17.8	15800	15200	14800	14400	13900	13300
	-5	-20.6	14200	13900	13400	13000	12600	12200
	-10	-23.3	12800	12500	12200	11900	11400	11000
	-15	-26.1	11600	11200	11000	10700	10300	9950
	-20	-28.9	10300	10100	9860	9590	9280	8940
	-25	-31.7	9200	9010	8790	8550	8260	7950
	-30	-34.4	8140	7960	7770	7550	7290	6990
	-35	-37.2	7120	6960	6780	6570	6330	6040
	-40	-40.0	6140	6000	5820	5620	5380	5090
TEZA035L8 Compressor Model ZF11K4E	0	-17.8	19300	18600	18000	17200	16500	15800
	-5	-20.6	17400	16800	16300	15600	14900	14300
	-10	-23.3	15600	15100	14600	14100	13400	12900
	-15	-26.1	14100	13500	13100	12600	12200	11700
	-20	-28.9	12500	12200	11800	11300	10900	10400
	-25	-31.7	11100	10800	10500	10100	9710	9310
	-30	-34.4	9900	9610	9300	8980	8650	8300
	-35	-37.2	8770	8510	8240	7960	7680	7370
	-40	-40.0	7740	7520	7280	7040	6780	6520

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Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA045L8 Compressor Model ZF13K4E	0	-17.8	24600	23700	22700	21700	20700	19600
	-5	-20.6	22100	21200	20400	19400	18500	17500
	-10	-23.3	19600	18900	18200	17300	16500	15600
	-15	-26.1	17400	16800	16100	15400	14700	14000
	-20	-28.9	15300	14800	14200	13700	13000	12500
	-25	-31.7	13400	12900	12500	12000	11600	11100
	-30	-34.4	11800	11300	10900	10600	10300	9940
	-35	-37.2	10200	9900	9630	9390	9180	8990
	-40	-40.0	8850	8650	8490	8370	8280	8240
TEZA055L8 Compressor Model ZF15K4E	0	-17.8	30000	28900	27700	26500	25200	23900
	-5	-20.6	27000	25900	24900	23800	22800	21600
	-10	-23.3	24000	23200	22300	21400	20400	19400
	-15	-26.1	21400	20700	19800	19100	18300	17400
	-20	-28.9	19000	18400	17600	17000	16300	15500
	-25	-31.7	16800	16200	15600	15100	14500	14000
	-30	-34.4	14700	14300	13900	13300	12900	12500
	-35	-37.2	12900	12600	12200	11900	11600	11200
	-40	-40.0	11300	11000	10800	10500	10300	10100
TEZA060L8 Compressor Model ZF18K4E	0	-17.8	35200	33800	32400	31100	29700	28200
	-5	-20.6	31700	30600	29400	28100	26900	25600
	-10	-23.3	28500	27400	26500	25400	24300	23200
	-15	-26.1	25400	24600	23700	22800	21800	21000
	-20	-28.9	22600	21800	21100	20400	19600	18900
	-25	-31.7	20000	19400	18800	18200	17600	17000
	-30	-34.4	17600	17100	16700	16200	15800	15300
	-35	-37.2	15400	15100	14700	14400	14100	13900
	-40	-40.0	13400	13200	13000	12800	12600	12500
TEZA075L8 Compressor Model ZF25K4E	0	-17.8	44100	42600	41100	39400	37800	36100
	-5	-20.6	39600	38200	36800	35400	33900	32600
	-10	-23.3	35300	34000	32900	31600	30300	29200
	-15	-26.1	31400	30200	29200	28200	27200	26100
	-20	-28.9	27700	26900	25900	25100	24300	23500
	-25	-31.7	24500	23700	23000	22400	21700	21200
	-30	-34.4	21500	20900	20400	20000	19500	19200
	-35	-37.2	18900	18500	18100	17900	17600	17500
	-40	-40.0	16600	16400	16200	16100	16100	16200
TEZA085L8 Compressor Model ZF28K4E	0	-17.8	50600	48700	46800	44900	43100	41200
	-5	-20.6	45500	43800	42100	40500	38900	37200
	-10	-23.3	40600	39200	37700	36300	34900	33500
	-15	-26.1	36100	35000	33700	32400	31300	30100
	-20	-28.9	32000	31000	29900	29000	28000	27100
	-25	-31.7	28200	27400	26600	25800	25200	24600
	-30	-34.4	24900	24300	23600	23100	22700	22400
	-35	-37.2	21900	21400	21100	20800	20600	20500
	-40	-40.0	19300	19100	18900	18900	18900	19100
TEZA100L8 Compressor Model ZF34K5E	0	-17.8	55200	53300	51300	49400	47100	44900
	-5	-20.6	49900	48200	46400	44500	42600	40600
	-10	-23.3	44800	43400	41800	40100	38400	36600
	-15	-26.1	40100	38700	37400	35900	34400	32900
	-20	-28.9	35600	34400	33300	32000	30800	29400
	-25	-31.7	31500	30500	29400	28400	27300	26100
	-30	-34.4	27600	26700	25800	25000	24000	23200
	-35	-37.2	23900	23200	22500	21700	21000	20400
	-40	-40.0	20500	19800	19300	18800	18300	17700
TEZA130L8 Compressor Model ZF41K5E	0	-17.8	71300	69100	66900	64500	62100	59500
	-5	-20.6	64400	62400	60400	58300	56100	53900
	-10	-23.3	57900	56200	54300	52500	50500	48500
	-15	-26.1	51800	50200	48600	47000	45300	43600
	-20	-28.9	46100	44700	43400	41900	40400	38900
	-25	-31.7	40700	39600	38300	37100	35800	34500
	-30	-34.4	35700	34800	33700	32700	31600	30500
	-35	-37.2	31100	30200	29300	28500	27600	26700
	-40	-40.0	26800	26000	25300	24600	23800	23100

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R448A R449A Low Temperature *(cont'd)*

Model TEZA	Saturated Suction Temp.		Selection Capacity BTU/h			Ambient Temperature		
			85°F	90°F	95°F	100°F	105°F	110°F
	° F	° C	(29.4°C)	(32.2°C)	(35°C)	(37.8°C)	(40.6°C)	(43.3°C)
TEZA150L8 Compressor Model ZF49K5E	0	-17.8	84700	82000	79200	76200	73200	70000
	-5	-20.6	76400	73900	71400	68800	66000	63200
	-10	-23.3	68600	66400	64200	61700	59300	56800
	-15	-26.1	61200	59300	57300	55200	53100	50800
	-20	-28.9	54400	52700	50900	49100	47300	45400
	-25	-31.7	48100	46600	45000	43500	41900	40200
	-30	-34.4	42200	41000	39600	38300	37000	35600
	-35	-37.2	36800	35700	34700	33500	32400	31400
	-40	-40.0	31900	31000	30100	29300	28400	27600
TEZA170L8 Compressor Model ZF54K5E	0	-17.8	96100	93000	89900	86800	83700	80400
	-5	-20.6	86100	83500	80700	78000	75200	72300
	-10	-23.3	77000	74600	72200	69800	67400	64900
	-15	-26.1	68500	66500	64400	62300	60200	58000
	-20	-28.9	60700	58900	57200	55300	53400	51600
	-25	-31.7	53700	52100	50600	49000	47400	45700
	-30	-34.4	47100	45900	44500	43200	41800	40200
	-35	-37.2	41400	40200	39100	37900	36500	35300
	-40	-40.0	36100	35100	34100	33000	31800	30700

Standard Models

Model TEZA		Compressor Model No.	Power Supply	Compressor		Condenser Fan Motor			Unit	
				RLA	LRA	Quantity	Watts	FLA	MCA	MOP
TEZA007H8-*	S2D	ZB06KAE-PFV	208-230/1/60	6.0	36.0	1	100**	1.0	8.5	15
	T3D	ZB06KAE-TF5	208-230/3/60	4.8	37.8	1	100**	1.0	7.0	15
TEZA008H8-*	S2D	ZB07KAE-PFV	208-230/1/60	6.3	48.0	1	100**	1.0	8.9	15
	T3D	ZB07KAE-TF5	208-230/3/60	5.2	37.8	1	100**	1.0	7.5	15
TEZA009H8-*	S2D	ZB08KAE-PFV	208-230/1/60	8.0	47.2	1	100**	1.0	11.0	15
	T3D	ZB08KAE-TF5	208-230/3/60	5.3	37.8	1	100**	1.0	7.6	15
TEZA010H8-*	S2D	ZS09KAE-PFV	208-230/1/60	10.0	40.3	1	240	1.1	13.6	20
	T3D	ZS09KAE-TF5	208-230/3/60	8.0	55.4	1	240	1.1	11.1	15
	T4D	ZS09KAE-TFD	460/3/60	3.8	28	1	240	0.6	5.4	15
TEZA011H8-*	S2D	ZS11KAE-PFV	208-230/1/60	12.6	55	1	240	1.1	16.9	25
	T3D	ZS11KAE-TF5	208-230/3/60	10.4	58	1	240	1.1	14.1	20
	T4D	ZS11KAE-TFD	460/3/60	4.3	28	1	240	0.6	6.0	15
TEZA015H8-*	S2D	ZS13KAE-PFV	208-230/1/60	12.0	56	1	240	1.1	16.1	25
	T3D	ZS13KAE-TF5	208-230/3/60	9.7	58	1	240	1.1	13.2	20
	T4D	ZS13KAE-TFD	460/3/60	4.8	29	1	240	0.6	6.6	15
	T5D	ZS13KAE-TFE	575/3/60	3.6	24.5	1	240	0.5	5.0	15
TEZA020H8-*	S2D	ZS15KAE-PFV	208-230/1/60	15.7	68	1	240	1.1	20.7	35
	T3D	ZS15KAE-TF5	208-230/3/60	10.6	58	1	240	1.1	14.4	25
	T4D	ZS15KAE-TFD	460/3/60	5.4	29	1	240	0.6	7.4	15
	T5D	ZS15KAE-TFE	575/3/60	3.9	24	1	240	0.5	5.4	15
TEZA025H8-*	S2D	ZS19KAE-PFV	208-230/1/60	18.0	75	1	400	2.1	24.6	40
	T3D	ZS19KAE-TF5	208-230/3/60	13.7	73	1	400	2.1	19.2	30
	T4D	ZS19KAE-TFD	460/3/60	6.5	38	1	400	1.1	9.2	15
	T5D	ZS19KAE-TFE	575/3/60	4.3	28	1	400	0.9	6.3	15
TEZA030H8-*	S2D	ZS21KAE-PFV	208-230/1/60	23.2	112	1	400	2.1	31.1	50
	T3D	ZS21KAE-TF5	208-230/3/60	15.2	93	1	400	2.1	21.1	35
	T4D	ZS21KAE-TFD	460/3/60	6.9	48	1	400	1.1	9.7	15
	T5D	ZS21KAE-TFE	575/3/60	5.8	33	1	400	0.9	8.2	15
TEZA035H8-*	S2D	ZS26KAE-PFV	208-230/1/60	23.6	104	1	400	2.1	31.6	50
	T3D	ZS26KAE-TF5	208-230/3/60	15.5	93	1	400	2.1	21.5	35
	T4D	ZS26KAE-TFD	460/3/60	6.9	48	1	400	1.1	9.7	15
	T5D	ZS26KAE-TFE	575/3/60	6.4	38	1	400	0.9	8.9	15
TEZA040H8-*	S2D	ZS29KAE-PFV	208-230/1/60	26.1	137	1	400	2.1	34.7	60
	T3D	ZS29KAE-TF5	208-230/3/60	20.5	114	1	400	2.1	27.7	45
	T4D	ZS29KAE-TFD	460/3/60	9.4	58	1	400	1.1	12.9	20
	T5D	ZS29KAE-TFE	575/3/60	5.8	43	1	400	0.9	8.2	15
TEZA045H8-*	S2D	ZS33KAE-PFV	208-230/1/60	25.6	146	1	400	2.1	34.1	60
	T3D	ZS33KAE-TF5	208-230/3/60	22.3	114	1	400	2.1	30.0	50
	T4D	ZS33KAE-TFD	460/3/60	10.0	52	1	400	1.1	13.6	20
	T5D	ZS33KAE-TFE	575/3/60	6.9	39.5	1	400	0.9	9.5	15
TEZA050H8-*	S2D	ZB38KCE-PFV	208-230/1/60	31.1	175	1	400	2.1	41.0	70
	T3D	ZB38KCE-TF5	208-230/3/60	22.1	128	1	400	2.1	29.7	50
	T4D	ZB38KCE-TFD	460/3/60	9.6	63	1	400	1.1	13.1	20
	T5D	ZB38KCE-TFE	575/3/60	7.1	50	1	400	0.9	9.8	15
TEZA060H8-*	T3D	ZB45KCE-TF5	208-230/3/60	22.5	156	1	400	2.1	30.2	50
	T4D	ZB45KCE-TFD	460/3/60	11.5	75	1	400	1.1	15.5	25
	T5D	ZB45KCE-TFE	575/3/60	7.9	54	1	400	0.9	10.8	15
TEZA061H8-*	T3D	ZB48KCE-TF5	208-230/3/60	25.4	164	1	400	2.1	33.9	50
	T4D	ZB48KCE-TFD	460/3/60	13.6	100	1	400	1.1	18.1	30
	T5D	ZB48KCE-TFE	575/3/60	10.1	78	1	400	0.9	13.5	20
TEZA070H8-*	T3D	ZB57KCE-TF5	208-230/3/60	35.5	224	2	800	4.2	48.6	80
	T4D	ZB57KCE-TFD	460/3/60	15.2	99	2	800	2.2	21.2	35
	T5D	ZB57KCE-TFE	575/3/60	11.6	82.4	2	800	1.8	16.3	25
TEZA076H8-*	T3D	ZB66K5E-TFC	208-230/3/60	39.3	225	2	800	4.2	53.3	90
	T4D	ZB66K5E-TFD	460/3/60	17.3	114	2	800	2.2	23.8	40
	T5D	ZB66K5E-TFE	575/3/60	14.3	80	2	800	1.8	19.7	30
TEZA085H8-*	T3D	ZB76K5E-TFC	208-230/3/60	43.0	239	2	800	4.2	58.0	100
	T4D	ZB76K5E-TFD	460/3/60	20.7	125	2	800	2.2	28.1	45
	T5D	ZB76K5E-TFE	575/3/60	14.6	80	2	800	1.8	20.1	30
TEZA110H8-*	T3D	ZB95K5E-TWC	208-230/3/60	52.9	298	2	1560	7.2	73.3	125
	T4D	ZB95K5E-TFD	460/3/60	25.0	150	2	1560	3.4	34.7	50
	T5D	ZB95K5E-TFE	575/3/60	20.8	123	2	1560	2.8	28.8	45
TEZA150H8-*	T3D	ZB114K5E-TWC	208-230/3/60	63.0	321	2	1560	7.2	86.0	125
	T4D	ZB114K5E-TFD	460/3/60	27.9	179	2	1560	3.4	38.3	60
	T5D	ZB114K5E-TWE	575/3/60	22.4	132	2	1560	2.8	30.8	50

* I = Indoor, H = Outdoor. Above listed RLA value is based on UL rating method and may differ from published compressor RLA data.
** SMARTSPEED EC Motor Standard

table continues on next page >>>

Standard Models *(cont'd)*

Model TEZA		Compressor Model No.	Power Supply	Compressor		Condenser Fan Motor			Unit	
				RLA	LRA	Quantity	Watts	FLA	MCA	MOP
TEZA008L8-*	S2D	ZF03KAE-PFV	208-230/1/60	6.4	42.6	1	100**	1.0	9.0	15
	T3D	ZF03KAE-TF5	208-230/3/60	4.1	31.7	1	100**	1.0	6.1	15
TEZA010L8-*	S2D	ZF04KAE-PFV	208-230/1/60	7.4	40	1	100**	1.0	10.3	15
	T3D	ZF04KAE-TF5	208-230/3/60	6.6	55	1	100**	1.0	9.3	15
TEZA015L8-*	S2D	ZF05KAE-PFV	208-230/1/60	8.7	55	1	100**	1.0	11.9	20
	T3D	ZF05KAE-TF5	208-230/3/60	7.5	58	1	100**	1.0	10.4	15
TEZA020L8-*	S2D	ZF07KAE-PFV	208-230/1/60	13.9	75	1	100**	1.0	18.4	30
	T3D	ZF07KAE-TF5	208-230/3/60	8.6	58	1	100**	1.0	11.8	20
TEZA025L8-*	S2D	ZF08K4E-PFV	208-230/1/60	16.4	73	1	240	1.1	21.6	35
	T3D	ZF08K4E-TF5	208-230/3/60	9.6	63	1	240	1.1	13.1	20
	T4D	ZF08K4E-TFD	460/3/60	5.0	31	1	240	0.6	6.9	15
TEZA030L8-*	S2D	ZF09K4E-PFV	208-230/1/60	15.4	88	1	240	1.1	20.4	35
	T3D	ZF09K4E-TF5	208-230/3/60	9.9	77	1	240	1.1	13.5	20
	T4D	ZF09K4E-TFD	460/3/60	5.0	39	1	240	0.6	6.9	15
	T5D	ZF09K4E-TFE	575/3/60	4.3	31	1	240	0.5	5.9	15
TEZA035L8-*	S2D	ZF11K4E-PFV	208-230/1/60	20.7	109	1	240	1.1	27.0	45
	T3D	ZF11K4E-TF5	208-230/3/60	12.7	88	1	240	1.1	17.0	25
	T4D	ZF11K4E-TFD	460/3/60	6.4	44	1	240	0.6	8.6	15
	T5D	ZF11K4E-TFE	575/3/60	4.6	34	1	240	0.5	6.3	15
TEZA045L8-*	S2D	ZF13K4E-PFV	208-230/1/60	25.0	129	1	400	2.1	33.4	50
	T3D	ZF13K4E-TF5	208-230/3/60	13.8	99	1	400	2.1	19.4	30
	T4D	ZF13K4E-TFD	460/3/60	7.1	49.5	1	400	1.1	10.0	15
	T5D	ZF13K4E-TFE	575/3/60	7.1	40	1	400	0.9	9.8	15
TEZA055L8-*	S2D	ZF15K4E-PFV	208-230/1/60	27.9	169	1	400	2.1	37.0	60
	T3D	ZF15K4E-TF5	208-230/3/60	18.9	123	1	400	2.1	25.7	40
	T4D	ZF15K4E-TFD	460/3/60	8.9	62	1	400	1.1	12.2	20
	T5D	ZF15K4E-TFE	575/3/60	6.4	50	1	400	0.9	8.9	15
TEZA060L8-*	T3D	ZF18K4E-TF5	208-230/3/60	21.8	156	1	400	2.1	29.4	50
	T4D	ZF18K4E-TFD	460/3/60	9.0	75	1	400	1.1	12.4	20
	T5D	ZF18K4E-TFE	575/3/60	7.9	54	1	400	0.9	10.8	15
TEZA075L8-*	T3D	ZF25K4E-TF5	208-230/3/60	26.7	224	1	400	2.1	35.5	60
	T4D	ZF25K4E-TFD	460/3/60	11.9	99	1	400	1.1	16.0	25
	T5D	ZF25K4E-TFE	575/3/60	9.1	82.4	1	400	0.9	12.3	20
TEZA085L8-*	T3D	ZF28K4E-TFC	208-230/3/60	30.4	199	1	400	2.1	40.1	70
	T4D	ZF28K4E-TFD	460/3/60	14.4	121	1	400	1.1	19.1	30
	T5D	ZF28K4E-TFE	575/3/60	11.4	68.9	1	400	0.9	15.2	25
TEZA100L8-*	T3D	ZF34K5E-TFC	208-230/3/60	37.1	239	1	400	2.1	48.5	80
	T4D	ZF34K5E-TFD	460/3/60	17.9	100	1	400	1.1	23.5	40
	T5D	ZF34K5E-TFE	575/3/60	14.3	100	1	400	0.9	18.8	30
TEZA130L8-*	T3D	ZF41K5E-TFC	208-230/3/60	42.1	248	2	800	4.2	56.8	90
	T4D	ZF41K5E-TFD	460/3/60	19.3	125	2	800	2.2	26.3	45
	T5D	ZF41K5E-TFE	575/3/60	15.6	100	2	800	1.8	21.3	35
TEZA150L8-*	T3D	ZF49K5E-TFC	208-230/3/60	50.7	339	2	800	4.2	67.6	100
	T4D	ZF49K5E-TFD	460/3/60	20.2	139	2	800	2.2	27.5	45
	T5D	ZF49K5E-TFE	575/3/60	18.2	123	2	800	1.8	24.6	40
TEZA170L8-*	T3D	ZF54K5E-TFC	208-230/3/60	58.7	423	2	1560	7.2	80.6	125
	T4D	ZF54K5E-TFD	460/3/60	28.6	185	2	1560	3.4	39.2	60
	T5D	ZF54K5E-TFE	575/3/60	22.9	145	2	1560	2.8	31.4	50

