



Purchasing Division
 2019 Washington Street East
 Post Office Box 50130
 Charleston, WV 25305-0130

State of West Virginia
 Request for Quotation
 09 - Construction

Proc Folder: 288932

Doc Description: MATERIALS & LABOR TO REPLACE CHILLER

Proc Type: Central Purchase Order

Date Issued	Solicitation Closes	Solicitation No	Version
2017-01-19	2017-02-16 13:30:00	CRFQ 0705 LOT1700000004	1

BID RECEIVING LOCATION

BID CLERK
 DEPARTMENT OF ADMINISTRATION
 PURCHASING DIVISION
 2019 WASHINGTON ST E
 CHARLESTON WV 25305
 US

VENDOR

Vendor Name, Address and Telephone Number:

02/23/17 13:17:19
 WV Purchasing Division

FOR INFORMATION CONTACT THE BUYER

Michelle L Childers
 (304) 558-2063
 michelle.l.childers@wv.gov

Signature X

FEIN #

55-0749511-001

DATE

2/22/2017

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION:

Request for Quotation

The West Virginia Purchasing Division is soliciting bids on behalf of the West Virginia Lottery to establish a contract for the one time purchase of a chiller replacement as indicated in Exhibit B.

The Vendor shall furnish all materials, labor, and equipment necessary to complete all Construction Services. The Vendor shall furnish any incidental work, materials, labor, and equipment that are necessary to complete the Construction Services, even if such incidental work is not explicitly included in the specifications.

INVOICE TO		SHIP TO	
ACCOUNTS PAYABLE LOTTERY PO BOX 2067		PURCHASING LOTTERY 900 PENNSYLVANIA AVE	
CHARLESTON	WV25327-2067	CHARLESTON	WV 25302
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	MATERIALS & LABOR TO REPLACE CHILLER	1			90,387.00

Comm Code	Manufacturer	Specification	Model #
40101714			

Extended Description :

Lump sum amount for materials and labor.

LOT1700000004	Document Phase Draft	Document Description MATERIALS & LABOR TO REPLACE CHILLER	Page 3
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ADDITIONAL TERMS AND CONDITIONS

See attached document(s) for additional Terms and Conditions

ADDITIONAL TERMS AND CONDITIONS (Construction Contracts Only)

1. CONTRACTOR'S LICENSE: West Virginia Code § 21-11-2 requires that all persons desiring to perform contracting work in this state be licensed. The West Virginia Contractors Licensing Board is empowered to issue the contractor's license. Applications for a contractor's license may be made by contacting the West Virginia Division of Labor. West Virginia Code § 21-11-11 requires any prospective Vendor to include the contractor's license number on its bid. Failure to include a contractor's license number on the bid shall result in Vendor's bid being disqualified. Vendors should include a contractor's license number in the space provided below.

Contractor's Name: CIMCO, Inc.
 Contractor's License No.: WV-025512

The apparent successful Vendor must furnish a copy of its contractor's license prior to the issuance of a Award Document.

2. DRUG-FREE WORKPLACE AFFIDAVIT: W. Va. Code § 21-1D-5 provides that any solicitation for a public improvement contract requires each Vendor that submits a bid for the work to submit at the same time an affidavit that the Vendor has a written plan for a drug-free workplace policy. To comply with this law, Vendor must either complete the enclosed drug-free workplace affidavit and submit the same with its bid or complete a similar affidavit that fulfills all of the requirements of the applicable code. Failure to submit the signed and notarized drug-free workplace affidavit or a similar affidavit that fully complies with the requirements of the applicable code, with the bid shall result in disqualification of Vendor's bid. Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is \$100,000 or less or temporary or emergency repairs.

2.1. DRUG-FREE WORKPLACE POLICY: Pursuant to W. Va. Code § 21-1D-4, Vendor and its subcontractors must implement and maintain a written drug-free workplace policy that complies with said article. The awarding public authority shall cancel this contract if: (1) Vendor fails to implement and maintain a written drug-free workplace policy described in the preceding paragraph, (2) Vendor fails to provide information regarding implementation of its drug-free workplace policy at the request of the public authority; or (3) Vendor provides to the public authority false information regarding the contractor's drug-free workplace policy.

Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is \$100,000 or less or temporary or emergency repairs.

3. DRUG FREE WORKPLACE REPORT: Pursuant to W. Va. Code § 21-1D-7b, no less than once per year, or upon completion of the project, every contractor shall provide a certified report to the public authority which let the contract. For contracts over \$25,000, the public authority shall be the West Virginia Purchasing Division. For contracts of \$25,000 or less, the public authority shall be the agency issuing the contract. The report shall include:

(1) Information to show that the education and training service to the requirements of West Virginia Code § 21-1D-5 was provided;

REQUEST FOR QUOTATION
Chiller Replacement

submit any warranty documents to the Agency project manager at final inspection.

11. FACILITIES ACCESS: Performance of Contract Services may require access cards and/or keys to gain entrance to Agency's facilities. In the event that access cards and/or keys are required:

11.1. Vendor must identify principal service personnel which will be issued access cards and/or keys to perform service.

11.2. Vendor will be responsible for controlling cards and keys and will pay replacement fee, if the cards or keys become lost or stolen.

11.3. Vendor shall notify Agency immediately of any lost, stolen, or missing card or key.

11.4. Anyone performing under this Contract will be subject to Agency's security protocol and procedures.

11.5. Vendor shall inform all staff of Agency's security protocol and procedures.

12. MISCELLANEOUS:

12.1. **Contract Manager:** During its performance of this Contract, Vendor must designate and maintain a primary contract manager responsible for overseeing Vendor's responsibilities under this Contract. The Contract manager must be available during normal business hours to address any customer service or other issues related to this Contract. Vendor should list its Contract manager and his or her contact information below.