* I = Indoor, H = Outdoor. Above listed RLA value is based on UL rating method and may differ from published compressor RLA data.
** **SMART**SPEED® EC Motor Standard

Models with Optional SMARTSPEED™ EC Motors

Model TEZA		Compressor Model No.	Power Supply	Compressor		ECM Condenser Fan Motor			Unit	
				RLA	LRA	Quantity	Watts	FLA	MCA	MOP
TEZA010H8-*	S2D	ZS09KAE-PFV	208-230/1/60	10.0	40.3	1	175	2.0	14.5	20
	T3D	ZS09KAE-TF5	208-230/3/60	8.0	55.4	1	175	2.0	12.0	20
	T4D	ZS09KAE-TFD	460/3/60	3.8	28	1	175	1.0	5.8	15
TEZA011H8-*	S2D	ZS11KAE-PFV	208-230/1/60	12.6	55	1	175	2.0	17.8	30
	T3D	ZS11KAE-TF5	208-230/3/60	10.4	58	1	175	2.0	15.0	25
	T4D	ZS11KAE-TFD	460/3/60	4.3	28	1	175	1.0	6.4	15
TEZA015H8-*	S2D	ZS13KAE-PFV	208-230/1/60	12.0	56	1	175	2.0	17.0	25
	T3D	ZS13KAE-TF5	208-230/3/60	9.7	58	1	175	2.0	14.1	20
	T4D	ZS13KAE-TFD	460/3/60	4.8	29	1	175	1.0	7.0	15
	T5D	ZS13KAE-TFE	575/3/60	3.6	24.5	1	175	0.8	5.3	15
TEZA020H8-*	S2D	ZS15KAE-PFV	208-230/1/60	15.7	68	1	175	2.0	21.6	35
	T3D	ZS15KAE-TF5	208-230/3/60	10.6	58	1	175	2.0	15.3	25
	T4D	ZS15KAE-TFD	460/3/60	5.4	29	1	175	1.0	7.8	15
	T5D	ZS15KAE-TFE	575/3/60	3.9	24	1	175	0.8	5.7	15
TEZA025H8-*	S2D	ZS19KAE-PFV	208-230/1/60	18.0	75	1	315	3.5	26.0	40
	T3D	ZS19KAE-TF5	208-230/3/60	13.7	73	1	315	3.5	20.6	30
	T4D	ZS19KAE-TFD	460/3/60	6.5	38	1	315	1.8	9.9	15
	T5D	ZS19KAE-TFE	575/3/60	4.3	28	1	315	1.4	6.8	15
TEZA030H8-*	S2D	ZS21KAE-PFV	208-230/1/60	23.2	112	1	315	3.5	32.5	50
	T3D	ZS21KAE-TF5	208-230/3/60	15.2	93	1	315	3.5	22.5	35
	T4D	ZS21KAE-TFD	460/3/60	6.9	48	1	315	1.8	10.4	15
	T5D	ZS21KAE-TFE	575/3/60	5.8	33	1	315	1.4	8.7	15
TEZA035H8-*	S2D	ZS26KAE-PFV	208-230/1/60	23.6	104	1	315	3.5	33.0	50
	T3D	ZS26KAE-TF5	208-230/3/60	15.5	93	1	315	3.5	22.9	35
	T4D	ZS26KAE-TFD	460/3/60	6.9	48	1	315	1.8	10.4	15
	T5D	ZS26KAE-TFE	575/3/60	6.4	38	1	315	1.4	9.4	15
TEZA040H8-*	S2D	ZS29KAE-PFV	208-230/1/60	26.1	137	1	315	3.5	36.1	60
	T3D	ZS29KAE-TF5	208-230/3/60	20.5	114	1	315	3.5	29.1	45
	T4D	ZS29KAE-TFD	460/3/60	9.4	58	1	315	1.8	13.6	20
	T5D	ZS29KAE-TFE	575/3/60	5.8	43	1	315	1.4	8.7	15
TEZA045H8-*	S2D	ZS33KAE-PFV	208-230/1/60	25.6	146	1	315	3.5	35.5	60
	T3D	ZS33KAE-TF5	208-230/3/60	22.3	114	1	315	3.5	31.4	50
	T4D	ZS33KAE-TFD	460/3/60	10.0	52	1	315	1.8	14.3	20
	T5D	ZS33KAE-TFE	575/3/60	6.9	39.5	1	315	1.4	10.0	15
TEZA050H8-*	S2D	ZB38KCE-PFV	208-230/1/60	31.1	175	1	315	3.5	42.4	70
	T3D	ZB38KCE-TF5	208-230/3/60	22.1	128	1	315	3.5	31.1	50
	T4D	ZB38KCE-TFD	460/3/60	9.6	63	1	315	1.8	13.8	20
	T5D	ZB38KCE-TFE	575/3/60	7.1	50	1	315	1.4	10.3	15
TEZA060H8-*	T3D	ZB45KCE-TF5	208-230/3/60	22.5	156	1	315	3.5	31.6	50
	T4D	ZB45KCE-TFD	460/3/60	11.5	75	1	315	1.8	16.2	25
	T5D	ZB45KCE-TFE	575/3/60	7.9	54	1	315	1.4	11.3	15
TEZA061H8-*	T3D	ZB48KCE-TF5	208-230/3/60	25.4	164	1	315	3.5	35.3	60
	T4D	ZB48KCE-TFD	460/3/60	13.6	100	1	315	1.8	18.8	30
	T5D	ZB48KCE-TFE	575/3/60	10.1	78	1	315	1.4	14.0	20
TEZA070H8-*	T3D	ZB57KCE-TF5	208-230/3/60	35.5	224	2	630	7.0	51.4	80
	T4D	ZB57KCE-TFD	460/3/60	15.2	99	2	630	3.6	22.6	35
	T5D	ZB57KCE-TFE	575/3/60	11.6	82.4	2	630	2.8	17.3	25
TEZA076H8-*	T3D	ZB66K5E-TFC	208-230/3/60	39.3	225	2	630	7.0	56.1	90
	T4D	ZB66K5E-TFD	460/3/60	17.3	114	2	630	3.6	25.2	40
	T5D	ZB66K5E-TFE	575/3/60	14.3	80	2	630	2.8	20.7	35
TEZA085H8-*	T3D	ZB76K5E-TFC	208-230/3/60	43.0	239	2	630	7.0	60.8	100
	T4D	ZB76K5E-TFD	460/3/60	20.7	125	2	630	3.6	29.5	50
	T5D	ZB76K5E-TFE	575/3/60	14.6	80	2	630	2.8	21.1	35
TEZA110H8-*	T3D	ZB95K5E-TWC	208-230/3/60	52.9	298	2	1180	10.6	76.7	125
	T4D	ZB95K5E-TFD	460/3/60	25.0	150	2	1180	5.8	37.1	60
	T5D	ZB95K5E-TFE	575/3/60	20.8	123	2	1180	4.2	30.2	50
TEZA150H8-*	T3D	ZB114K5E-TWC	208-230/3/60	63.0	321	2	1180	10.6	89.4	150
	T4D	ZB114K5E-TFD	460/3/60	27.9	179	2	1180	5.8	40.7	60
	T5D	ZB114K5E-TWE	575/3/60	22.4	132	2	1180	4.2	32.2	50

* I = Indoor, H = Outdoor. Above listed RLA value is based on UL rating method and may differ from published compressor RLA data.

table continues on next page >>>

Models with Optional SMARTSPEED® EC Motors *(cont'd)*

Model TEZA		Compressor Model No.	Power Supply	Compressor		ECM Condenser Fan Motor			Unit	
				RLA	LRA	Quantity	Watts	FLA	MCA	MOP
TEZA025L8-*	S2D	ZF08K4E-PFV	208-230/1/60	16.4	73	1	175	2.0	22.5	35
	T3D	ZF08K4E-TF5	208-230/3/60	9.6	63	1	175	2.0	14.0	20
	T4D	ZF08K4E-TFD	460/3/60	5.0	31	1	175	1.0	7.3	15
TEZA030L8-*	S2D	ZF09K4E-PFV	208-230/1/60	15.4	88	1	175	2.0	21.3	35
	T3D	ZF09K4E-TF5	208-230/3/60	9.9	77	1	175	2.0	14.4	20
	T4D	ZF09K4E-TFD	460/3/60	5.0	39	1	175	1.0	7.3	15
	T5D	ZF09K4E-TFE	575/3/60	4.3	31	1	175	0.8	6.2	15
TEZA035L8-*	S2D	ZF11K4E-PFV	208-230/1/60	20.7	109	1	175	2.0	27.9	45
	T3D	ZF11K4E-TF5	208-230/3/60	12.7	88	1	175	2.0	17.9	30
	T4D	ZF11K4E-TFD	460/3/60	6.4	44	1	175	1.0	9.0	15
	T5D	ZF11K4E-TFE	575/3/60	4.6	34	1	175	0.8	6.6	15
TEZA045L8-*	S2D	ZF13K4E-PFV	208-230/1/60	25.0	129	1	315	3.5	34.8	60
	T3D	ZF13K4E-TF5	208-230/3/60	13.8	99	1	315	3.5	20.8	30
	T4D	ZF13K4E-TFD	460/3/60	7.1	49.5	1	315	1.8	10.7	15
	T5D	ZF13K4E-TFE	575/3/60	7.1	40	1	315	1.4	10.3	15
TEZA055L8-*	S2D	ZF15K4E-PFV	208-230/1/60	27.9	169	1	315	3.5	38.4	60
	T3D	ZF15K4E-TF5	208-230/3/60	18.9	123	1	315	3.5	27.1	45
	T4D	ZF15K4E-TFD	460/3/60	8.9	62	1	315	1.8	12.9	20
	T5D	ZF15K4E-TFE	575/3/60	6.4	50	1	315	1.4	9.4	15
TEZA060L8-*	T3D	ZF18K4E-TF5	208-230/3/60	21.8	156	1	315	3.5	30.8	50
	T4D	ZF18K4E-TFD	460/3/60	9.0	75	1	315	1.8	13.1	20
	T5D	ZF18K4E-TFE	575/3/60	7.9	54	1	315	1.4	11.3	15
TEZA075L8-*	T3D	ZF25K4E-TF5	208-230/3/60	26.7	224	1	315	3.5	36.9	60
	T4D	ZF25K4E-TFD	460/3/60	11.9	99	1	315	1.8	16.7	25
	T5D	ZF25K4E-TFE	575/3/60	9.1	82.4	1	315	1.4	12.8	20
TEZA085L8-*	T3D	ZF28K4E-TFC	208-230/3/60	30.4	199	1	315	3.5	41.5	70
	T4D	ZF28K4E-TFD	460/3/60	14.4	121	1	315	1.8	19.8	30
	T5D	ZF28K4E-TFE	575/3/60	11.4	68.9	1	315	1.4	15.7	25
TEZA100L8-*	T3D	ZF34K5E-TFC	208-230/3/60	37.1	239	1	315	3.5	49.9	80
	T4D	ZF34K5E-TFD	460/3/60	17.9	100	1	315	1.8	24.2	40
	T5D	ZF34K5E-TFE	575/3/60	14.3	100	1	315	1.4	19.3	30
TEZA130L8-*	T3D	ZF41K5E-TFC	208-230/3/60	42.1	248	2	630	7.0	59.6	100
	T4D	ZF41K5E-TFD	460/3/60	19.3	125	2	630	3.6	27.7	45
	T5D	ZF41K5E-TFE	575/3/60	15.6	100	2	630	2.8	22.3	35
TEZA150L8-*	T3D	ZF49K5E-TFC	208-230/3/60	50.7	339	2	630	7.0	70.4	120
	T4D	ZF49K5E-TFD	460/3/60	20.2	139	2	630	3.6	28.9	45
	T5D	ZF49K5E-TFE	575/3/60	18.2	123	2	630	2.8	25.6	40
TEZA170L8-*	T3D	ZF54K5E-TFC	208-230/3/60	58.7	423	2	1180	10.6	84.0	125
	T4D	ZF54K5E-TFD	460/3/60	28.6	185	2	1180	5.4	41.2	70
	T5D	ZF54K5E-TFE	575/3/60	22.9	145	2	1180	4.2	32.8	50

* I = Indoor, H = Outdoor. Above listed RLA value is based on UL rating method and may differ from published compressor RLA data.

Annual Walk-In Energy Factor Ratings - High/Medium Temperature

If a numerical value is listed in the table below, the following statement applies to that corresponding model: "This refrigeration system is designed and certified for use in walk-in cooler applications."

Model TEZA		Power Supply	Outdoor Models				Indoor Models			
			R404A R507	R407A	R448A R449A	R407C	R404A R507	R407A	R448A R449A	R407C
TEZA007H8-*	S2D	208-230/1/60	7.6	7.6	7.6	-	-	-	-	-
	T3D	208-230/3/60	7.6	7.6	7.6	-	-	-	-	-
TEZA008H8-*	S2D	208-230/1/60	7.6	7.6	7.6	-	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	-	5.61	5.61	5.61	5.61
TEZA009H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA010H8-*	S2D	208-230/1/60	7.6	7.6	7.6	-	-	-	-	-
	T3D	208-230/3/60	7.6	7.6	7.6	-	-	-	-	-
	T4D	460/3/60	7.6	7.6	7.6	-	-	-	-	-
TEZA011H8-*	S2D	208-230/1/60	7.6	7.6	7.6	-	-	5.61	5.61	-
	T3D	208-230/3/60	7.6	7.6	7.6	-	-	5.61	5.61	-
	T4D	460/3/60	7.6	7.6	7.6	-	-	5.61	5.61	-
TEZA015H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA020H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	-	-	-	-
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	-	-	-	-
	T4D	460/3/60	7.6	7.6	7.6	7.6	-	-	-	-
	T5D	575/3/60	7.6	7.6	7.6	7.6	-	-	-	-
TEZA025H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA030H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA035H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA040H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA045H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA050H8-*	S2D	208-230/1/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
	T3D	208-230/3/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
TEZA060H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA061H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	-	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	-	-	5.61	5.61	-
TEZA070H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA076H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA085H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61
TEZA110H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	5.61	5.61	5.61	5.61
TEZA150H8-*	T3D	208-230/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61
	T4D	460/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61
	T5D	575/3/60	7.6	7.6	7.6	7.6	-	-	5.61	5.61

— = Non-compliant model

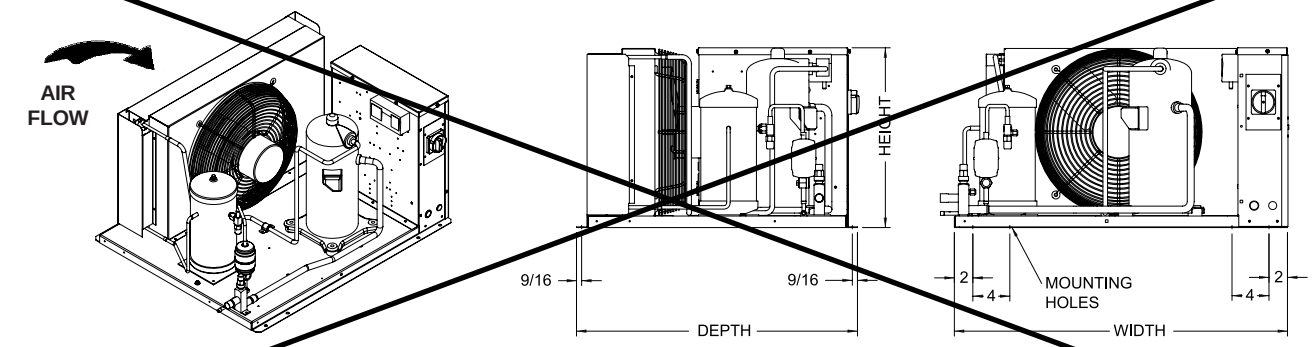
Annual Walk-In Energy Factor Ratings - Low Temperature

If a numerical value is listed in the table below, the following statement applies to that corresponding model: "This refrigeration system is designed and certified for use in walk-in freezer applications."

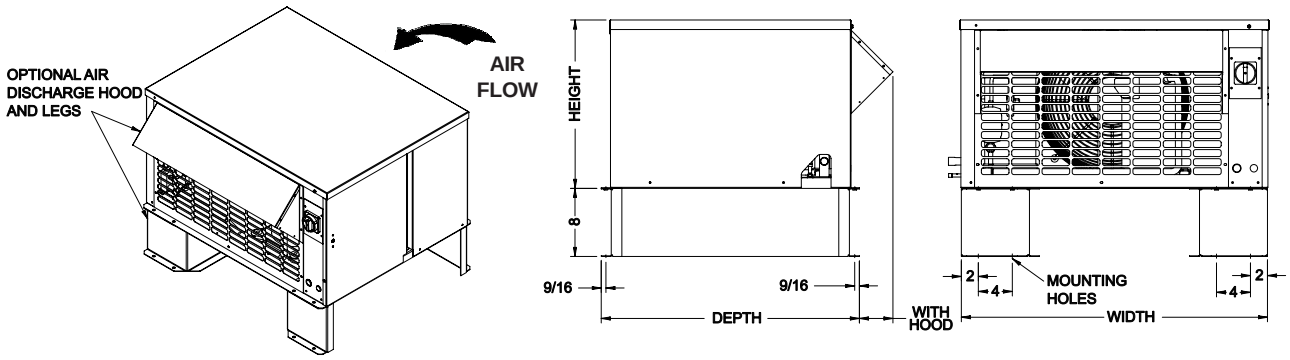
Model TEZA		Power Supply	Outdoor Models			Indoor Models		
			R404A R507	R407A	R448A R449A	R404A R507	R407A	R448A R449A
TEZA008L8-*	S2D	208-230/1/60	2.88	-	-	2.03	-	-
	T3D	208-230/3/60	2.88	-	-	2.03	-	-
TEZA010L8-*	S2D	208-230/1/60	2.93	2.91	2.92	2.10	-	-
	T3D	208-230/3/60	2.93	2.91	2.92	2.10	-	-
TEZA015L8-*	S2D	208-230/1/60	2.98	2.96	2.97	2.17	2.13	2.15
	T3D	208-230/3/60	2.98	2.96	2.97	2.17	2.13	2.15
TEZA020L8-*	S2D	208-230/1/60	3.1	3.08	3.08	-	-	-
	T3D	208-230/3/60	3.1	3.08	3.08	-	-	-
TEZA025L8-*	S2D	208-230/1/60	3.15	-	3.14	2.40	-	2.39
	T3D	208-230/3/60	3.15	3.13	3.14	2.40	-	2.39
	T4D	460/3/60	3.15	3.13	3.14	2.40	-	2.39
TEZA030L8-*	S2D	208-230/1/60	3.15	-	3.15	2.40	-	2.40
	T3D	208-230/3/60	3.15	3.15	3.15	2.40	-	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	-	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	-	2.40
TEZA035L8-*	S2D	208-230/1/60	3.15	-	3.15	-	-	-
	T3D	208-230/3/60	3.15	3.15	3.15	2.40	-	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	-	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	-	2.40
TEZA045L8-*	S2D	208-230/1/60	3.15	-	3.15	2.40	-	-
	T3D	208-230/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	2.40	2.40
TEZA055L8-*	S2D	208-230/1/60	3.15	-	3.15	-	2.40	2.40
	T3D	208-230/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	2.40	2.40
TEZA060L8-*	T3D	208-230/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	2.40	2.40
TEZA075L8-*	T3D	208-230/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	2.40	2.40
TEZA085L8-*	T3D	208-230/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T4D	460/3/60	3.15	3.15	3.15	2.40	2.40	2.40
	T5D	575/3/60	3.15	3.15	3.15	2.40	2.40	2.40
TEZA100L8-*	T3D	208-230/3/60	3.15	-	3.15	-	2.40	2.40
	T4D	460/3/60	3.15	-	3.15	-	2.40	2.40
	T5D	575/3/60	3.15	-	3.15	-	2.40	2.40
TEZA130L8-*	T3D	208-230/3/60	3.15	-	3.15	2.40	-	2.40
	T4D	460/3/60	3.15	-	3.15	2.40	-	2.40
	T5D	575/3/60	3.15	-	3.15	2.40	-	2.40
TEZA150L8-*	T3D	208-230/3/60	3.15	-	3.15	-	-	-
	T4D	460/3/60	3.15	-	3.15	-	-	-
	T5D	575/3/60	3.15	-	3.15	-	-	-
TEZA170L8-*	T3D	208-230/3/60	-	-	3.15	-	-	-
	T4D	460/3/60	-	-	3.15	-	-	-
	T5D	575/3/60	-	-	3.15	-	-	-