Contract Manager: Josh Stephenson

Telephone Number: (304) 549-2793

Fax Number: (304) 397-4178

Email Address: Jstephenson@Cimcowv.com

REQUEST FOR QUOTATION
Chiller Replacement

EXHIBIT A – Pricing Page

DATE: 2/22/2017

NAME OF VENDOR: CIMCO, Inc.

The aforementioned, hereinafter called Vendor, being familiar with and understanding the Bidding Documents and also having examined the site and being familiar with all local conditions affecting the project hereby proposes to furnish all labor, material, equipment, supplies and transportation and to perform all Work in accordance with the Bidding Documents within the time set forth for the sum of:

BASE BID:

For the sum of: Ninety thousand three hundred eighty seven dollars
(\$ 90,387.00).

(Show amount in both words and numbers)



State of West Virginia
DRUG FREE WORKPLACE CONFORMANCE AFFIDAVIT
West Virginia Code §21-1D-5

STATE OF WEST VIRGINIA,
COUNTY OF Putnam, TO-WIT:

I, Josh Stephenson, after being first duly sworn, depose and state as follows:

1. I am an employee of Cimco Inc.; and,
(Company Name)
2. I do hereby attest that Cimco Inc.
(Company Name)

maintains a written plan for a drug-free workplace policy and that such plan and policy are in compliance with **West Virginia Code** §21-1D.

The above statements are sworn to under the penalty of perjury.

Printed Name: Josh Stephenson
 Signature: [Signature]
 Title: Service Division Manager
 Company Name: CIMCO, Inc.
 Date: 2/23/2017

Taken, subscribed and sworn to before me this 23 day of February, 2017.

By Commission expires April 3, 2024

(Seal)



OFFICIAL SEAL
 STATE OF WEST VIRGINIA
 NOTARY PUBLIC
 Cheryl L Griffith
 4810 Spring Hill Ave
 South Charleston WV 25309

[Signature]
 (Notary Public)

THIS AFFIDAVIT MUST BE SUBMITTED WITH THE BID IN ORDER TO COMPLY WITH WV CODE PROVISIONS. FAILURE TO INCLUDE THE AFFIDAVIT WITH THE BID SHALL RESULT IN DISQUALIFICATION OF THE BID.

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

Josh Stephenson, Service Division Manager
 (Name, Title)
Josh Stephenson Service Division Manager
 (Printed Name and Title)
2336 Virginia Ave. Hurricane, W.V. 25526
 (Address)
~~(304) 549-5874~~ (304) 549-2793 / (304) 397-4178
 (Phone Number) / (Fax Number)
jstephenson@CimcoWV.com
 (email address)

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through wvOASIS, I certify that I have reviewed this Solicitation in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

CIMCO, Inc.
 (Company)
[Signature] Service Division Manager
 (Authorized Signature) (Representative Name, Title)
Josh Stephenson Service Division Manager
 (Printed Name and Title of Authorized Representative)
2/22/2017
 (Date)
(304) 549-2793 / (304) 397-4178
 (Phone Number) (Fax Number)

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

MANDATE: Under W. Va. Code §5A-3-10a, no contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

EXCEPTION: The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Employer default" means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

"Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

AFFIRMATION: By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (W. Va. Code §61-5-3) that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: CIMCO, Inc.

Authorized Signature: [Signature] Date: 2/22/2017

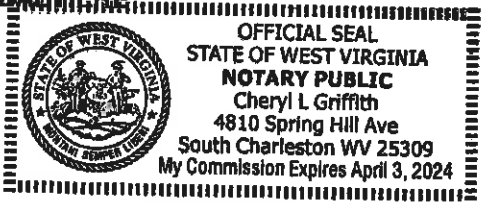
State of West Virginia

County of Putnam, to-wit:

Taken, subscribed, and sworn to before me this 22 day of February, 2017.

My Commission expires April 3, 2024.

AFFIX SEAL HERE



NOTARY PUBLIC [Signature]
Purchasing Affidavit (Revised 08/01/2015)

INSTRUCTIONS TO VENDORS SUBMITTING BIDS

1. REVIEW DOCUMENTS THOROUGHLY: The attached documents contain a solicitation for bids. Please read these instructions and all documents attached in their entirety. These instructions provide critical information about requirements that if overlooked could lead to disqualification of a Vendor's bid. All bids must be submitted in accordance with the provisions contained in these instructions and the Solicitation. Failure to do so may result in disqualification of Vendor's bid.

2. MANDATORY TERMS: The Solicitation may contain mandatory provisions identified by the use of the words "must," "will," and "shall." Failure to comply with a mandatory term in the Solicitation will result in bid disqualification.

3. PREBID MEETING: The item identified below shall apply to this Solicitation.

A pre-bid meeting will not be held prior to bid opening

A NON-MANDATORY PRE-BID meeting will be held at the following place and time:

A MANDATORY PRE-BID meeting will be held at the following place and time:

West Virginia Lottery
900 Pennsylvania Avenue
Charleston, WV

February 2, 2017 at 2:00 PM EST.

All Vendors submitting a bid must attend the mandatory pre-bid meeting. Failure to attend the mandatory pre-bid meeting shall result in disqualification of the Vendor's bid. No one person attending the pre-bid meeting may represent more than one Vendor.

An attendance sheet provided at the pre-bid meeting shall serve as the official document verifying attendance. The State will not accept any other form of proof or documentation to verify attendance. Any person attending the pre-bid meeting on behalf of a Vendor must list on the attendance sheet his or her name and the name of the Vendor he or she is representing.

Additionally, the person attending the pre-bid meeting should include the Vendor's E-Mail address, phone number, and Fax number on the attendance sheet. It is the Vendor's responsibility to locate the attendance sheet and provide the required information. Failure to complete the attendance sheet as required may result in disqualification of Vendor's bid.

All Vendors should arrive prior to the starting time for the pre-bid. Vendors who arrive after the starting time but prior to the end of the pre-bid will be permitted to sign in, but are charged with knowing all matters discussed at the pre-bid.