— = Non-compliant model

Drawing A: 1 Fan Models, Chassis 1 and 2

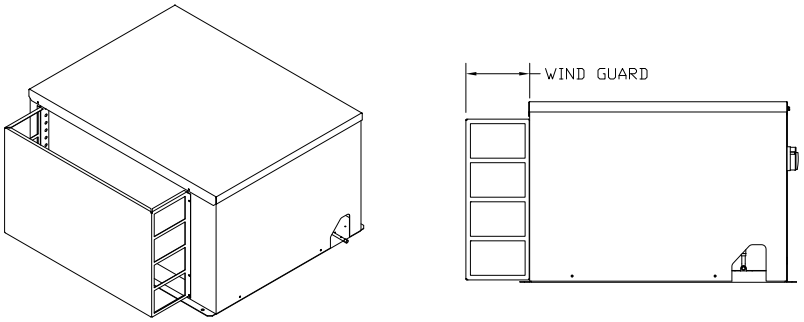


INDOOR DIMENSIONS



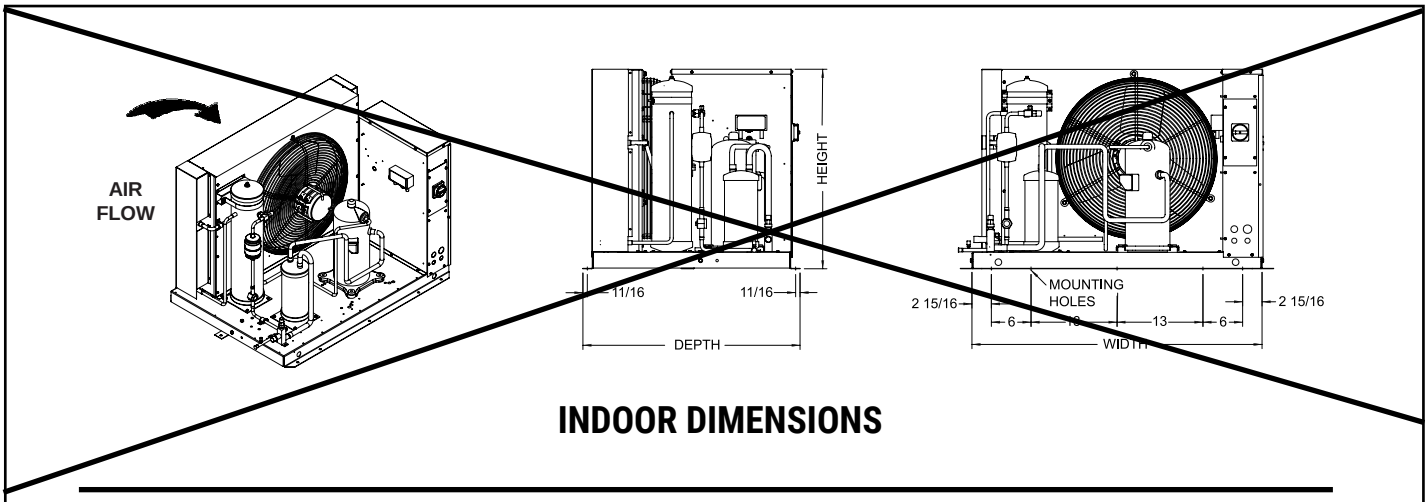
OUTDOOR DIMENSIONS

NOTE: Discharge hood, legs and wind guard are optional components

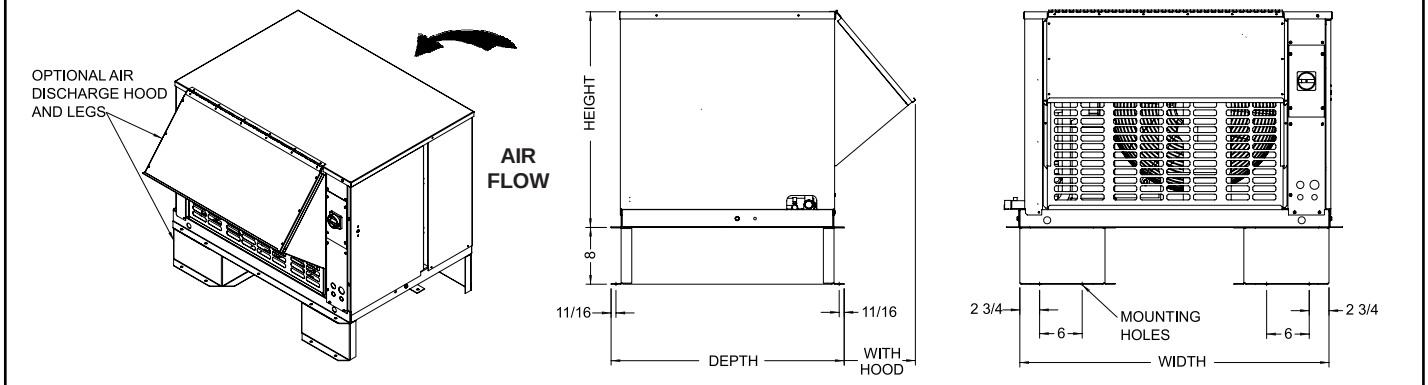


**REFER TO PAGE 29 FOR
DIMENSIONAL DATA FOR SPECIFIC MODELS**

Drawing B: 1 Fan Models, Chassis 3 and 4

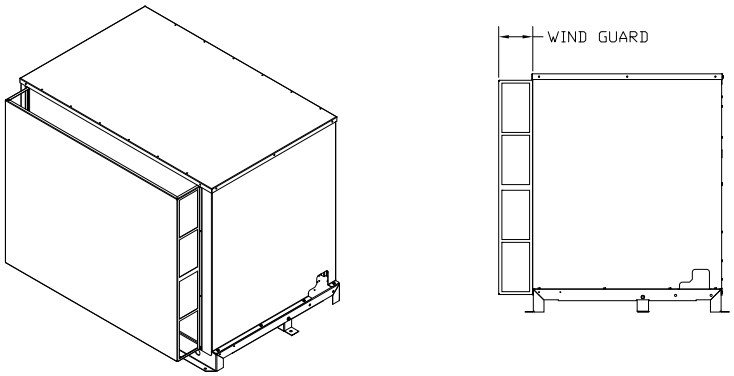


INDOOR DIMENSIONS



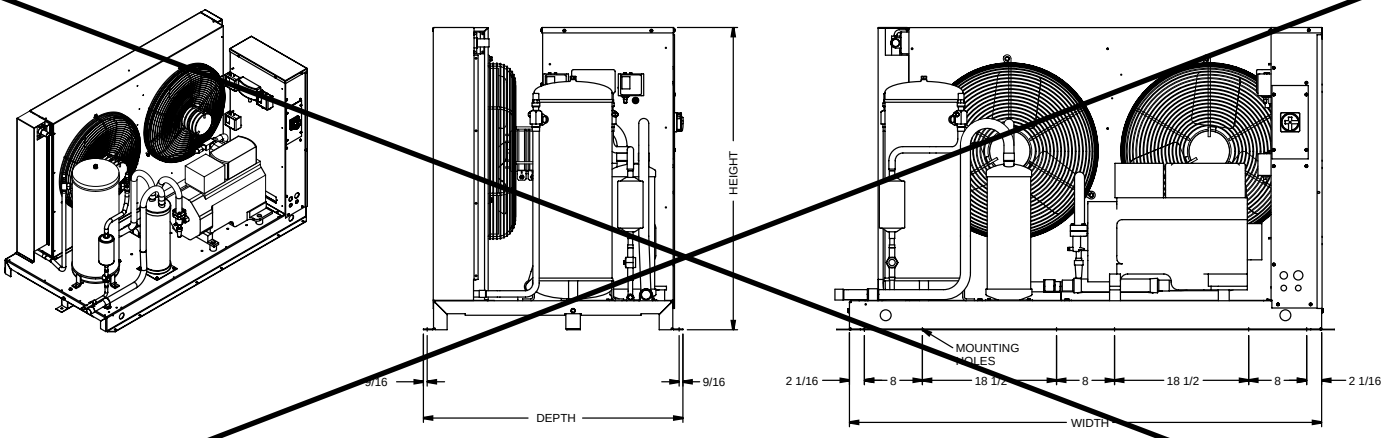
OUTDOOR DIMENSIONS

NOTE: Discharge hood, legs and wind guard are optional components

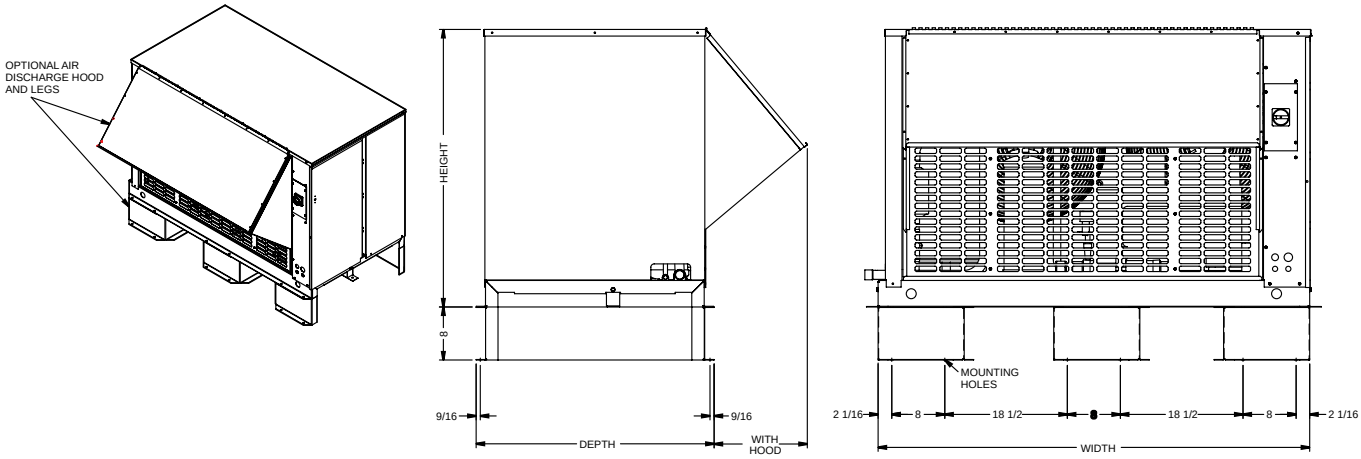


REFER TO PAGE 29 FOR DIMENSIONAL DATA FOR SPECIFIC MODELS

Drawing C: 2 Fan Models, Chassis 5

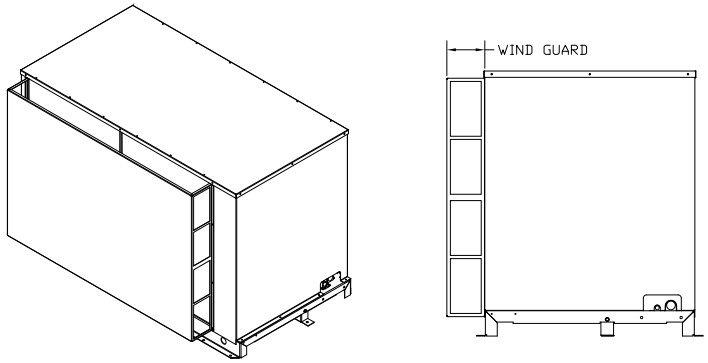


INDOOR DIMENSIONS



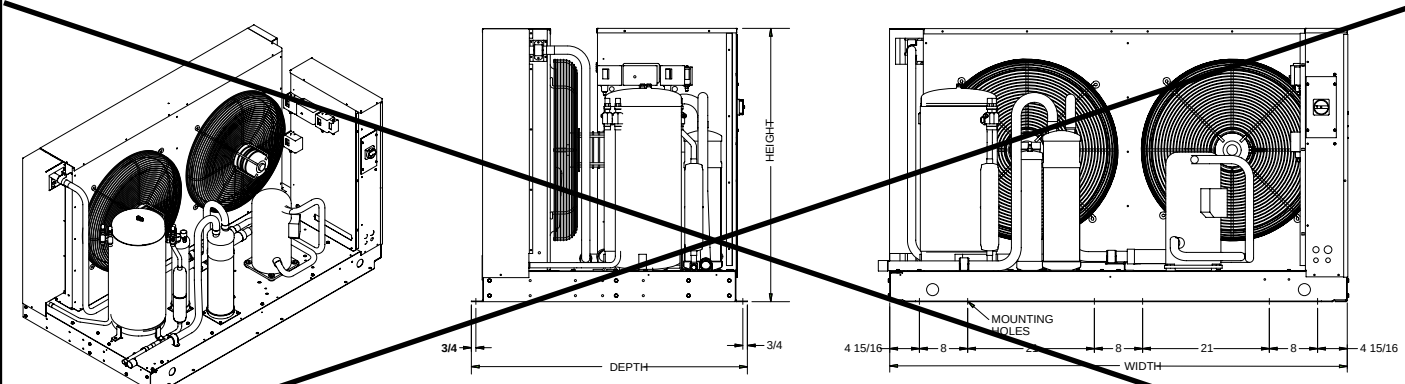
OUTDOOR DIMENSIONS

NOTE: Discharge hood, legs and wind guard are optional components

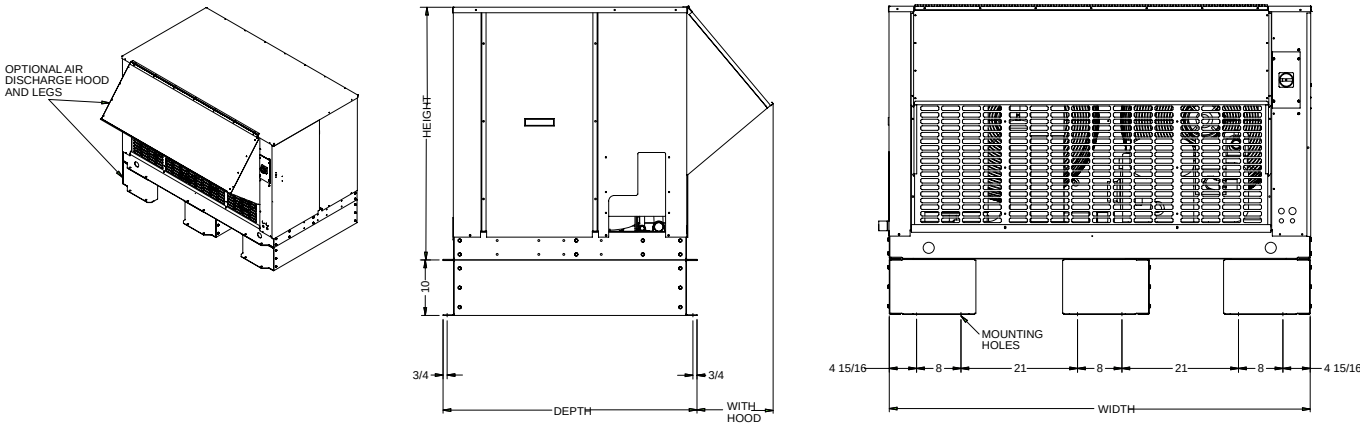


REFER TO PAGE 29 FOR DIMENSIONAL DATA FOR SPECIFIC MODELS

Drawing D: 2 Fan Models, Chassis 6

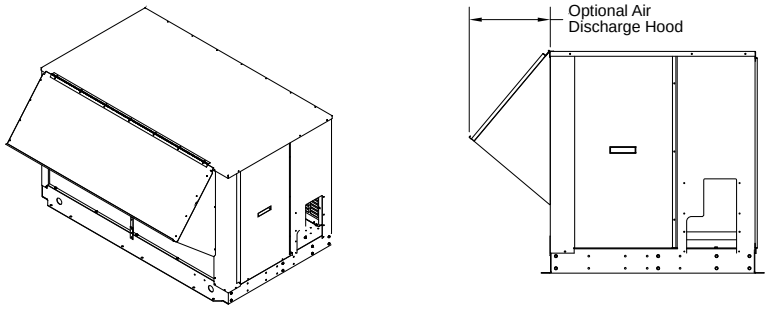


INDOOR DIMENSIONS



OUTDOOR DIMENSIONS

NOTE: Discharge hood, legs and wind guard are optional components



REFER TO PAGE 29 FOR DIMENSIONAL DATA FOR SPECIFIC MODELS

Model TEZA	Chassis (see details below)	Outdoor Models								Indoor Models					
		Width		Depth				Height		Width		Depth		Height	
				Base		with Hood									
		Inches	*mm*	Inches	*mm*	Inches	*mm*	Inches	*mm*	Inches	*mm*	Inches	*mm*	Inches	*mm*
TEZA007H8	1	24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA008H8		24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA009H8		24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA010H8	2	36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA011H8		36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA015H8		36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA020H8		36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA025H8	3	43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 1/16	*767*
TEZA030H8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA035H8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA040H8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA045H8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA050H8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA060H8	4	52 1/8	*1324*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	52 1/8	*1324*	35 7/8	*911*	41 11/16	*1059*
TEZA061H8		52 1/8	*1324*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	52 1/8	*1324*	35 7/8	*911*	41 11/16	*1059*
TEZA070H8	5	65 1/8	*1654*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	65 1/8	*1654*	35 7/8	*911*	41 11/16	*1059*
TEZA076H8		65 1/8	*1654*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	65 1/8	*1654*	35 7/8	*911*	41 11/16	*1059*
TEZA085H8		65 1/8	*1654*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	65 1/8	*1654*	35 7/8	*911*	41 11/16	*1059*
TEZA110H8	6	75 7/8	*1927*	45 3/4	*1162*	59	*1511*	45 1/2	*1156*	75 7/8	*1927*	45 3/4	*1162*	45 17/32	*1156*
TEZA150H8		75 7/8	*1927*	45 3/4	*1162*	59	*1511*	45 1/2	*1156*	75 7/8	*1927*	45 3/4	*1162*	45 17/32	*1156*
TEZA008L8	1	24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA010L8		24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA015L8		24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA020L8		24 7/8	*632*	30 3/8	*772*	34 3/8	*873*	19 3/8	*492*	24 5/8	*625*	30 3/8	*772*	19	*483*
TEZA025L8	2	36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA030L8		36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA035L8		36 3/8	*924*	30 3/8	*772*	34 3/8	*873*	19 7/8	*505*	36 3/8	*924*	30 3/8	*772*	19 1/2	*495*
TEZA045L8	3	43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA055L8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA060L8		43 7/8	*1114*	32 7/8	*835*	43	*1092*	30 3/8	*772*	43 7/8	*1114*	32 7/8	*835*	30 3/16	*767*
TEZA075L8	4	52 1/8	*1324*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	52 1/8	*1324*	35 7/8	*911*	41 11/16	*1059*
TEZA085L8		52 1/8	*1324*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	52 1/8	*1324*	35 7/8	*911*	41 11/16	*1059*
TEZA100L8		52 1/8	*1324*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	52 1/8	*1324*	35 7/8	*911*	41 11/16	*1059*
TEZA130L8	5	65 1/8	*1654*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	65 1/8	*1654*	35 7/8	*911*	41 11/16	*1059*
TEZA150L8		65 1/8	*1654*	35 7/8	*911*	43	*1092*	41 7/8	*1064*	65 1/8	*1654*	35 7/8	*911*	41 11/16	*1059*
TEZA170L8	6	75 7/8	*1927*	45 3/4	*1162*	59	*1511*	45 1/2	*1156*	75 7/8	*1927*	45 3/4	*1162*	45 17/32	*1156*

Chassis	Drawing	See Page #
1	A	25
2	A	25
3	B	26
4	B	26
5	C	27
6	D	28

SPECIFICATIONS

TEZ - SCROLL CONDENSING UNITS

Model TEZA	Unit Connections				R404A Receiver Capacity 90% Full *		Approx. Shipping Weight			
	Suction (OD)		Liquid (OD)				Outdoor Models		Indoor Models	
	Inches	*mm*	Inches	*mm*	Lbs.	*Kgs*	Lbs.	*Kgs*	Lbs.	*Kgs*
TEZA007H8	5/8	*16*	3/8	*10*	5.4	*2.4*	183	*83*	161	*73*
TEZA008H8	5/8	*16*	3/8	*10*	5.4	*2.4*	188	*85*	167	*76*
TEZA009H8	5/8	*16*	3/8	*10*	5.4	*2.4*	188	*85*	167	*76*
TEZA010H8	5/8	*16*	3/8	*10*	11	*4.9*	285	*129*	265	*120*
TEZA011H8	5/8	*16*	3/8	*10*	11	*4.9*	285	*129*	265	*120*
TEZA015H8	7/8	*22*	3/8	*10*	11	*4.9*	285	*129*	265	*120*
TEZA020H8	7/8	*22*	3/8	*10*	11	*4.9*	300	*136*	280	*127*
TEZA025H8	7/8	*22*	1/2	*13*	22	*10.0*	405	*184*	370	*168*
TEZA030H8	7/8	*22*	1/2	*13*	22	*10.0*	410	*186*	375	*170*
TEZA035H8	7/8	*22*	1/2	*13*	22	*10.0*	415	*188*	380	*172*
TEZA040H8	1 1/8	*29*	1/2	*13*	22	*10.0*	420	*191*	390	*177*
TEZA045H8	1 1/8	*29*	1/2	*13*	22	*10.0*	425	*193*	390	*177*
TEZA050H8	1 1/8	*29*	1/2	*13*	22	*10.0*	425	*193*	390	*177*
TEZA060H8	1 1/8	*29*	5/8	*16*	30	*13.8*	470	*213*	430	*195*
TEZA061H8	1 1/8	*29*	5/8	*16*	30	*13.6*	510	*231*	465	*211*
TEZA070H8	1 3/8	*35*	5/8	*16*	54	*24.5*	625	*283*	570	*259*
TEZA076H8	1 3/8	*35*	5/8	*16*	54	*24.5*	635	*288*	580	*263*
TEZA085H8	1 3/8	*35*	5/8	*16*	54	*24.5*	645	*293*	590	*268*
TEZA110H8	1 3/8	*35*	7/8	*22*	76	*34.5*	745	*338*	690	*313*
TEZA150H8	1 5/8	*41*	7/8	*22*	76	*34.5*	845	*383*	790	*358*
TEZA008L8	5/8	*16*	3/8	*10*	5.4	*2.4*	205	*93*	185	84
TEZA010L8	5/8	*16*	3/8	*10*	5.4	*2.4*	205	*93*	185	*84*
TEZA015L8	5/8	*16*	3/8	*10*	5.4	*2.4*	210	*95*	190	*86*
TEZA020L8	7/8	*22*	3/8	*10*	11	*4.9*	315	*143*	290	*132*
TEZA025L8	7/8	*22*	3/8	*10*	14	*6.3*	335	*152*	310	*141*
TEZA030L8	7/8	*22*	3/8	*10*	14	*6.3*	425	*193*	390	*177*
TEZA035L8	7/8	*22*	1/2	*13*	14	*6.3*	430	*195*	400	*181*
TEZA045L8	1 1/8	*29*	1/2	*13*	22	*10.0*	435	*197*	400	*181*
TEZA055L8	1 1/8	*29*	1/2	*13*	22	*10.0*	440	*200*	400	*181*
TEZA060L8	1 1/8	*29*	1/2	*13*	22	*10.0*	485	*220*	450	*204*
TEZA075L8	1 3/8	*35*	5/8	*16*	30	*13.8*	495	*225*	460	*209*
TEZA085L8	1 3/8	*35*	5/8	*16*	30	*13.6*	525	*238*	480	*218*
TEZA100L8	1 3/8	*35*	5/8	*16*	30	*13.6*	545	*247*	500	*227*
TEZA130L8	1 3/8	*35*	5/8	*16*	54	*24.5*	725	*329*	670	*304*
TEZA150L8	1 5/8	*35*	5/8	*16*	54	*24.5*	745	*338*	690	*313*
TEZA170L8	1 5/8	*41*	7/8	*22*	76	*34.5*	955	*433*	900	*408*

*** NOTE ON ALTERNATE REFRIGERANTS:**

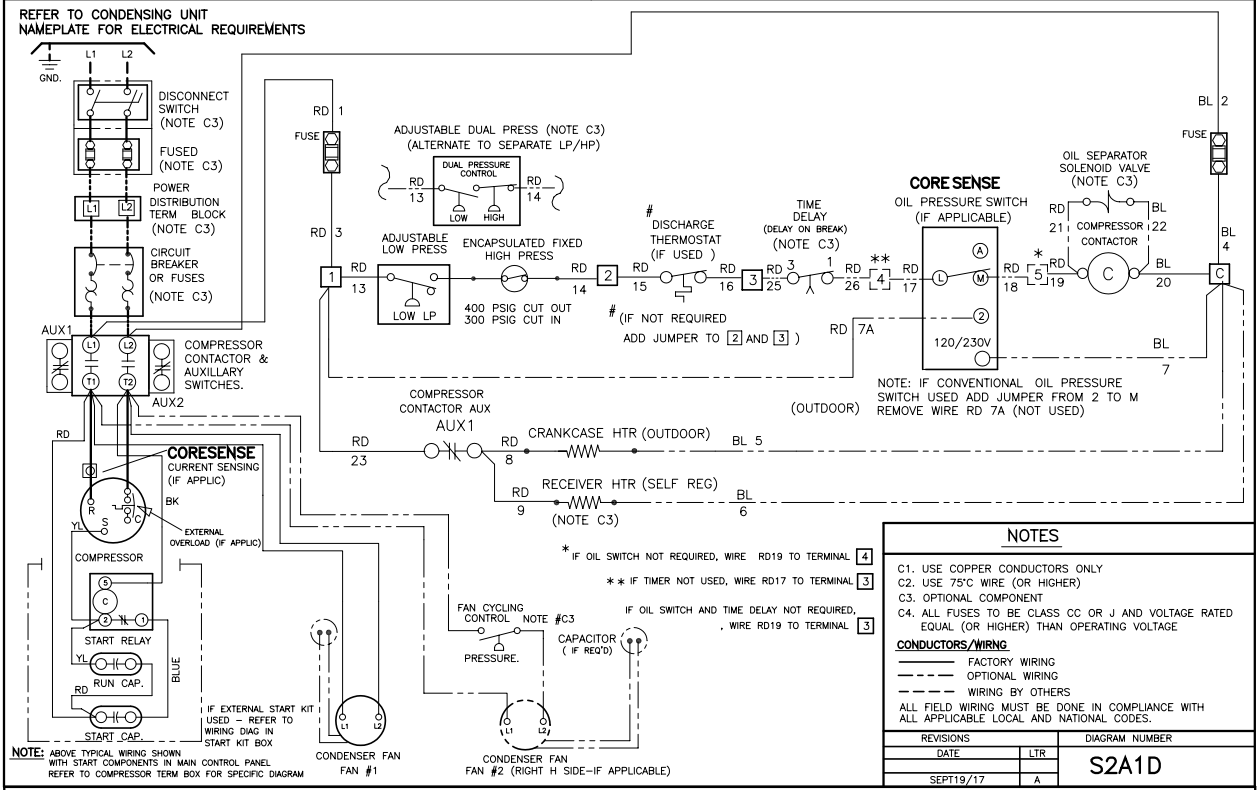
* PUBLISHED RECEIVER CAPACITY IS BASED ON R404A ON MODELS USING "8" AS REFRIGERANT CODE.
FOR ALTERNATE REFRIGERANTS, MULTIPLY R404A VALUE BY THE APPROPRIATE VALUE BELOW:

R407A	R407C	R448A	R449A	R507	R22
1.10	1.10	1.05	1.05	1.00	1.15

208-230/1/60 Unit with 230V Air Defrost Evaporator

CONDENSING UNIT WIRING DIAGRAM

– 208/230V–1–60 or 200/220V–1–50 Hz
– OPTIONAL CORESENSE OIL PROTECTION
– STANDARD CTRL CIRCUIT–WITH DISCH T'STAT (IF REQUIRED)



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

CONDUCTORS/WIRING

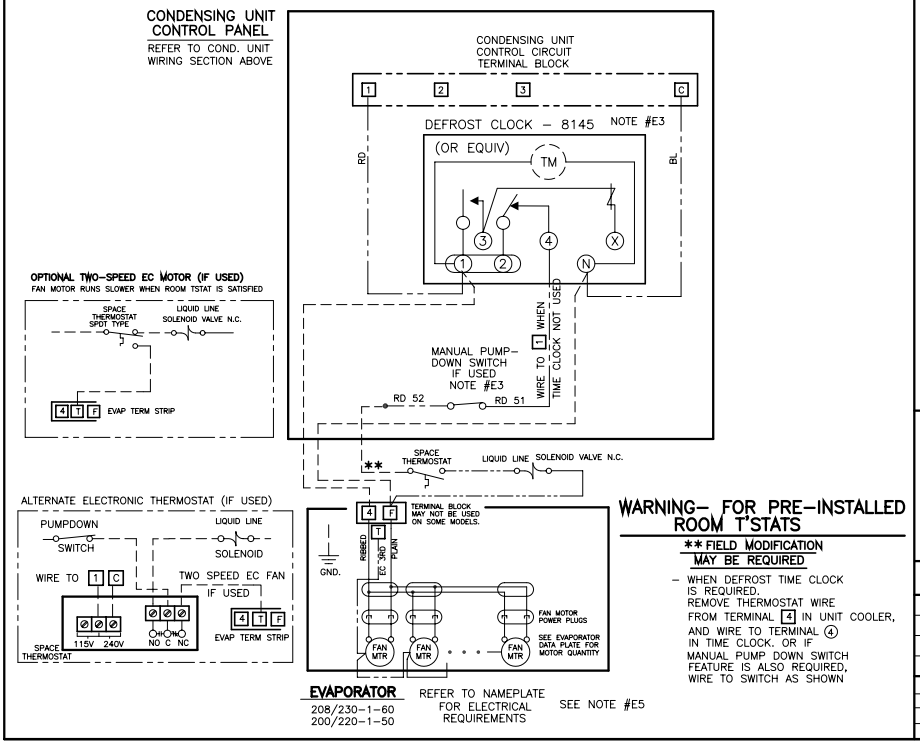
——— FACTORY WIRING
– – – – OPTIONAL WIRING
– – – – WIRING BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	S2A1D
SEPT19/17	A	

TYPICAL EVAPORATOR WIRING: FOR SINGLE AIR DEFROST EVAPORATOR– SINGLE POINT

FOR USE WITH: 208/230–1–60, 200/220–1–50 OR 208/230–3–60, 200/220–3–50 CONDENSING UNITS WITH OR WITHOUT DEFROST TIME CLOCK AND FOR TOTAL EVAP FAN AMPS NOT EXCEEDING 12A



WARNING– FOR PRE–INSTALLED ROOM T'STATS

**** FIELD MODIFICATION MAY BE REQUIRED**

– WHEN DEFROST TIME CLOCK IS REQUIRED, REMOVE THERMOSTAT WIRE FROM TERMINAL 4 IN UNIT COOLER, AND WIRE TO TERMINAL ④ IN TIME CLOCK. OR IF MANUAL PUMP DOWN SWITCH FEATURE IS ALSO REQUIRED, WIRE TO SWITCH AS SHOWN

NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN COND. UNIT, EVAPORATOR, OR SUPPLIED BY OTHERS.
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS

○ –COMPONENT TERMINAL – MARKED
⬡ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
○ –COMPONENT TERMINAL – UNMARKED (UNIDENTIFIABLE)
□ –TERMINAL BLOCK TERMINAL
● –WIRE SPLICE

CONDUCTORS/WIRING

——— FACTORY WIRING
– – – – WIRING BY OTHERS
——– – – ——– OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

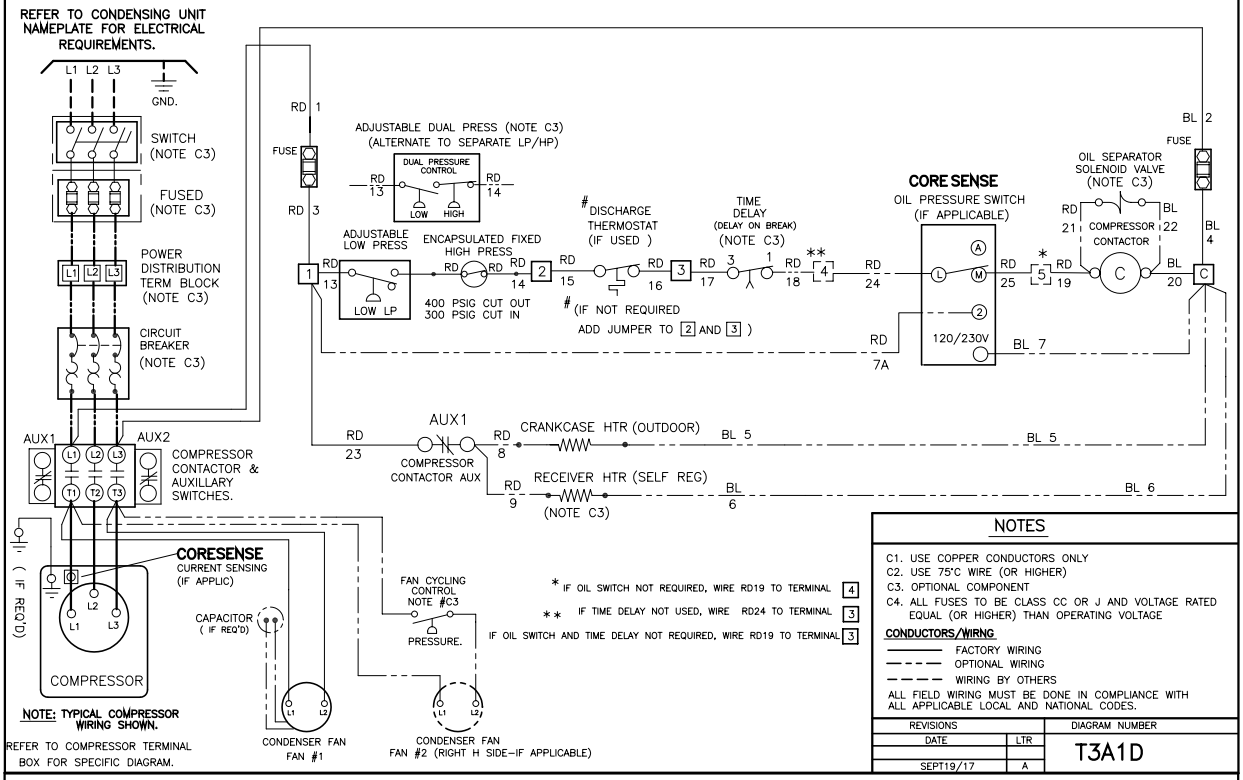
CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	KA101
JAN 18 / 10	D	
MAR26/03	A	

208-230/3/60 Unit with 230V Electric Defrost Evaporator

CONDENSING UNIT WIRING DIAGRAM

- 208/230V–3–60 or 200/220V–3–50 Hz
- INHERENT LINE BREAK MOTOR PROTECTION
- STANDARD CTRL CIRCUIT–WITH DISCH T'STAT (IF USED)



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

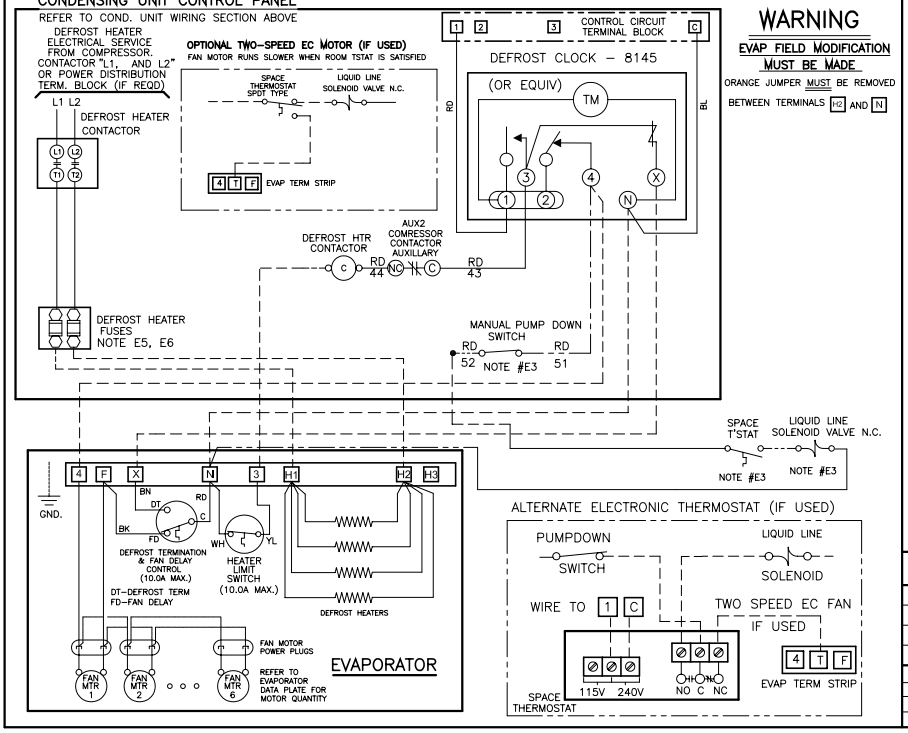
CONDUCTORS/WIRNG
- FACTORY WIRING
- OPTIONAL WIRING
- WIRING BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	T3A1D
SEPT19/17	A	

TYPICAL EVAPORATOR WIRING: FOR SINGLE LOW PROFILE ELECT 1 PHASE DEFROST EVAPORATOR–SINGLE POINT

FOR USE WITH: 230V SINGLE OR THREE PHASE CONDENSING UNITS WITH DEFROST TIME CLOCK, AND DEFROST HEATER CONTACTOR



NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN COND. UNIT, EVAPORATOR, OR SUPPLIED BY OTHERS.
E4. HEATER LOADS ARE NOT CONCURRENT WITH REFRIGERATION LOAD
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS
- ○ –COMPONENT TERMINAL – MARKED
- ⬡ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
- ○ –COMPONENT TERMINAL – UNMARKED (UNIDENTIFIABLE)
- □ –TERMINAL BLOCK TERMINAL
- • –WIRE SPLICE

CONDUCTORS/WIRING
- FACTORY WIRING
- WIRING BY OTHERS
- OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

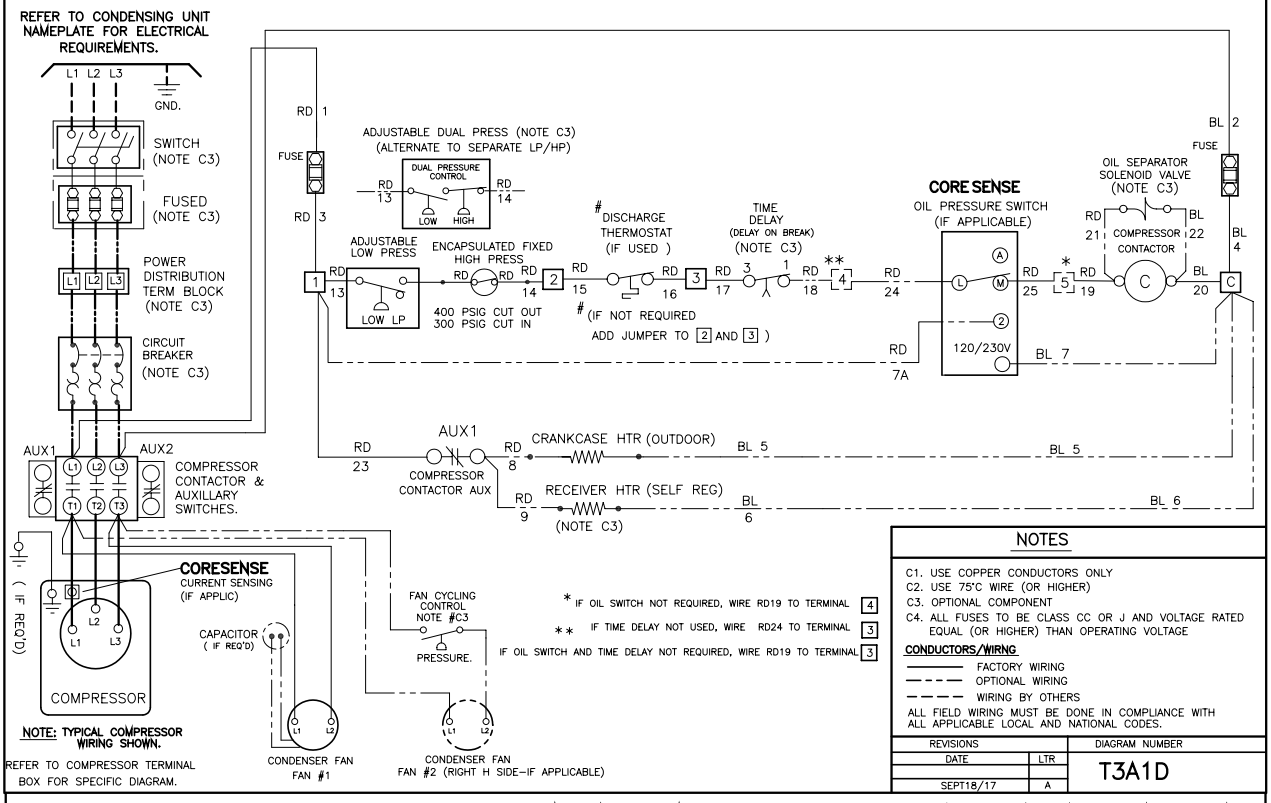
CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	LPE101
JAN 18/10	C	
JAN2/08	BM	

208-230/3/60 Unit with Two (2) 230V Electric Defrost Evaporators

CONDENSING UNIT WIRING DIAGRAM

- 208/230V–3–60 or 200/220V–3–50 Hz
- INHERENT LINE BREAK MOTOR PROTECTION
- STANDARD CTRL CIRCUIT–WITH DISCH T'STAT (IF USED)



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

CONDUCTORS/WIRNG

——— FACTORY WIRING
– – – – OPTIONAL WIRING
– – – – WIRING BY OTHERS

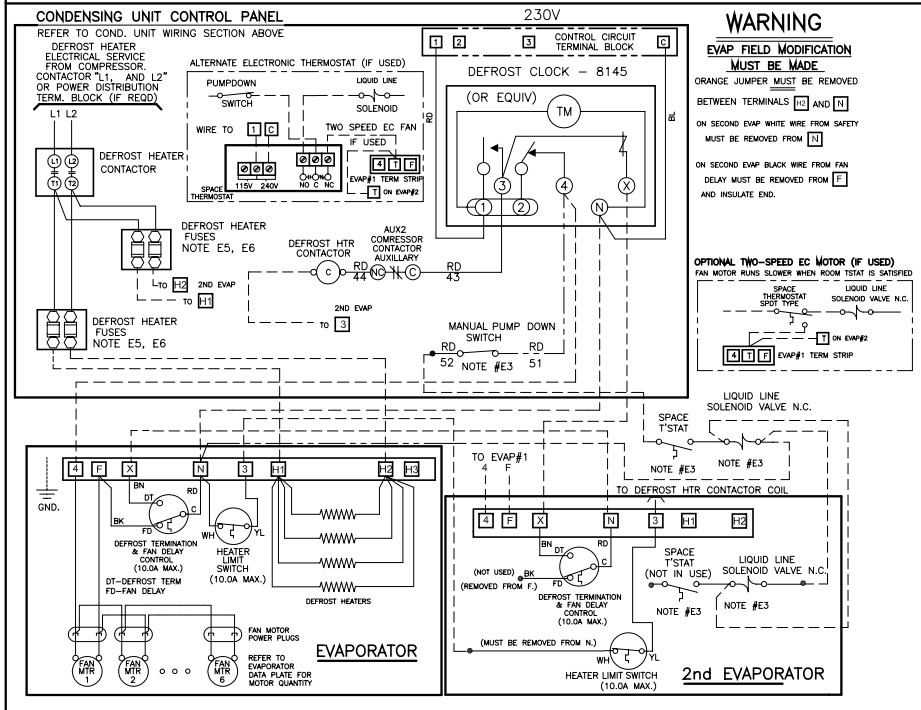
ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	T3A1D
SEPT18/17	A	

TYPICAL EVAPORATOR WIRING:

FOR TWO SINGLE LOW PROFILE ELECT DEF 230V 1 PH. EVAPORATORS–SINGLE POINT MAX TOTAL EVAP FAN AMPS–10A

FOR USE WITH: 230V SINGLE OR THREE PHASE CONDENSING UNITS WITH DEFROST TIME CLOCK, AND DEFROST HEATER CONTACTOR



NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN COND. UNIT, EVAPORATOR, OR SUPPLIED BY OTHERS.
E4. HEATER LOADS ARE NOT CONCURRENT WITH REFRIGERATION LOAD
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS

○ –COMPONENT TERMINAL – MARKED
⬡ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
○ –COMPONENT TERMINAL – UNMARKED (UNIDENTIFIABLE)
□ –TERMINAL BLOCK TERMINAL
• –WIRE SPLICE

CONDUCTORS/WIRING

——— FACTORY WIRING
– – – – – – WIRING BY OTHERS
——— – – ——— OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

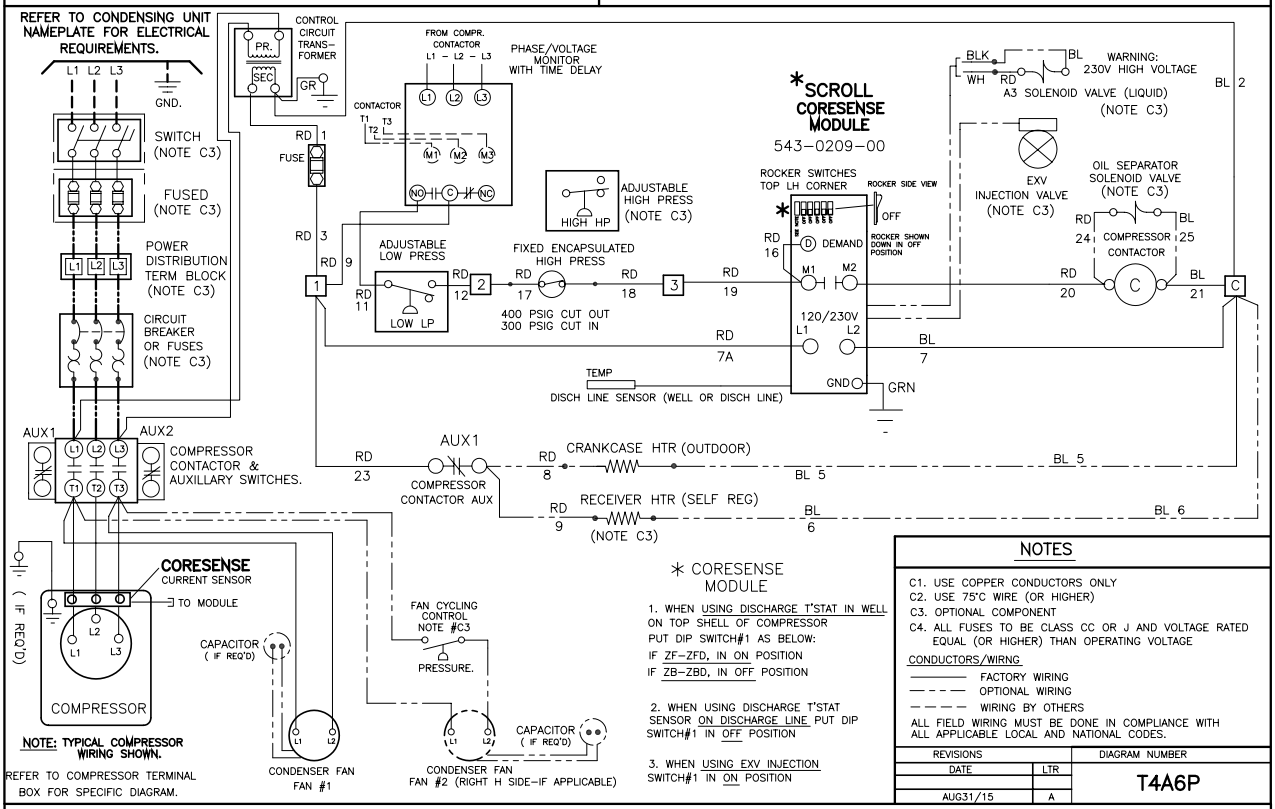
CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	LPE201
JAN 18/10	E	
FEB21/08	BM	

460/360 or 575/3/60 Unit with Two (2) 460V or 575V Electric Defrost Evaporators

CONDENSING UNIT WIRING DIAGRAM

– 460V–3–60 , 575V–3–60 or 380/400V–3–50 Hz
– INHERENT MOTOR OVERLOAD WITH SCROLL 260 BOM CORESENSE PROTECTION
– STANDARD CONTROL CIRCUIT WITH PHASE–VOLT MONITOR



* CORESENSE MODULE

1. WHEN USING DISCHARGE T'STAT IN WELL ON TOP SHELL OF COMPRESSOR PUT DIP SWITCH#1 AS BELOW:
   IF ZF–ZFD, IN ON POSITION
   IF ZB–ZBD, IN OFF POSITION
2. WHEN USING DISCHARGE T'STAT SENSOR ON DISCHARGE LINE PUT DIP SWITCH#1 IN OFF POSITION
3. WHEN USING EXV INJECTION SWITCH#1 IN ON POSITION