Questions submitted at least five business days prior to a scheduled pre-bid will be discussed at the pre-bid meeting if possible. Any discussions or answers to questions at the pre-bid meeting are preliminary in nature and are non-binding. Official and binding answers to questions will be published in a written addendum to the Solicitation prior to bid opening.

4. VENDOR QUESTION DEADLINE: Vendors may submit questions relating to this Solicitation to the Purchasing Division. Questions must be submitted in writing. All questions must be submitted on or before the date listed below and to the address listed below in order to be considered. A written response will be published in a Solicitation addendum if a response is possible and appropriate. Non-written discussions, conversations, or questions and answers regarding this Solicitation are preliminary in nature and are nonbinding.

Submitted e-mails should have solicitation number in the subject line.

Question Submission Deadline: February 9, 2017 at 9:00 AM EST.

Submit Questions to: Michelle Childers
 2019 Washington Street, East
 Charleston, WV 25305
 Fax: (304) 558-4115 (Vendors should not use this fax number for bid submission)
 Email: Michelle.L.Childers@wv.gov

5. VERBAL COMMUNICATION: Any verbal communication between the Vendor and any State personnel is not binding, including verbal communication at the mandatory pre-bid conference. Only information issued in writing and added to the Solicitation by an official written addendum by the Purchasing Division is binding.

6. BID SUBMISSION: All bids must be submitted electronically through wvOASIS or signed and delivered by the Vendor to the Purchasing Division at the address listed below on or before the date and time of the bid opening. Any bid received by the Purchasing Division staff is considered to be in the possession of the Purchasing Division and will not be returned for any reason. The Purchasing Division will not accept bids, modification of bids, or addendum acknowledgment forms via e-mail. Acceptable delivery methods include electronic submission via wvOASIS, hand delivery, delivery by courier, or facsimile.

The bid delivery address is:
 Department of Administration, Purchasing Division
 2019 Washington Street East
 Charleston, WV 25305-0130

A bid that is not submitted electronically through wvOASIS should contain the information listed below on the face of the envelope or the bid may be rejected by the Purchasing Division.:

SEALED BID:

BUYER:

SOLICITATION NO.:

BID OPENING DATE:

BID OPENING TIME:

FAX NUMBER:

The Purchasing Division may prohibit the submission of bids electronically through wvOASIS at its sole discretion. Such a prohibition will be contained and communicated in the wvOASIS system resulting in the Vendor's inability to submit bids through wvOASIS. Submission of a response to an Expression or Interest or Request for Proposal is not permitted in wvOASIS.

For Request For Proposal ("RFP") Responses Only: In the event that Vendor is responding to a request for proposal, the Vendor shall submit one original technical and one original cost proposal plus N/A convenience copies of each to the Purchasing Division at the address shown above. Additionally, the Vendor should identify the bid type as either a technical or cost proposal on the face of each bid envelope submitted in response to a request for proposal as follows:

BID TYPE: (This only applies to CRFP)

Technical

Cost

7. BID OPENING: Bids submitted in response to this Solicitation will be opened at the location identified below on the date and time listed below. Delivery of a bid after the bid opening date and time will result in bid disqualification. For purposes of this Solicitation, a bid is considered delivered when confirmation of delivery is provided by wvOASIS (in the case of electronic submission) or when the bid is time stamped by the official Purchasing Division time clock (in the case of hand delivery).

Bid Opening Date and Time: February 16, 2017 at 1:30 PM EST.

Bid Opening Location: Department of Administration, Purchasing Division
 2019 Washington Street East
 Charleston, WV 25305-0130

8. ADDENDUM ACKNOWLEDGEMENT: Changes or revisions to this Solicitation will be made by an official written addendum issued by the Purchasing Division. Vendor should acknowledge receipt of all addenda issued with this Solicitation by completing an Addendum Acknowledgment Form, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

9. BID FORMATTING: Vendor should type or electronically enter the information onto its bid to prevent errors in the evaluation. Failure to type or electronically enter the information may result in bid disqualification.

10. ALTERNATES: Any model, brand, or specification listed in this Solicitation establishes the acceptable level of quality only and is not intended to reflect a preference for, or in any way favor, a particular brand or vendor. Vendors may bid alternates to a listed model or brand provided that the alternate is at least equal to the model or brand and complies with the required specifications. The equality of any alternate being bid shall be determined by the State at its sole discretion. Any Vendor bidding an alternate model or brand should clearly identify the alternate items in its bid and should include manufacturer's specifications, industry literature, and/or any other relevant documentation demonstrating the equality of the alternate items. Failure to provide information for alternate items may be grounds for rejection of a Vendor's bid.

11. EXCEPTIONS AND CLARIFICATIONS: The Solicitation contains the specifications that shall form the basis of a contractual agreement. Vendor shall clearly mark any exceptions, clarifications, or other proposed modifications in its bid. Exceptions to, clarifications of, or modifications of a requirement or term and condition of the Solicitation may result in bid disqualification.

12. COMMUNICATION LIMITATIONS: In accordance with West Virginia Code of State Rules §148-1-6.6, communication with the State of West Virginia or any of its employees regarding this Solicitation during the solicitation, bid, evaluation or award periods, except through the Purchasing Division, is strictly prohibited without prior Purchasing Division approval. Purchasing Division approval for such communication is implied for all agency delegated and exempt purchases.

13. REGISTRATION: Prior to Contract award, the apparent successful Vendor must be properly registered with the West Virginia Purchasing Division and must have paid the \$125 fee, if applicable.

14. UNIT PRICE: Unit prices shall prevail in cases of a discrepancy in the Vendor's bid.

15. PREFERENCE: Vendor Preference may only be granted upon written request and only in accordance with the West Virginia Code § 5A-3-37 and the West Virginia Code of State Rules. A Vendor Preference Certificate form has been attached hereto to allow Vendor to apply for the preference. Vendor's failure to submit the Vendor Preference Certificate form with its bid will result in denial of Vendor Preference. Vendor Preference does not apply to construction projects.