NOTES

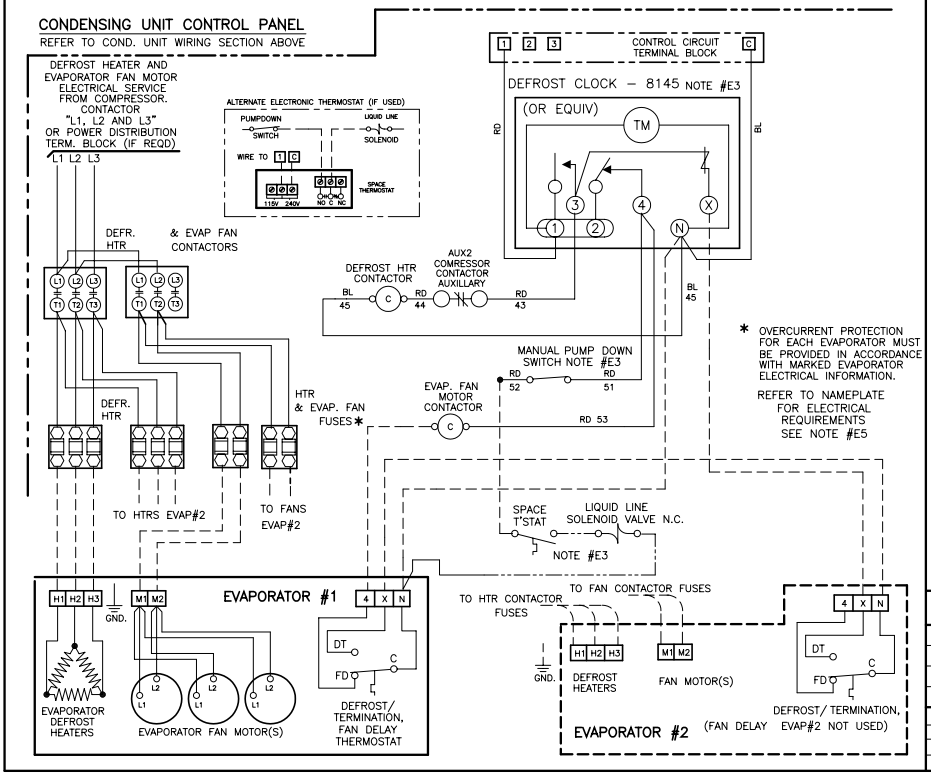
C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

CONDUCTORS/WIRING
———— FACTORY WIRING
– – – – OPTIONAL WIRING
– – – – WIRING BY OTHERS
ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	
		T4A6P
AUG31/15	A	

TYPICAL EVAPORATOR WIRING: FOR TWO MED PROFILE ELECT DEFROST EVAPORATORS– SINGLE POINT

FOR USE WITH: THREE PHASE CONDENSING UNITS WITH DEFROST TIME CLOCK, & EVAP FAN AND DEFR. HTR. CONTACTORS.



* OVERCURRENT PROTECTION FOR EACH EVAPORATOR MUST BE PROVIDED IN ACCORDANCE WITH MARKED EVAPORATOR ELECTRICAL INFORMATION.
REFER TO NAMEPLATE FOR ELECTRICAL REQUIREMENTS SEE NOTE #E5

NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN COND. UNIT, EVAPORATOR, OR SUPPLIED BY OTHERS.
E4. HEATER LOADS ARE NOT CONCURRENT WITH REFRIGERATION LOAD
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS
○ –COMPONENT TERMINAL – MARKED
⬡ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
○ –COMPONENT TERMINAL – UNMARKED (UNIDENTIFIABLE)
□ –TERMINAL BLOCK TERMINAL
• –WIRE SPLICE

CONDUCTORS/WIRING
———— FACTORY WIRING
– – – – – – WIRING BY OTHERS
—— – – —— OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

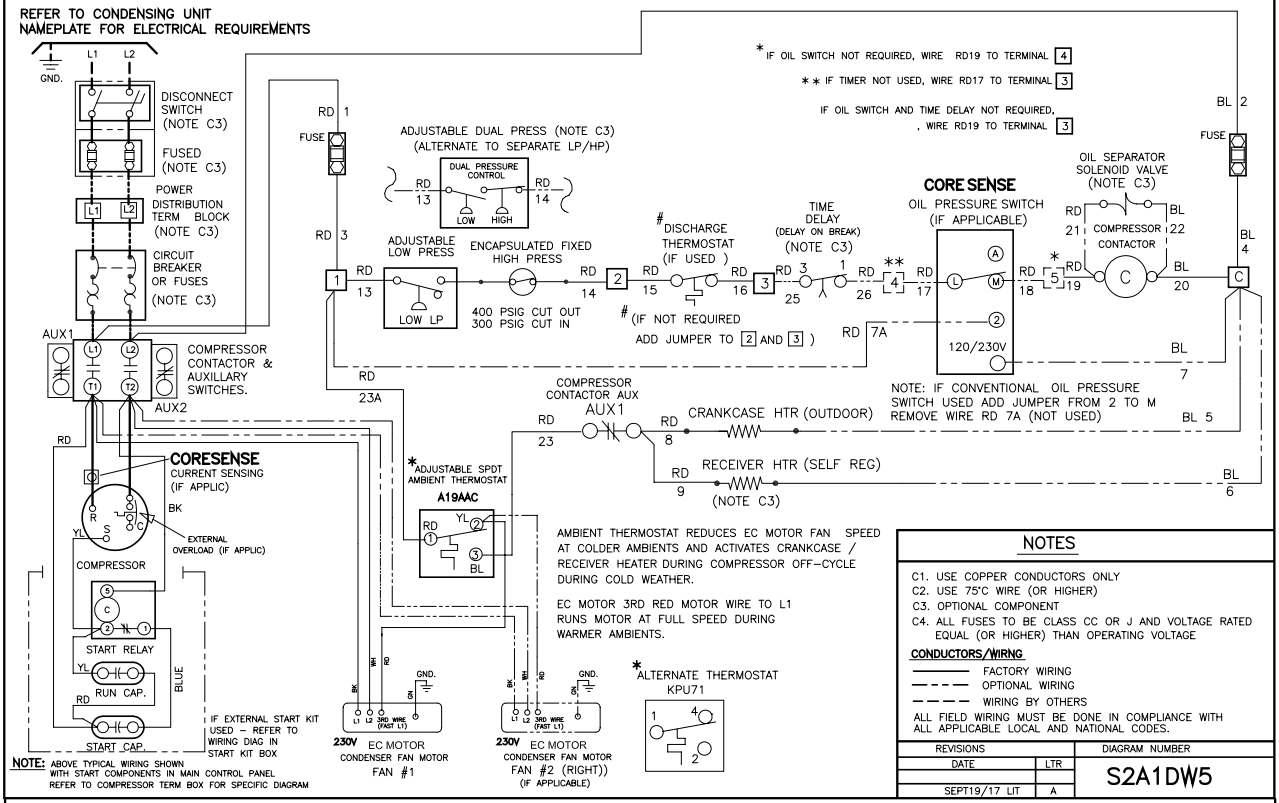
CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	
		JE201A
DEC20/16	A	

208-230/1/60 Unit with SMARTSPEED™ with 230V Air Defrost Evaporator

CONDENSING UNIT WIRING DIAGRAM

- 208/230V–1–60 or 200/220V–1–50 Hz
- OPTIONAL CORESENSE OIL PROTECTION
- STD CTRL CIRCUIT–WITH DISCH T'STAT (IF USED) AND TWO SPEED EC COND FAN MOTOR



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

CONDUCTORS/WIRING

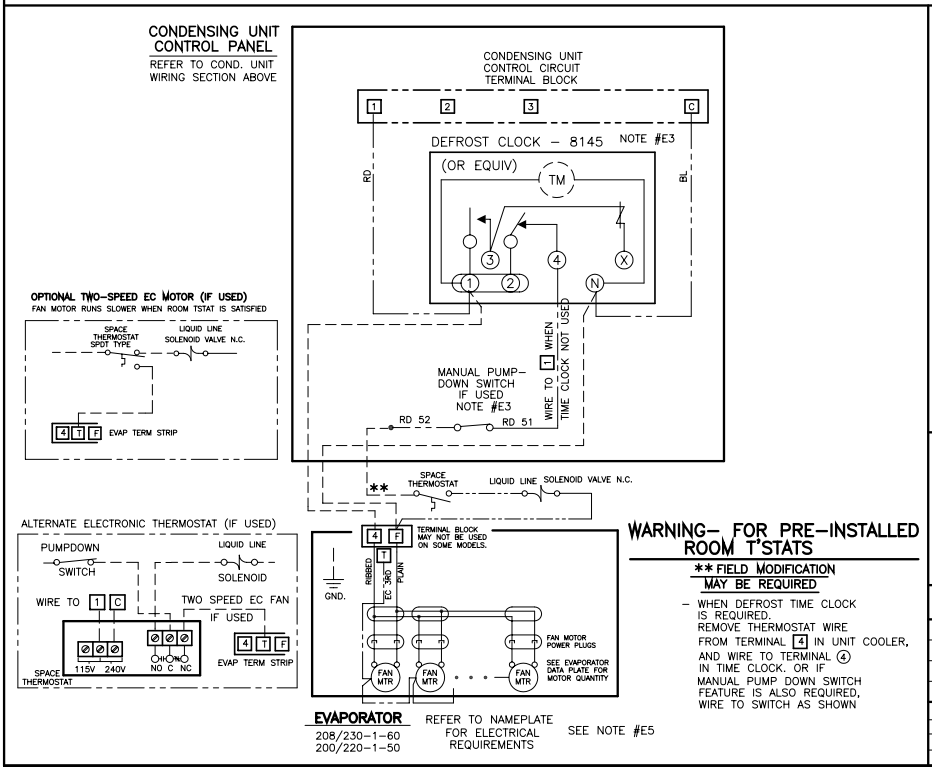
——— FACTORY WIRING
– – – – OPTIONAL WIRING
– – – – WIRING BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	S2A1DW5
SEPT19/17 LIT	A	

TYPICAL EVAPORATOR WIRING: FOR SINGLE AIR DEFROST EVAPORATOR– SINGLE POINT

FOR USE WITH: 208/230–1–60, 200/220–1–50 OR 208/230–3–60, 200/220–3–50 CONDENSING UNITS WITH OR WITHOUT DEFROST TIME CLOCK AND FOR TOTAL EVAP FAN AMPS NOT EXCEEDING 12A



WARNING– FOR PRE–INSTALLED ROOM T'STATS

**** FIELD MODIFICATION MAY BE REQUIRED**

– WHEN DEFROST TIME CLOCK IS REQUIRED. REMOVE THERMOSTAT WIRE FROM TERMINAL 4 IN UNIT COOLER, AND WIRE TO TERMINAL 4 IN TIME CLOCK. OR IF MANUAL PUMP DOWN SWITCH FEATURE IS ALSO REQUIRED, WIRE TO SWITCH AS SHOWN

NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN COND. UNIT, EVAPORATOR, OR SUPPLIED BY OTHERS.
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS

○ –COMPONENT TERMINAL – MARKED
⬡ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
○ –COMPONENT TERMINAL – UNMARKED (UNIDENTIFIABLE)
□ –TERMINAL BLOCK TERMINAL
● –WIRE SPLICE

CONDUCTORS/WIRING

——— FACTORY WIRING
– – – – – – WIRING BY OTHERS
——— – – ——— OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

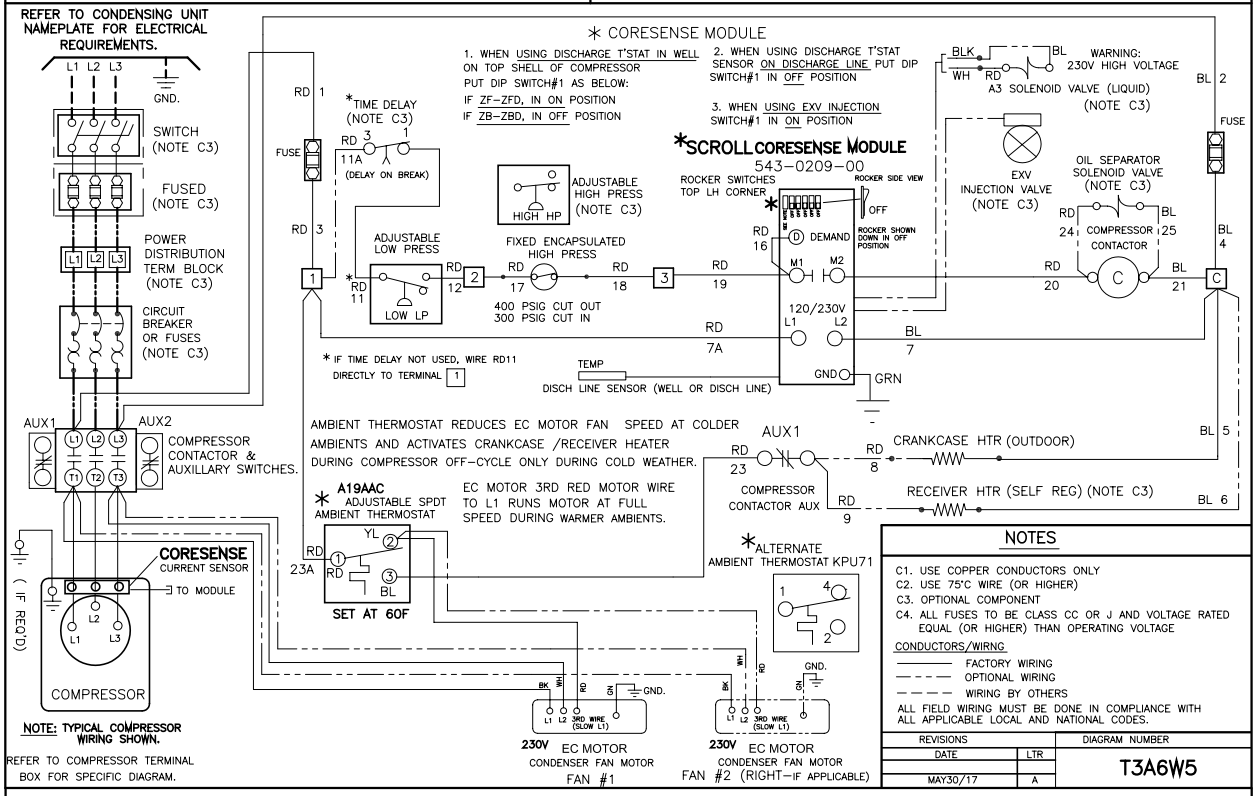
CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	KA101
JAN 18 / 10	D	
MAR26/03	A	

208-230/3/60 Unit with SMARTSPEED™ with 230V Air Defrost Evaporator

CONDENSING UNIT WIRING DIAGRAM

- 208/230V–3–60 or 200/220V–3–50 Hz
- INHERENT MOTOR OVERLOAD WITH SCROLL 260 BOM CORESENSE PROTECTION
- STANDARD CONTROL CIRCUIT WITH TWO–SPEED COND FAN



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

CONDUCTORS/WIRNG
——— FACTORY WIRING
– – – – OPTIONAL WIRING
– – – – WIRING BY OTHERS

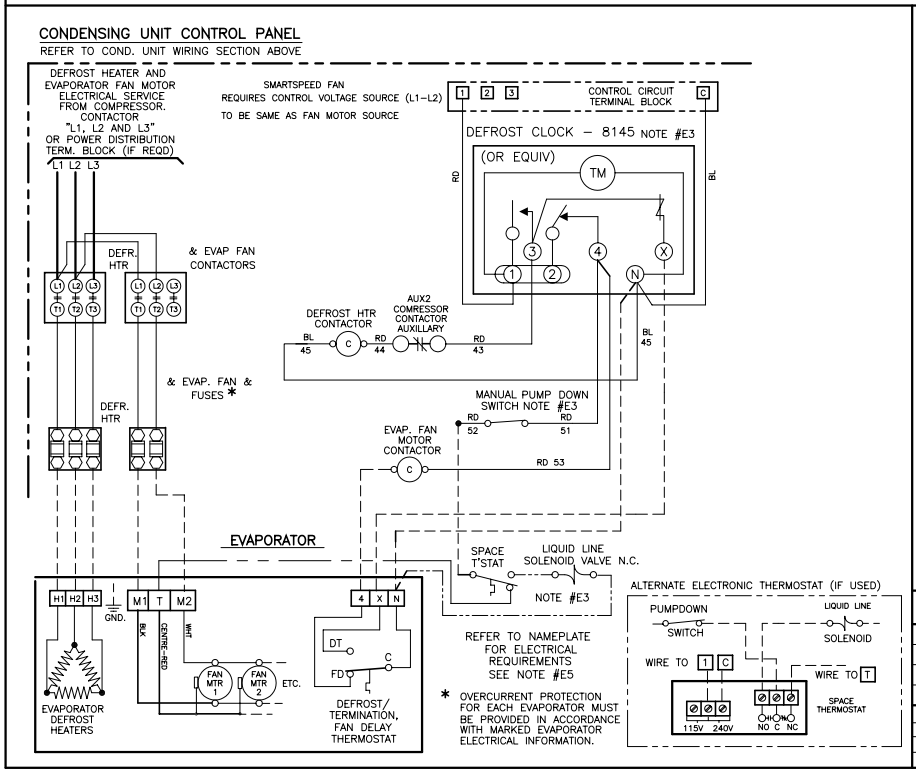
ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	T3A6W5
MAY30/17	A	

TYPICAL EVAPORATOR WIRING:

FOR (1) ONE, THREE PHASE MED PROFILE ELECT DEFROST EVAPORATOR – SINGLE POINT WITH SMARTSPEED

FOR USE WITH: THREE PHASE CONDENSING UNITS WITH DEFROST TIME CLOCK, & EVAP FAN AND DEFR. HTR. CONTACTORS.



NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN COND. UNIT, EVAPORATOR, OR SUPPLIED BY OTHERS.
E4. HEATER LOADS ARE NOT CONCURRENT WITH REFRIGERATION LOAD
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS
○ –COMPONENT TERMINAL – MARKED
⬡ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
○ –COMPONENT TERMINAL – UNMARKED (UNIDENTIFIABLE)
□ –TERMINAL BLOCK TERMINAL
● –WIRE SPLICE

CONDUCTORS/WIRING
——— FACTORY WIRING
– – – – – – – WIRING BY OTHERS
—— – – —— OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	JE101A–EC
JUNE22/15	B	
MAY24/13	A	

System	
Model Number	Date of Start-Up
Serial Number	Service Contractor
Refrigerant	Phone
Electrical Supply	E-mail

PRODUCT SUPPORT	*web:* **www.t-rp.com/tez** *email:* **smcu@t-rp.com** *call:* **1-844-893-3222 x521**
TROUBLESHOOTING	*email:* **troubleshooting@t-rp.com** *call:* **1-844-893-3222 x529**
SERVICE PARTS	*web:* **www.t-rp.com/parts** *email:* **parts@t-rp.com** *call:* **1-844-893-3222 x504**
WARRANTY	*web:* **www.t-rp.com/warranty** *email:* **warranty@t-rp.com** *call:* **1-844-893-3222 x507**
ORDERS	*email:* **orders@t-rp.com** *call:* **1-844-893-3222 x501**
SHIPPING	*email:* **shipping@t-rp.com** *call:* **1-844-893-3222 x503**

Trenton Refrigeration
Brantford, ON • Longview, TX
1-800-463-9517 info@t-rp.com www.t-rp.com

SECTION 230200 - GENERAL REQUIREMENTS MECHANICAL

PART 1 - GENERAL

1.1 SPECIAL NOTES

A. Refer to "General Conditions" and "Supplementary General Conditions" of the specifications. Work under this section of the specifications shall be governed by requirements thereunder.

B. The use of the word "PROVIDE" in the specifications and on drawings for work under this section shall mean: Furnish and install complete, supplying all necessary labor and materials.

C. This section applies to all sections of Division 23 of this project except as specified otherwise in the individual sections and here-in. Work described in this section includes general requirements common to all mechanical systems. Provisions of this section apply to all mechanical specification sections.

1.2 GENERAL REQUIREMENTS

A. Provide necessary labor, material, plant and equipment including materials not specifically mentioned, but necessary to complete the job in a neat, correct and workmanlike manner.

B. The drawings and specifications shall be considered as supplementary, one to the other, so that materials and labor indicated, called for or implied by the one and not the other, shall be supplied and installed as though specifically called for by both.

C. All electrical equipment shall be UL listed and all gas equipment is to be AGA certified.

D. All items to be properly lubricated and in perfect operation upon completion of the project and prior to final acceptance by owner.

E. Contractor shall be held responsible for having visited job site and having familiarized himself with existing conditions prior to submitting bid. If any existing problems are identified, notify Architect in writing prior to submitting bid.

1.3 SCOPE

A. Provide a complete self-contained Refrigeration system for the new Exterior Walk-In Freezer as specified here-in and as indicated on the accompanying drawings.

B. Insulate all piping, and equipment as herein specified and as indicated on the drawings.

C. Provide control for the Refrigeration equipment per the drawings.

D. Furnish and install complete self-contained Refrigeration system as scheduled and shown on drawings.

E. All labor and materials to provide the control systems as shown on the drawings shall be furnished by the Contractor.

I. Provide all control, interlock and starting circuit wiring. Wiring shall be as indicated on the equipment specifications. Provide transformers and relays as required to comply with this requirement. Conduit shall be steel conforming to the requirements of the Electrical Specifications, except as otherwise specified.

F. Start, test, adjust, balance and place into operation the refrigeration system. System air balance is to be accompanied with certified test forms as to obtained air quantities. Proper fan performance and coil discharge air temperature reading shall also be certified on test forms.

G. All mechanical installations, equipment, and piping shall be seismically braced or restrained as required by the International Building Code.

1.4 SPACE CONDITIONS

A. All work shall fit the spaces available. Verify all dimensions of the work before commencing fabrication and/or installation. Minor deviations from the drawings required to conform to space conditions and to provide the required accessibility shall be made at no additional cost to Owner.

B. Only base manufacturer's equipment has been investigated and determined to meet necessary space conditions. It shall be the responsibility of the approved equal manufacturer and contractor to verify their suitability for use on this project.

1.5 QUALITY ASSURANCE

A. Codes, Permits, Inspection Fees, Etc. All work shall be installed in complete accordance with State, Municipal, and Local Codes. The Contractor shall obtain all necessary permits, licenses, etc. and pay for all inspections required by agencies having jurisdictional authority in connection with this work.

B. Inspection. The architect’s refrigeration consultant will observe the job periodically. Checklist will be completed noting any items that will need to be corrected prior to the next visit. A copy of this inspection shall go to the General Contractor and Owner.

C. Contractor's Qualifications. The Owner assumes and requires that the Contractor has had sufficient general knowledge and experience to anticipate the needs for a construction project of this nature. The Contractor shall furnish everything needed or required to complete the construction in accordance with reasonable interpretation of the intent of the drawings, specifications, and any minor items required by code, law, or regulations shall be provided whether or not specified or specifically shown. This is not intended to cover any major items of equipment or labor not shown or specified and intended, but is intended and will be interpreted to cover the Contractor's full responsibility for providing all miscellaneous labor, parts, devices, accessories, and appurtenances which are required or applicable and considered required in keeping with good practice for first-class workmanship, and a system which is complete and operable in every respect.

D. Workmanship. Skilled and experienced workmen in accordance with the best-accepted practices of the industry shall make the entire installation. Where codes are not specific as to workmanship, the Architect and his consultants shall reserve the right in determining if the workmanship is sub-standard. If any workman is found to be failing in the correct performance of his work, he shall be removed from the job immediately. The Owner also reserves the right to cut fittings for verification that Nitrogen was ran when fittings were soldered.

1.6 DRAWINGS

A. The Plans are not intended to show all pipes, valves, fittings, connections, and details of the work to be done. The piping, duct, and equipment locations shall be adhered to as closely as possible; however, any changes necessary to avoid project condition conflicts shall be made at no additional cost to the Owner.

B. Conflicts in the plans and specifications where changes and alterations are necessary, or where exceptions are taken by the Contractor with regard to sizes, locations, and other details indicated on the drawings, they shall be discussed with the Architect and have his consent in writing before any changes are made. The Contractor shall confer with the Architect for the exact location of all openings into finished areas and all equipment and piping locations before proceeding with the work.

C. The drawings of this work were prepared in conjunction with the other trades and plans of the project and it shall be the Contractor's responsibility to provide himself with drawings of the other trades as required and to coordinate and schedule the work with the other trades.

D. Should any difficulties prevent the installation of the work as indicated, the proposed changes shall be submitted to the Architect in detail and must be approved in writing before the work may be performed.

E. All inverts, locations, and elevations on all piping, equipment, trenches, etc. shall be verified on the job site prior to the performance of any work that may be affected in any manner by said inverts, locations, and elevations. Before construction of project starts, check location of proposed equipment. Review other drawings for project, checking locations of structural elements, locations and sizes of chases, type and method of construction of roof, ceilings, walls, and partitions. Report to Architect and Engineers before start of construction any conflicts or unsatisfactory conditions. In no case shall Contractor proceed in uncertainty. No extra charge will be approved after start of construction for work resulting from failure to follow these instructions.

F. Where connections and drains are provided to serve specific pieces of equipment, it shall be the Contractor's responsibility to verify the exact location of the equipment connections and drains and no installation shall be attempted until exact locations have been established. This applies to all equipment regardless of who furnishes said equipment.

1.7 PERMITS, LICENSES, AND FEES

A. The installation of the system covered by these specifications shall conform in strict accordance to all ordinances, codes and regulations of the City, County, State, and/or all other authorities having jurisdiction and shall conform to all applicable requirements and recommendations of the N.F.P.A. These requirements are minimum and shall be complied with at no additional cost to the Owner.

B. In the absence of local regulation and codes, on refrigeration, or in items or circumstances not covered by local regulation and codes, all recommendations and requirements of the ASHRAE, as set forth in the current edition of the ASHRAE Guide, shall be met as well as all requirements and recommendations of NFPA 90A and the International Building Code.

C. Where requirements of the drawings and specifications exceed code requirements, the work shall be provided in accordance with the drawings and specifications. Any work provided contrary to these

requirements shall be removed and replaced at the Contractor's expense.

D. The Contractor shall obtain and pay for all necessary permits and inspections required for the installation of this work and shall pay all charges incident thereto. The Contractor shall deliver to the Architect all certificates of said inspections issued by the authorities having jurisdiction.

1.8 BID BASIS

A. Basis of Design: Reference Section 114121- Walk-In Freezer- Equipment Schedule.

1.9 MATERIALS AND WORKMANSHIP

A. All materials and equipment shall be new and free from flaws and defects of any nature. Materials called for are to be considered as standard of quality; which however, implies no right on part of Contractor to substitute other materials and methods without written authority from Architect.

B. All work shall be performed by skilled mechanics, under competent supervision, employing latest and best practices of the trade. Work shall be installed in accordance with recommendations of ASHRAE Guide, and equipment manufacturer's installation instructions. In the event there is any conflict or doubt, consult Architect for clarification and approval.

1.10 SUBSTITUTIONS

A. Specific reference in the specifications to any article, device, product, material, fixture, form or type of construction, etc., by name, make, or catalog number, with or without the words "or equal" shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition, and the Contractor in such cases may at his option, use any article, device, product, material, fixture, form or type of construction, which in the judgement of the Architect, expressed in writing prior to bidding as specified below, is equal to that herein named.

B. Requests for written approval to substitute materials or equipment considered by the Contractor as equal to those specified, shall be submitted for approval to the Architect ten days before bids are taken. Requests shall be accompanied by samples, descriptive literature, and engineering information, as necessary to fully identify and appraise the product. No increase in the contract sum will be considered when requests are not approved. If the item is found to be equal, the Architect will issue an Addendum making it a part of the Contract Documents prior to bidding. After bidding, no further changes will be considered.

C. Contractor shall be responsible for determining that all products submitted for approval meet given space limitations and maintain all required clearances for proper access and service.

D. Being listed as an approved equal manufacturer means only that the listed manufacturer is basically a reputable supplier whose equipment will receive consideration if in accordance with all document requirements including space limitations and deliver. Being listed is not to be construed as indicating nor implying that the supplier's product is assured of being acceptable for the project. The burden of developing a product to comply with the documents and of obtaining approval of the product rests solely with the Contractor.

1.11 SUBMITTAL

A. Shop Drawings: After award of Contract, and before any materials of this Section are delivered to the job site, submit electronic Shop Drawings in pdf format to Architect in accordance with the requirements listed below and in accordance with the provisions of the Architectural Section of these Specifications.

1. After securing tentative approval on all items pending shop drawing submission, the contractor shall submit for approval, manufacturer's shop drawings of all equipment, and shop drawings to scale of all fabricated work furnished under this Section of the specifications including piping, equipment layouts, supports and equipment foundation pad layout. Shop drawings shall be of scale large enough to clearly indicate all details of work. Submit on a scale of not less than 1/4-inch equals one foot.
2. Where colors or finishes are specified for products, a sample showing the color or finish shall be submitted with the shop drawings.
3. Where high efficiency motors have been specified, submit certification of motor efficiency with shop drawings for each motor of one horsepower or greater.

B. Material List: Accompanying the shop drawings, submit a complete list of all materials proposed to be furnished and installed under this Section, giving manufacturer's name and catalog number, sizes, capacities, model numbers, accessories and other pertinent information for each item to indicate full compliance with drawings and specifications; this shall in no way be construed as permitting substitution except as specifically provided in the Architectural Section of these specifications. Every device or piece of equipment herein specified by model and manufacturer shall be submitted for approval. Partial lists submitted from time-to-time will not be permitted.

C. Mechanical/Electrical Coordination: Before equipment is ordered and after all motors, loads, controls, and other characteristics of equipment are known, the Contractor shall review the data shown on the Electrical drawings. Special attention shall be given to motor size, starters, means of disconnect, control wiring, etc. that are being furnished under the electrical section of the specifications. At the time of shop drawing submittal, the contractor shall by letter to the Engineer point out any discrepancies and describe the proposed corrective action.

1. Prior to start of construction, contractor shall submit a starter schedule for review by Engineers. This schedule shall contain equipment description, starter manufacturer and model number, starter accessories, control voltage and source of starter power and control circuitry.
2. No extra charge will be approved after start of construction for work resulting from failure of contractor to follow these instructions.

D. As-Built Drawings: Contractor shall maintain on the job site one complete set of the mechanical drawings for this project. All changes authorized by the Architect as to the location, sizes, etc., of piping, ductwork, and other mechanical equipment shall be indicated in red ink on the mechanical drawings as the work progresses. At the completion of the project, Contractor shall deliver a complete set of "As-Built" prints of the mechanical drawings to the Architect.

E. Control Drawings:

1. Before installation of controls, submit an electronic copy in pdf format of complete submittal data, including equipment specifications, control diagrams, schematic diagrams, internal connections, and sequence of operation to the Architect for his approval. Diagrams shall show all instruments, devices, tubing, etc. Set points and actions of instruments, operating ranges, and normal position of controlled devices shall

be indicated. Operating sequence describing each system shall appear on the same drawing as the system's control diagram.

2. Wiring diagrams shall show conduit and wire sizes, transformers, fuses and correct schematic diagrams for each motor starter and magnetic contractor. Diagram shall be coordinated with the equipment manufacturers involved and shall show the terminal designations for all connections to the equipment and the manufacturer's approval obtained.

F. Manual: Upon completion of this portion of the work, and as a condition of its acceptance, deliver to the Owner through the Architect two copies each of a Manual compiled in accordance with the provisions of the Architectural Section of these specifications; and also include in each copy of the Manual a copy of the As-Built Drawings, operating and maintenance instructions, approved control drawings, spare parts lists, name and address of local service representatives and all warranty certificates for new equipment.

1.12 ELECTRIC WORK

A. Electrical Contractor will provide the following for the mechanical equipment:

1. A source of power as required for each electric motor and for each electrical heating and cooling item of equipment installed under the mechanical contract, including final wiring connections to motor terminals or to terminals in a control panel mounted on each respective unit.
2. Circuit breaker protection as required for each electric heating and cooling item of equipment installed under the mechanical contract.
3. Wiring each electric motor and each electrical heating and cooling item of equipment (where applicable) through a magnetic starter or a magnetic contactor furnished by the Mechanical Contractor.
4. Wiring each constant speed ceiling exhaust fan through a wall switch furnished by the Electrical contractor.

B. All motors shall be provided with thermal overload protection either internally or at the starter and all electrical equipment shall be U.L. listed.

C. In the event Refrigerant Contractor proposes to use any items of mechanical equipment which have sizes, numbers of electrical meters, or other electrical requirements different from those specified on schedules, drawing or elsewhere, Contractor shall be responsible for coordinating these changes with the Electrical Contractor and he shall reimburse the Electrical Contractor for all additional costs necessitated by these changes.

D. In general, the Electrical Contractor will do all power wiring for the mechanical equipment as described above, and the Refrigerant Contractor shall do all control and interlock wiring, unless otherwise specified or indicated on drawings.

E. Consult electrical drawings for extent of electrical work provided for the mechanical equipment. Verify current characteristics with Electrical Contractor before ordering any equipment for this project.

F. Refrigerant Contractor shall provide all other wiring not covered above, that is necessary for complete and operating the freezer system, including all control wiring, interlock wiring, conduit, relays, controls, starters, disconnect switches, circuit breakers, control conduit and outlet boxes, wiring of all applicable control items of equipment, and other electrical work as required.

G. All wiring shall be run in galvanized or sherardized rigid electrical conduit or E.M.T. where allowed under the electrical section of the specifications, and shall be concealed in finished areas and occupied spaces. All conduit shall be attached to ceiling or walls, attachment to or suspension from other equipment will not be permitted. If routing of conduit is questionable, verify routing with Engineers before proceeding with installation.

H. All electrical work required under this Contract shall comply with the National Electrical Code, and shall meet all local requirements. All electric equipment shall bear UL labels.

1.13 GUARANTEES

A. The Contractor agrees:

1. To correct defects in workmanship, new materials, new equipment, and the operation of system for a period of one year from date of acceptance. Equipment and materials, repaired or replaced are guaranteed for one year following date of correction.
2. To repair any damage to building and equipment resulting from defects in workmanship, materials, equipment, and system operation.
3. To remove any item not specified or given approval and replace it with specified or approved item.
4. Any item submitted for approval that does not conform to these specifications shall have accompanying note of exception.
5. That the system as installed shall comply with code requirements.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. All equipment and materials provided under this section of the specifications shall be new and of the best grade and quality. Materials and equipment manufactured outside of the United States will not be acceptable.

B. The approval of the Architect shall be obtained by the Contractor on all equipment and materials before any installation is made.

C. Equipment that is installed and then does not perform as represented by selection data or shop drawings shall be replaced with equipment that meets the job requirements and specifications at no additional cost to the Owner.

D. All equipment, materials, and work indicated on the drawings or as specified hereinafter is intended to be installed in a manner conforming to the best engineering practices and all equipment is intended to be complete in every respect to satisfy the job requirements and this specification. In the event any material or equipment is indicated to be used or installed contrary to the manufacturer's recommendations, or if any part, control accessory or auxiliary item required for satisfactory and proper operation and performance of the material and/or equipment is not indicated or specified, it shall be the Contractor's responsibility to notify the Architect in writing prior to installation. In the event the Contractor fails to give such notice, he will be required to correct the work and/or furnish items omitted (in the performance of his work) at no increase in the contract sum.

E. Upon request from the Architect, the Contractor shall furnish to the Architect a certification on all materials and equipment so designated by the Architect. The certification shall be made by the manufacturer of the material and/or equipment; shall be signed by an official of the manufacturing concern; and shall state that the drawings, specifications, and project requirements have been thoroughly studied by the manufacturer and that the proposed material and/or equipment is unconditionally guaranteed to operate and/or perform properly as applied.

PART 3 - EXECUTION

3.1 UTILITY CONNECTION AND MODIFICATIONS

A. It shall be the Contractor's responsibility to determine all requirements regarding utility services to the building. The Contractor shall verify the exact locations of stubs provided.