16. SMALL, WOMEN-OWNED, OR MINORITY-OWNED BUSINESSES: For any solicitations publicly advertised for bid, in accordance with West Virginia Code §5A-3-37(a)(7) and W. Va. CSR § 148-22-9, any non-resident vendor certified as a small, women-owned, or minority-owned business under W. Va. CSR § 148-22-9 shall be provided the same preference made available to any resident vendor. Any non-resident small, women-owned, or minority-owned business must identify itself as such in writing, must submit that writing to the Purchasing Division with its bid, and must be properly certified under W. Va. CSR § 148-22-9 prior to contract award to receive the preferences made available to resident vendors. Preference for a non-resident small, women-owned, or minority owned business shall be applied in accordance with W. Va. CSR § 148-22-9.

17. WAIVER OF MINOR IRREGULARITIES: The Director reserves the right to waive minor irregularities in bids or specifications in accordance with West Virginia Code of State Rules § 148-1-4.6.

18. ELECTRONIC FILE ACCESS RESTRICTIONS: Vendor must ensure that its submission in wvOASIS can be accessed and viewed by the Purchasing Division staff immediately upon bid opening. The Purchasing Division will consider any file that cannot be immediately accessed and viewed at the time of the bid opening (such as, encrypted files, password protected files, or incompatible files) to be blank or incomplete as context requires, and are therefore unacceptable. A vendor will not be permitted to unencrypt files, remove password protections, or resubmit documents after bid opening to make a file viewable if those documents are required with the bid. A Vendor may be required to provide document passwords or remove access restrictions to allow the Purchasing Division to print or electronically save documents provided that those documents are viewable by the Purchasing Division prior to obtaining the password or removing the access restriction.

19. NON-RESPONSIBLE: The Purchasing Division Director reserves the right to reject the bid of any vendor as Non-Responsible in accordance with W. Va. Code of State Rules § 148-1-5.3, when the Director determines that the vendor submitting the bid does not have the capability to fully perform, or lacks the integrity and reliability to assure good-faith performance.”

20. ACCEPTANCE/REJECTION: The State may accept or reject any bid in whole, or in part in accordance with W. Va. Code of State Rules § 148-1-4.5. and § 148-1-6.4.b.”

21. YOUR SUBMISSION IS A PUBLIC DOCUMENT: Vendor's entire response to the Solicitation and the resulting Contract are public documents. As public documents, they will be disclosed to the public following the bid/proposal opening or award of the contract, as required by the competitive bidding laws of West Virginia Code §§ 5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq. and the Freedom of Information Act West Virginia Code §§ 29B-1-1 et seq.

DO NOT SUBMIT MATERIAL YOU CONSIDER TO BE CONFIDENTIAL, A TRADE SECRET, OR OTHERWISE NOT SUBJECT TO PUBLIC DISCLOSURE.

Submission of any bid, proposal, or other document to the Purchasing Division constitutes your explicit consent to the subsequent public disclosure of the bid, proposal, or document. The Purchasing Division will disclose any document labeled "confidential," "proprietary," "trade secret," "private," or labeled with any other claim against public disclosure of the documents, to include any "trade secrets" as defined by West Virginia Code § 47-22-1 et seq. All submissions are subject to public disclosure without notice.

GENERAL TERMS AND CONDITIONS:

- 1. CONTRACTUAL AGREEMENT:** Issuance of a Award Document signed by the Purchasing Division Director, or his designee, and approved as to form by the Attorney General's office constitutes acceptance of this Contract made by and between the State of West Virginia and the Vendor. Vendor's signature on its bid signifies Vendor's agreement to be bound by and accept the terms and conditions contained in this Contract.
- 2. DEFINITIONS:** As used in this Solicitation/Contract, the following terms shall have the meanings attributed to them below. Additional definitions may be found in the specifications included with this Solicitation/Contract.
- 2.1. "Agency" or "Agencies"** means the agency, board, commission, or other entity of the State of West Virginia that is identified on the first page of the Solicitation or any other public entity seeking to procure goods or services under this Contract.
- 2.2. "Bid" or "Proposal"** means the vendors submitted response to this solicitation.
- 2.3. "Contract"** means the binding agreement that is entered into between the State and the Vendor to provide the goods or services requested in the Solicitation.
- 2.4. "Director"** means the Director of the West Virginia Department of Administration, Purchasing Division.
- 2.5. "Purchasing Division"** means the West Virginia Department of Administration, Purchasing Division.
- 2.6. "Award Document"** means the document signed by the Agency and the Purchasing Division, and approved as to form by the Attorney General, that identifies the Vendor as the contract holder.
- 2.7. "Solicitation"** means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.
- 2.8. "State"** means the State of West Virginia and/or any of its agencies, commissions, boards, etc. as context requires.
- 2.9. "Vendor" or "Vendors"** means any entity submitting a bid in response to the Solicitation, the entity that has been selected as the lowest responsible bidder, or the entity that has been awarded the Contract as context requires.

3. CONTRACT TERM; RENEWAL; EXTENSION: The term of this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below:

Term Contract

Initial Contract Term: This Contract becomes effective on _____ and extends for a period of _____ year(s).

Renewal Term: This Contract may be renewed upon the mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any request for renewal should be submitted to the Purchasing Division thirty (30) days prior to the expiration date of the initial contract term or appropriate renewal term. A Contract renewal shall be in accordance with the terms and conditions of the original contract. Renewal of this Contract is limited to _____ successive one (1) year periods or multiple renewal periods of less than one year, provided that the multiple renewal periods do not exceed _____ months in total. Automatic renewal of this Contract is prohibited. Notwithstanding the foregoing, Purchasing Division approval is not required on agency delegated or exempt purchases. Attorney General approval may be required for vendor terms and conditions.