3.2 PROTECTION

A. The Contractor shall provide adequate protection to all materials, equipment, fixtures, etc. provided under this section of the specifications to prevent damage of any nature. The Contractor shall be required to remove and replace, at no additional cost to Owner, any item showing any sign of damage of any nature that cannot be restored to its new condition and appearance. Grinding and polishing may be used in the restoration of damaged equipment and materials when approved by the Architect.

3.3 EXCAVATION AND BACKFILLING

A. General Contractor shall do all excavating and backfilling for installation of work included under this contract and he shall promptly remove from the premises all excess earth, debris, and trash for which he is responsible. Coordinate with the General Contractor for cutting and patching excavation conditions. All work shall comply with section 230500 as well as the Architectural sections of these specifications.

3.4 CUTTING AND PATCHING (If required)

A. The Mechanical Contractor will do all cutting and the General Contractor shall do all patching and construction of chases within building for this installation. Mechanical Contractor shall advise General Contractor well in advance of sizes and locations of all openings, sleeves, etc., required. Failure to do so will result in Mechanical Contractor bearing cost of this phase of the work.

3.5 REFRIGERATION - ELECTRICAL COORDINATION

A. Refrigeration equipment, insulated box, and piping shall be installed with proper clearances to existing elements. The clearances shall be the greater of the requirements of the NEC in front of the equipment. Refrigeration equipment or piping shall not be installed directly over the electrical gear and not less than 3'-0" horizontally from the top of the electrical gear.

3.6 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall acquaint and instruct the Owner's representative with all details of performance, operation, and maintenance of the systems. In addition, the contractor shall furnish two copies of a brochure to the Owner through the Architect, which shall contain printed operating and maintenance instructions, parts list, control diagram, etc., including a list of spare parts and any special tools recommended by the equipment manufacturers to be stocked by the Owner. The manuals shall include a complete set of all approved shop drawings furnished under this section of the specifications.

B. The basis of Owner's instructions shall be written for inclusion in the maintenance and operating instructions data specified above. Obtain certificates, signed by the Owner's representative, that these instructions have been received and understood.

3.7 CLEANING

A. The Contractor shall keep the job site clean, removing all debris and unused material as they occur. At the completion of the work, the Contractor shall thoroughly clean all materials and equipment provided as part of the work.

B. Prior to testing and adjusting, all piping systems, including all components of systems, shall be thoroughly cleaned inside and out.

C. All soil, waste, drain and rainwater lines shall be rodded out in the presence of the Architect's representative. All cleanout plugs shall be removed, lubricated and replaced.

D. Prior to acceptance of the work, thoroughly clean all exposed portions of the new installation, removing all labels and all traces of foreign substances, using only a cleaning solution approved by the manufacturer of the item being cleaned. Caution should be taken to avoid damage to all finished surfaces.

3.8 START-UP

A. The Contractor shall place the systems in full operation before testing begins. The Contractor shall make corrections in the system, including furnishing and installing drives, motors, dampers, valves, etc., if required to balance the systems. All such corrections shall be included in the Contractor's base bid and shall be accomplished at no additional cost to the Owner. All piping shall be tested before covered with insulation or being concealed.

END OF SECTION 230200

SECTION 230300 - PRESSURE TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work in this section includes the pressure testing of all air conditioning systems and includes requirements common to all the mechanical systems. Provide all labor, tools instruments, etc. as required to completely test the systems.

B. Other sections of these specifications are a part of this section. Refer to all other sections for a complete description of the work. Work, conditions, and materials specified in other sections and not duplicated in this section includes, but is not limited to the following:

1. Mechanical General Provisions.
2. Basic Materials and Methods.
3. Refrigeration.

C. All work provided under these specifications shall be subject to constant inspection and final approval of the Architect and all Code authorities having jurisdiction. Tests, in addition to these specified herein, required to prove Code compliance shall be provided as required by the Authorities without additional cost to the Owner. All work found to be defective or indicating leakage shall be repaired or replaced with new materials, as directed by the Architect. Tests shall be repeated until all work is proven tight.

1.2 QUALITY CONTROL

A. All tests shall be conducted by qualified personnel. When requested the qualifications of individuals shall be submitted to the Architect for approval.

1.3 NOTIFICATION

A. The Architect shall be notified prior to all tests.

B. The Code Authorities having jurisdiction shall be notified prior to all tests.

PART 2 - PRODUCTS

2.1 Provide all material, test equipment, instruments, and labor required for the tests. All instruments shall be properly calibrated and shall have records on calibration.PART 3 - EXECUTIONS

3.1 REFRIGERANT PIPING PRESSURE TESTING

A. After Freon piping has been completed and before insulating pipe and enclosing chases, the field installed piping shall be pressure tested at a pressure of 300 psi (high side) and 150 psi (low side). While the system is being pressure tested, an electronic leak detector shall be used to check for leaks.

B. Pressure shall be maintained on piping for a minimum of 12 hours. All field installed piping shall be evacuated when surrounding ambient air is not less than 60 degrees F. A minimum vacuum of 2.0 mm of mercury shall be pulled on piping system and maintained for 12 hours. The vacuum pressure displacement shall be not less than 5 CFM. The vacuum shall be checked with an electronic gauge.

END OF SECTION 230300

SECTION 230700 - INSULATION OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Trained personnel regularly engaged in the installation of insulation and approved by the insulation manufacturer shall install the insulation in a neat and professional manner.

B. Except where specifically specified otherwise, all insulation, adhesives, coverings and coatings shall be applied in strict accordance with its respective manufacturer's recommendations.

C. No wheat paste or organic materials that breed or sustain mold shall be used in conjunction with the insulation work.

D. The Contractor shall verify that all tests and inspections of the work to be insulated have been completed and approved before the insulation is applied.

E. Adequate provisions shall be made to protect the premises, equipment, and the work of other trades against all droppings, adhesives and coatings used in the installation.

F. Pipe unions, strainers and flanges on hot lines shall not be insulated; starting and stopping points for the insulation on hot lines shall be 1 inch on either side and shall be neatly tapered and tightly sealed. Cold lines subject to sweating shall be insulated throughout, including unions, flanges and strainers.

G. Ample provisions shall be made at hanger and support points to prevent the compression of insulation beyond that recommended by the insulation manufacturer for the application.

H. All insulation shall have a composite insulation, jacket, binders, and adhesives fire and smoke hazard rating as tested by procedure ASTM E84, NFPA 255, and UL 723, not exceeding the following values and shall be so listed by UL:

1. Flame Spread 25
2. Smoke Developed 50

I. All accessories, including but not limited to, adhesives, mastics, tapes, shall have the same component ratings. All materials shall be labeled indicating compliance with the above requirements. All treatments used to obtain the required ratings shall be permanent; water-soluble treatments will not be acceptable. Flexible elastomeric insulation with smoke developed exceeding 50 is prohibited in ceiling plenums, return air plenums, or ductwork.

1.2 SUBMITTALS

A. Submit shop drawings and data to prove complete compliance with these specifications on all products and methods of installation.

1.3 SCOPE

A. Includes but not limited to insulation of the following items:

1. Condensate drain lines. (Armaflex)
2. Refrigerant Piping (flexible foam)

1.4 QUALIFICATIONS

A. All insulation shall be installed in a workmanlike manner by qualified insulation mechanics. Install all insulation in strict accordance with the manufacturer's recommendations, using approved type laggings, adhesives, mastics, and other materials as applicable.

PART 2 - PRODUCTS

2.1 REFRIGERANT LINE INSULATION

A. Flexible foamed pipe insulation. Foam rubber insulation shall have a maximum k factor of .27 and shall have an operating temperature range of -40 degrees F to 220 degrees F. Insulation shall comply with ASTM C-534 and UL 94-5v. Insulation shall be rated for use in return air plenum and shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less. Insulation as installed shall meet the minimum requirements of the current edition of the International Energy Conservation Code.

B. Thickness:

1. 1" thick for 1-1/2” outside diameter and smaller pipe.
2. 1-1/2" thick for pipes larger than 1-1/2” outside diameter pipe.

C. Approved Manufacturers: Armaflex, Rubatex, GSG " Ultrafoam", Halstead "Insul-tube", Manville Aerotube II, Imcolock, or Imcoaflex. Approved adhesives are Armaflex 520, Manville Micro-Lok 650, BFG Construction adhesive #105, Imcoa fuse seal joining system, or Imcoa Leaktite.

2.2 CONDENSATE DRAIN LINES

A. Insulate condensate lines with 3/4" foamed rubber pipe insulation. Foam rubber insulation shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less as tested by ASTM E 84-75. Seal all seams and joints with adhesive equal to Armstrong 520.

B. Insulation shall be Armaflex "AP", or equal product by Rubatex, or Manville.

2.06	Up to 1-1/2”	0.27	1½”
	Over 1-1/2”	0.27	3.0”
	Over 6”	0.27	3.5”

C. Insulation shall be Owens-Corning ASJ/SSL-II. or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all insulation in strict accordance with the manufacturer's recommendations, using approved type laggings, adhesives, mastics, and other materials as applicable

3.2 REFRIGERANT PIPING

A. Insulation shall fit in snug contact with pipe and be installed in accordance with manufacturer's recommendations.

B. Stagger joints on layered insulation.

C. Slip insulation on tubing before tubing sections and fittings are assembled keeping slitting of insulation to a minimum.

D. Seal joints in insulation with Manufacturer's approved adhesive.

E. Provide six inch long, 20 gauge galvanized steel sleeve around pipe insulation at each support.

F. Extend insulation through pipe support clamps.

G. Insulation exposed outside building shall have any required slit joints and seams placed on bottom of pipe and given two coats of gray adhesive finish.

H. Insulate fittings with sheet insulation and as recommended by Manufacturer.

I. Paint exterior exposed insulation with two coats of gray finish recommended by Insulation Manufacturer, then finish with a .016" thick aluminum jacket secured with stainless steel bands.

J. Underground refrigerant lines shall be run in rigid PVC conduit. Each line shall be run in a separate conduit of sufficient size to accommodate pipe and insulation. Where conduit penetrates exterior wall and interior floor slab, it shall be sealed with a waterproof mastic.

3.3 CONDENSATE DRAIN LINES

A. Seal all seams and joints with adhesive.

B. Where possible, slip insulation on piping without splitting.

3.4 DOMESTIC WATER PIPING

A. All piping outside the building or in rooms subject to freezing temperatures shall be traced with electrical heat tracing for freeze protection prior to insulation.

B. Water piping exposed above grade shall have insulation covered with two layers of pre-sized glass cloth and waterproof mastic and finished with a 0.016" thick corrugated aluminum jacket and sealed to prevent entry of water into the insulation.

C. Insulation shall be applied over the electric heating tape. Mastics, etc. shall be compatible with the electric heating cable. Pressure sensitive taped joints and seams will not be accepted.

END OF SECTION 230700

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SPECIAL NOTE

A. Piping shown on drawings shall be installed complete and shall be of the size shown. When a size is not indicated, the Mechanical Contractor shall request the pipe size from the Architect through the General Contractor. All piping shall be installed parallel or perpendicular to the building construction.

B. Some refrigerant line lengths and/or vertical lifts may exceed manufacturer's recommendations. Mechanical contractor is responsible for insuring the equipment manufacturer sizes all refrigerant lines for these pieces of equipment. Provide suction line accumulators and solenoid valves near the expansion valve if necessary.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

A. All refrigerant piping shall be type "L-ACR " copper tubing, hard drawn with wrought copper solder type fittings suitable for connection with silver solder.

B. Refrigerant suction piping shall be trapped at each indoor unit. Each liquid line shall be provided with a dryer as specified in the Equipment section of these specifications. Provide all necessary valves to isolate dryer to allow service without losing entire system charge.

PART 3 - EXECUTION

3.1 REFRIGERANT PIPING JOINTS

A. All joints in piping shall be silver soldered. The piping shall be charged with dry nitrogen while constructing the joints. Piping within chases in building shall be one piece, no joints will be allowed in hidden or inaccessible areas.

3.2 PRESSURE TESTING

A. All refrigerant piping shall be tested in accordance with equipment manufacturer's recommendations and in compliance with Section 232300.

3.3 PIPE HANGERS AND SUPPORTS

A. The contractor shall furnish all labor, materials, equipment and incidentals and install pipe hangers, supports, concrete inserts, and anchor bolts including all metallic hanging and supporting devices for supporting exposed piping.

B. Hangers and supports shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for pipe supports shall be five (5) times the ultimate strength of the support. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the contractor shall submit a certification stating that such requirements have been complied with.

C. Submit to the Engineer for approval shop drawings of all items to be furnished under this section.

D. Submit to the Engineer samples of all materials specified herein if requested. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, and fittings and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such a equipment, pipe and personnel contact.

E. All materials used in manufacturing hangers and supports shall be capable of meeting the respective ASTM Standard Specifications with regard to tests and physical and chemical properties, and be in accordance with MSS SP-58.

F. Hangers and supports shall be spaced in accordance with MSS SP-69 Table 3.

G. Pipe hangers and supports shall be as manufactured by B-Line Systems, Inc. or equal by PHD, Grinnell, or Fee and Mason. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product shall not be considered as proprietary. Any item comparable in type, style, quality, design and performance will be considered for approval.

H. Hanger rods, nuts, and bolts shall be galvanized steel.

I. All supports outside of building shall be galvanized construction.

J. Pipe Hangers and Supports for Refrigerant piping shall be equal to B-Line galvanized steel strut system.

1. All hangers and supports shall have some form of adjustment available after installation. Hanger material shall be compatible with the pipe material.
2. Hangers for copper tubing shall be B-Line Systems, Inc. Strut system with Vibra Cushion isolators and pipe clamps.
3. Piping hangers shall be installed around the outside of the insulation with protective shields.

K. Hanger Rods:

1. Hanger rods shall be B-Line Systems, Inc. figures B3205 and ATR or equal.
2. Hanger rods shall be subjected to tension only. Lateral and axial movement shall be accommodated by proper linkage in the rod assemble.
3. Hanger rod diameters shall be based on MSS SP-69 Table 4.

L. Concrete Inserts:

1. Concrete inserts for pipe hangers shall be continuous metal inserts designed to be used in ceilings, walls, or floors, spot inserts for individual pipe hangers and shall be as manufactured by B-Line Systems, Inc. or equal and shall be as follows:
   a. Continuous concrete inserts shall be used where applicable and shall be used for hanger rod sizes up to and including 3/4" diameter. Inserts to be used where supports are parallel to the main slab reinforcement shall be B221, B321, or B521 by B-Line Systems, Inc. or equal.
   b. Spot concrete inserts shall be used where applicable and shall be used for hanger sizes up to and including 7/8" diameter. Inserts shall be figures B2505 thru B2508, B2500, or B3014 by B-Line Systems, Inc. or equal.

M. Riser Clamps:

1. Riser piping shall be supported independently of any connected horizontal piping of possible. Provide supplementary steel or concrete supports for clamps. The clamps shall not be supported by the sleeves.
2. Support all vertical runs of ambient piping at each floor or as specified with B-Line Systems, Inc. figures B3373, B3131, B3373CT as required or equal.

N. Saddles:

1. Pipe covering protection saddles shall be used in conjunction with all insulated cold pipe lines. All saddles shall be centered on the piping and in the hangers.
2. Saddles for all insulated piping shall be galvanized sheet metal saddle shields of adequate size to cover the bottom 120 degrees of the pipe insulation. The shields shall be properly curved to evenly contact the outside circumference of the insulation and shall have rounded corners (1/2" radius). The length of the shields shall be as recommended by the pipe insulation manufacturer for the pipe size, insulation thickness and hanger spacing, but in shields shall be constructed of sheet metal of gauges not less than that listed below:

Pipe Size	Min. Gauge	Min. Length
Up thru 3"	18 gauge	12" long
3-1/2 thru 5"	16 gauge	16" long
6" and 8"	14 gauge	20" long
10" and 12"	12 gauge	24" long

3.4 PIPING shall be installed and connected to the equipment essentially as indicated on the drawings, in a neat and workmanlike manner. Unless specifically noted otherwise, all piping shall be concealed above ceilings and in chases.

3.5 ALL PIPING and equipment shall be supported by the building structure. Unless specifically noted otherwise, no piping or equipment shall be supported from ductwork, other piping, plenum construction or other equipment.

3.6 ALL PIPING shall be installed and arranged to allow free movement to the piping due to expansion, contraction, building movement, etc. without putting excessive stress or strain into the piping or equipment. All piping, risers, runouts, etc. subject to deflection by expansion and contraction shall be cold-sprung 50% of the deflection required to be absorbed. All sleeves and

other openings in the construction shall be of sufficient size and spaced so as to allow for the necessary pipe movement without undue stress on piping. Risers shall be free to travel as required with the horizontal piping. Piping runouts to and from risers shall be absorbed and still maintain the specified pitch for the runouts and piping to and from the risers.

3.7 PIPING and equipment suspended from steel construction shall be suspended from beams or from the panel points of the bar joist only. When the hanger point is not directly below a structural member or a joist panel point, supplementary supporting steel shall be provided across the structural members or bridge joists as required to receive the hanger. The hangers and supporting steel shall not be attached to the roof deck construction.

3.8 ALL VERTICAL PIPING shall be installed plum and true. Horizontal piping specified to be graded shall be installed at a straight and uniform grade without pockets. Horizontal piping not specified to be graded, shall be installed in a straight and true manner.

3.9 All piping suspended from structure, where the distance from the top of the duct or equipment to the bottom of the structure is more than six (6) inches, shall be provided with siesmic cable restraints as detailed in Vibration Mounting and Control, Inc. Drawing # 33557 or 33558 as appropriate. Cabling system shall be sized and installed in strict accordance with manufacturer's recommendations for compliance with Standard Building Code Section 1206.

3.10 ALL PIPING SYSTEMS shall be arranged to drain to one or more low points. Each low point shall be equipped with a hose and valve drain connection.

3.11 UNIONS and/or companion flanges shall be provided at all equipment connections and elsewhere as indicated on the drawings or as required for easy removal of equipment.

3.12 INSULATION

A. Insulate refrigerant piping as specified in section 230700 of these specifications.

END OF SECTION 232300