Delivery Order Limitations: In the event that this contract permits delivery orders, a delivery order may only be issued during the time this Contract is in effect. Any delivery order issued within one year of the expiration of this Contract shall be effective for one year from the date the delivery order is issued. No delivery order may be extended beyond one year after this Contract has expired.

Fixed Period Contract: This Contract becomes effective upon Vendor's receipt of the notice to proceed and must be completed within sixty (60) days.

Fixed Period Contract with Renewals: This Contract becomes effective upon Vendor's receipt of the notice to proceed and part of the Contract more fully described in the attached specifications must be completed within _____ days.

Upon completion, the vendor agrees that maintenance, monitoring, or warranty services will be provided for one year thereafter with an additional _____ successive one year renewal periods or multiple renewal periods of less than one year provided that the multiple renewal periods do not exceed _____ months in total. Automatic renewal of this Contract is prohibited.

One Time Purchase: The term of this Contract shall run from the issuance of the Award Document until all of the goods contracted for have been delivered, but in no event will this Contract extend for more than one fiscal year.

Other: See attached.

4. NOTICE TO PROCEED: Vendor shall begin performance of this Contract immediately upon receiving notice to proceed unless otherwise instructed by the Agency. Unless otherwise specified, the fully executed Award Document will be considered notice to proceed.

5. QUANTITIES: The quantities required under this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below.

Open End Contract: Quantities listed in this Solicitation are approximations only, based on estimates supplied by the Agency. It is understood and agreed that the Contract shall cover the quantities actually ordered for delivery during the term of the Contract, whether more or less than the quantities shown.

Service: The scope of the service to be provided will be more clearly defined in the specifications included herewith.

Combined Service and Goods: The scope of the service and deliverable goods to be provided will be more clearly defined in the specifications included herewith.

One Time Purchase: This Contract is for the purchase of a set quantity of goods that are identified in the specifications included herewith. Once those items have been delivered, no additional goods may be procured under this Contract without an appropriate change order approved by the Vendor, Agency, Purchasing Division, and Attorney General's office.

6. EMERGENCY PURCHASES: The Purchasing Division Director may authorize the Agency to purchase goods or services in the open market that Vendor would otherwise provide under this Contract if those goods or services are for immediate or expedited delivery in an emergency. Emergencies shall include, but are not limited to, delays in transportation or an unanticipated increase in the volume of work. An emergency purchase in the open market, approved by the Purchasing Division Director, shall not constitute of breach of this Contract and shall not entitle the Vendor to any form of compensation or damages. This provision does not excuse the State from fulfilling its obligations under a One Time Purchase contract.

7. REQUIRED DOCUMENTS: All of the items checked below must be provided to the Purchasing Division by the Vendor as specified below.

BID BOND (Construction Only): Pursuant to the requirements contained in W. Va. Code § 5-22-1(c), All Vendors submitting a bid on a construction project shall furnish a valid bid bond in the amount of five percent (5%) of the total amount of the bid protecting the State of West Virginia. The bid bond must be submitted with the bid.

PERFORMANCE BOND: The apparent successful Vendor shall provide a performance bond in the amount of _____. The performance bond must be received by the Purchasing Division prior to Contract award. On construction contracts, the performance bond must be 100% of the Contract value.

LABOR/MATERIAL PAYMENT BOND: The apparent successful Vendor shall provide a labor/material payment bond in the amount of 100% of the Contract value. The labor/material payment bond must be delivered to the Purchasing Division prior to Contract award. In lieu of the Bid Bond, Performance Bond, and Labor/Material Payment Bond, the Vendor may provide certified checks, cashier's checks, or irrevocable letters of credit. Any certified check, cashier's check, or irrevocable letter of credit provided in lieu of a bond must be of the same amount and delivered on the same schedule as the bond it replaces. A letter of credit submitted in lieu of a performance and labor/material payment bond will only be allowed for projects under \$100,000. Personal or business checks are not acceptable.

MAINTENANCE BOND: The apparent successful Vendor shall provide a two (2) year maintenance bond covering the roofing system. The maintenance bond must be issued and delivered to the Purchasing Division prior to Contract award.

LICENSE(S) / CERTIFICATIONS / PERMITS: In addition to anything required under the Section entitled Licensing, of the General Terms and Conditions, the apparent successful Vendor shall furnish proof of the following licenses, certifications, and/or permits prior to Contract award, in a form acceptable to the Purchasing Division.

WV Contractor's License

The apparent successful Vendor shall also furnish proof of any additional licenses or certifications contained in the specifications prior to Contract award regardless of whether or not that requirement is listed above.

8. INSURANCE: The apparent successful Vendor shall furnish proof of the insurance identified by a checkmark below prior to Contract award. Subsequent to contract award, and prior to the insurance expiration date, Vendor shall provide the Agency with proof that the insurance mandated herein has been continued. Vendor must also provide Agency with immediate notice of any changes in its insurance policies mandated herein, including but not limited to, policy cancelation, policy reduction, or change in insurers. The insurance coverages identified below must be maintained throughout the life of this contract. The apparent successful Vendor shall also furnish proof of any additional insurance requirements contained in the specifications prior to Contract award regardless of whether or not that insurance requirement is listed in this section.

Vendor must maintain:

Commercial General Liability Insurance in at least an amount of:
\$500,000.00

Automobile Liability Insurance in at least an amount of: _____

Professional/Malpractice/Errors and Omission Insurance in at least an amount of: _____

Commercial Crime and Third Party Fidelity Insurance in an amount of: _____

Cyber Liability Insurance in an amount of: _____

Builders Risk Insurance in an amount equal to 100% of the amount of the Contract.

9. WORKERS' COMPENSATION INSURANCE: The apparent successful Vendor shall comply with laws relating to workers compensation, shall maintain workers' compensation insurance when required, and shall furnish proof of workers' compensation insurance upon request.

10. LITIGATION BOND: The Director reserves the right to require any Vendor that files a protest of an award to submit a litigation bond in the amount equal to one percent of the lowest bid submitted or \$5,000, whichever is greater. The entire amount of the bond shall be forfeited if the hearing officer determines that the protest was filed for frivolous or improper purpose, including but not limited to, the purpose of harassing, causing unnecessary delay, or needless expense for the Agency. All litigation bonds shall be made payable to the Purchasing Division. In lieu of a bond, the protester may submit a cashier's check or certified check payable to the Purchasing Division. Cashier's or certified checks will be deposited with and held by the State Treasurer's office. If it is determined that the protest has not been filed for frivolous or improper purpose, the bond or deposit shall be returned in its entirety.

11. LIQUIDATED DAMAGES: Vendor shall pay liquidated damages in the amount of

for _____.

This clause shall in no way be considered exclusive and shall not limit the State or Agency's right to pursue any other available remedy.

12. ACCEPTANCE: Vendor's signature on its bid, or on the certification and signature page, constitutes an offer to the State that cannot be unilaterally withdrawn, signifies that the product or service proposed by vendor meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise indicated, and signifies acceptance of the terms and conditions contained in the Solicitation unless otherwise indicated.

13. PRICING: The pricing set forth herein is firm for the life of the Contract, unless specified elsewhere within this Solicitation/Contract by the State. A Vendor's inclusion of price adjustment provisions in its bid, without an express authorization from the State in the Solicitation to do so, may result in bid disqualification.

14. PAYMENT: Payment in advance is prohibited under this Contract. Payment may only be made after the delivery and acceptance of goods or services. The Vendor shall submit invoices, in arrears.

15. PURCHASING CARD ACCEPTANCE: The State of West Virginia currently utilizes a Purchasing Card program, administered under contract by a banking institution, to process payment for goods and services. The Vendor must accept the State of West Virginia's Purchasing Card for payment of all orders under this Contract unless the box below is checked.

Vendor is not required to accept the State of West Virginia's Purchasing Card as payment for all goods and services.

16. TAXES: The Vendor shall pay any applicable sales, use, personal property or any other taxes arising out of this Contract and the transactions contemplated thereby. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.

17. ADDITIONAL FEES: Vendor is not permitted to charge additional fees or assess additional charges that were not either expressly provided for in the solicitation published by the State of West Virginia or included in the unit price or lump sum bid amount that Vendor is required by the solicitation to provide. Including such fees or charges as notes to the solicitation may result in rejection of vendor's bid. Requesting such fees or charges be paid after the contract has been awarded may result in cancellation of the contract.

18. FUNDING: This Contract shall continue for the term stated herein, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise made available, this Contract becomes void and of no effect beginning on July 1 of the fiscal year for which funding has not been appropriated or otherwise made available.

19. CANCELLATION: The Purchasing Division Director reserves the right to cancel this Contract immediately upon written notice to the vendor if the materials or workmanship supplied do not conform to the specifications contained in the Contract. The Purchasing Division Director may also cancel any purchase or Contract upon 30 days written notice to the Vendor in accordance with West Virginia Code of State Rules § 148-1-5.2.b.

20. TIME: Time is of the essence with regard to all matters of time and performance in this Contract.

21. APPLICABLE LAW: This Contract is governed by and interpreted under West Virginia law without giving effect to its choice of law principles. Any information provided in specification manuals, or any other source, verbal or written, which contradicts or violates the West Virginia Constitution, West Virginia Code or West Virginia Code of State Rules is void and of no effect.

22. COMPLIANCE: Vendor shall comply with all applicable federal, state, and local laws, regulations and ordinances. By submitting a bid, Vendor acknowledges that it has reviewed, understands, and will comply with all applicable laws, regulations, and ordinances.

23. ARBITRATION: Any references made to arbitration contained in this Contract, Vendor's bid, or in any American Institute of Architects documents pertaining to this Contract are hereby deleted, void, and of no effect.

24. MODIFICATIONS: This writing is the parties' final expression of intent. Notwithstanding anything contained in this Contract to the contrary no modification of this Contract shall be binding without mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any change to existing contracts that adds work or changes contract cost, and were not included in the original contract, must be approved by the Purchasing Division and the Attorney General's Office (as to form) prior to the implementation of the change or commencement of work affected by the change.

25. WAIVER: The failure of either party to insist upon a strict performance of any of the terms or provision of this Contract, or to exercise any option, right, or remedy herein contained, shall not be construed as a waiver or a relinquishment for the future of such term, provision, option, right, or remedy, but the same shall continue in full force and effect. Any waiver must be expressly stated in writing and signed by the waiving party.

26. SUBSEQUENT FORMS: The terms and conditions contained in this Contract shall supersede any and all subsequent terms and conditions which may appear on any form documents submitted by Vendor to the Agency or Purchasing Division such as price lists, order forms, invoices, sales agreements, or maintenance agreements, and includes internet websites or other electronic documents. Acceptance or use of Vendor's forms does not constitute acceptance of the terms and conditions contained thereon.

27. ASSIGNMENT: Neither this Contract nor any monies due, or to become due hereunder, may be assigned by the Vendor without the express written consent of the Agency, the Purchasing Division, the Attorney General's office (as to form only), and any other government agency or office that may be required to approve such assignments. Notwithstanding the foregoing, Purchasing Division approval may or may not be required on certain agency delegated or exempt purchases.

28. WARRANTY: The Vendor expressly warrants that the goods and/or services covered by this Contract will: (a) conform to the specifications, drawings, samples, or other description furnished or specified by the Agency; (b) be merchantable and fit for the purpose intended; and (c) be free from defect in material and workmanship.

29. STATE EMPLOYEES: State employees are not permitted to utilize this Contract for personal use and the Vendor is prohibited from permitting or facilitating the same.

30. BANKRUPTCY: In the event the Vendor files for bankruptcy protection, the State of West Virginia may deem this Contract null and void, and terminate this Contract without notice.

31. PRIVACY, SECURITY, AND CONFIDENTIALITY: The Vendor agrees that it will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the Agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the Agency's policies, procedures, and rules. Vendor further agrees to comply with the Confidentiality Policies and Information Security Accountability Requirements, set forth in <http://www.state.wv.us/admin/purchase/privacy/default.html>.

32. YOUR SUBMISSION IS A PUBLIC DOCUMENT: Vendor's entire response to the Solicitation and the resulting Contract are public documents. As public documents, they will be disclosed to the public following the bid/proposal opening or award of the contract, as required by the competitive bidding laws of West Virginia Code §§ 5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq. and the Freedom of Information Act West Virginia Code §§ 29B-1-1 et seq.

DO NOT SUBMIT MATERIAL YOU CONSIDER TO BE CONFIDENTIAL, A TRADE SECRET, OR OTHERWISE NOT SUBJECT TO PUBLIC DISCLOSURE.

Submission of any bid, proposal, or other document to the Purchasing Division constitutes your explicit consent to the subsequent public disclosure of the bid, proposal, or document. The Purchasing Division will disclose any document labeled "confidential," "proprietary," "trade secret," "private," or labeled with any other claim against public disclosure of the documents, to include any "trade secrets" as defined by West Virginia Code § 47-22-1 et seq. All submissions are subject to public disclosure without notice.

33. LICENSING: In accordance with West Virginia Code of State Rules § 148-1-6.1.e, Vendor must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agency or political subdivision. Upon request, the Vendor must provide all necessary releases to obtain information to enable the Purchasing Division Director or the Agency to verify that the Vendor is licensed and in good standing with the above entities.

34. ANTITRUST: In submitting a bid to, signing a contract with, or accepting a Award Document from any agency of the State of West Virginia, the Vendor agrees to convey, sell, assign, or transfer to the State of West Virginia all rights, title, and interest in and to all causes of action it may now or hereafter acquire under the antitrust laws of the United States and the State of West Virginia for price fixing and/or unreasonable restraints of trade relating to the particular commodities or services purchased or acquired by the State of West Virginia. Such assignment shall be made and become effective at the time the purchasing agency tenders the initial payment to Vendor.

35. VENDOR CERTIFICATIONS: By signing its bid or entering into this Contract, Vendor certifies (1) that its bid or offer was made without prior understanding, agreement, or connection with any corporation, firm, limited liability company, partnership, person or entity submitting a bid or offer for the same material, supplies, equipment or services; (2) that its bid or offer is in all respects fair and without collusion or fraud; (3) that this Contract is accepted or entered into without any prior understanding, agreement, or connection to any other entity that could be considered a violation of law; and (4) that it has reviewed this Solicitation in its entirety; understands the requirements, terms and conditions, and other information contained herein.

Vendor's signature on its bid or offer also affirms that neither it nor its representatives have any interest, nor shall acquire any interest, direct or indirect, which would compromise the performance of its services hereunder. Any such interests shall be promptly presented in detail to the Agency. The individual signing this bid or offer on behalf of Vendor certifies that he or she is authorized by the Vendor to execute this bid or offer or any documents related thereto on Vendor's behalf; that he or she is authorized to bind the Vendor in a contractual relationship; and that, to the best of his or her knowledge, the Vendor has properly registered with any State agency that may require registration.

36. VENDOR RELATIONSHIP: The relationship of the Vendor to the State shall be that of an independent contractor and no principal-agent relationship or employer-employee relationship is contemplated or created by this Contract. The Vendor as an independent contractor is solely liable for the acts and omissions of its employees and agents. Vendor shall be responsible for selecting, supervising, and compensating any and all individuals employed pursuant to the terms of this Solicitation and resulting contract. Neither the Vendor, nor any employees or subcontractors of the Vendor, shall be deemed to be employees of the State for any purpose whatsoever. Vendor shall be exclusively responsible for payment of employees and contractors for all wages and salaries, taxes, withholding payments, penalties, fees, fringe benefits, professional liability insurance premiums, contributions to insurance and pension, or other deferred compensation plans, including but not limited to, Workers' Compensation and Social Security obligations, licensing fees, etc. and the filing of all necessary documents, forms, and returns pertinent to all of the foregoing.

Vendor shall hold harmless the State, and shall provide the State and Agency with a defense against any and all claims including, but not limited to, the foregoing payments, withholdings, contributions, taxes, Social Security taxes, and employer income tax returns.

37. INDEMNIFICATION: The Vendor agrees to indemnify, defend, and hold harmless the State and the Agency, their officers, and employees from and against: (1) Any claims or losses for services rendered by any subcontractor, person, or firm performing or supplying services, materials, or supplies in connection with the performance of the Contract; (2) Any claims or losses resulting to any person or entity injured or damaged by the Vendor, its officers, employees, or subcontractors by the publication, translation, reproduction, delivery, performance, use, or disposition of any data used under the Contract in a manner not authorized by the Contract, or by Federal or State statutes or regulations; and (3) Any failure of the Vendor, its officers, employees, or subcontractors to observe State and Federal laws including, but not limited to, labor and wage and hour laws.

38. PURCHASING AFFIDAVIT: In accordance with West Virginia Code § 5A-3-10a, all Vendors are required to sign, notarize, and submit the Purchasing Affidavit stating that neither the Vendor nor a related party owe a debt to the State in excess of \$1,000. The affidavit must be submitted prior to award, but should be submitted with the Vendor's bid. A copy of the Purchasing Affidavit is included herewith.

39. ADDITIONAL AGENCY AND LOCAL GOVERNMENT USE: This Contract may be utilized by other agencies, spending units, and political subdivisions of the State of West Virginia; county, municipal, and other local government bodies; and school districts (“Other Government Entities”). Any extension of this Contract to the aforementioned Other Government Entities must be on the same prices, terms, and conditions as those offered and agreed to in this Contract, provided that such extension is in compliance with the applicable laws, rules, and ordinances of the Other Government Entity. If the Vendor does not wish to extend the prices, terms, and conditions of its bid and subsequent contract to the Other Government Entities, the Vendor must clearly indicate such refusal in its bid. A refusal to extend this Contract to the Other Government Entities shall not impact or influence the award of this Contract in any manner.

40. CONFLICT OF INTEREST: Vendor, its officers or members or employees, shall not presently have or acquire an interest, direct or indirect, which would conflict with or compromise the performance of its obligations hereunder. Vendor shall periodically inquire of its officers, members and employees to ensure that a conflict of interest does not arise. Any conflict of interest discovered shall be promptly presented in detail to the Agency.

41. REPORTS: Vendor shall provide the Agency and/or the Purchasing Division with the following reports identified by a checked box below:

Such reports as the Agency and/or the Purchasing Division may request. Requested reports may include, but are not limited to, quantities purchased, agencies utilizing the contract, total contract expenditures by agency, etc.

Quarterly reports detailing the total quantity of purchases in units and dollars, along with a listing of purchases by agency. Quarterly reports should be delivered to the Purchasing Division via email at purchasing.requisitions@wv.gov.

42. BACKGROUND CHECK: In accordance with W. Va. Code § 15-2D-3, the Director of the Division of Protective Services shall require any service provider whose employees are regularly employed on the grounds or in the buildings of the Capitol complex or who have access to sensitive or critical information to submit to a fingerprint-based state and federal background inquiry through the state repository. The service provider is responsible for any costs associated with the fingerprint-based state and federal background inquiry.

After the contract for such services has been approved, but before any such employees are permitted to be on the grounds or in the buildings of the Capitol complex or have access to sensitive or critical information, the service provider shall submit a list of all persons who will be physically present and working at the Capitol complex to the Director of the Division of Protective Services for purposes of verifying compliance with this provision. The State reserves the right to prohibit a service provider’s employees from accessing sensitive or critical information or to be present at the Capitol complex based upon results addressed from a criminal background check.

Service providers should contact the West Virginia Division of Protective Services by phone at (304) 558-9911 for more information.

43. PREFERENCE FOR USE OF DOMESTIC STEEL PRODUCTS: Except when authorized by the Director of the Purchasing Division pursuant to W. Va. Code § 5A-3-56, no contractor may use or supply steel products for a State Contract Project other than those steel products made in the United States. A contractor who uses steel products in violation of this section may be subject to civil penalties pursuant to W. Va. Code § 5A-3-56. As used in this section:

a. "State Contract Project" means any erection or construction of, or any addition to, alteration of or other improvement to any building or structure, including, but not limited to, roads or highways, or the installation of any heating or cooling or ventilating plants or other equipment, or the supply of and materials for such projects, pursuant to a contract with the State of West Virginia for which bids were solicited on or after June 6, 2001.

b. "Steel Products" means products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two or more or such operations, from steel made by the open heath, basic oxygen, electric furnace, Bessemer or other steel making process. The Purchasing Division Director may, in writing, authorize the use of foreign steel products if:

c. The cost for each contract item used does not exceed one tenth of one percent (.1%) of the total contract cost or two thousand five hundred dollars (\$2,500.00), whichever is greater. For the purposes of this section, the cost is the value of the steel product as delivered to the project; or

d. The Director of the Purchasing Division determines that specified steel materials are not produced in the United States in sufficient quantity or otherwise are not reasonably available to meet contract requirements.

44. PREFERENCE FOR USE OF DOMESTIC ALUMINUM, GLASS, AND STEEL: In Accordance with W. Va. Code § 5-19-1 et seq., and W. Va. CSR § 148-10-1 et seq., for every contract or subcontract, subject to the limitations contained herein, for the construction, reconstruction, alteration, repair, improvement or maintenance of public works or for the purchase of any item of machinery or equipment to be used at sites of public works, only domestic aluminum, glass or steel products shall be supplied unless the spending officer determines, in writing, after the receipt of offers or bids, (1) that the cost of domestic aluminum, glass or steel products is unreasonable or inconsistent with the public interest of the State of West Virginia, (2) that domestic aluminum, glass or steel products are not produced in sufficient quantities to meet the contract requirements, or (3) the available domestic aluminum, glass, or steel do not meet the contract specifications. This provision only applies to public works contracts awarded in an amount more than fifty thousand dollars (\$50,000) or public works contracts that require more than ten thousand pounds of steel products.

The cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than twenty percent (20%) of the bid or offered price for foreign made aluminum, glass, or steel products. If the domestic aluminum, glass or steel products to be supplied or produced in a "substantial labor surplus area", as defined by the United States Department of Labor, the cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than thirty percent (30%) of the bid or offered price for foreign made aluminum, glass, or steel products. This preference shall be applied to an item of machinery or equipment, as indicated above, when the item is a single unit of equipment or machinery manufactured primarily of aluminum, glass or steel, is part of a public works contract and has the sole purpose or of being a permanent part of a single public works project. This provision does not apply to equipment or machinery purchased by a spending unit for use by that spending unit and not as part of a single public works project.

All bids and offers including domestic aluminum, glass or steel products that exceed bid or offer prices including foreign aluminum, glass or steel products after application of the preferences provided in this provision may be reduced to a price equal to or lower than the lowest bid or offer price for foreign aluminum, glass or steel products plus the applicable preference. If the reduced bid or offer prices are made in writing and supersede the prior bid or offer prices, all bids or offers, including the reduced bid or offer prices, will be reevaluated in accordance with this rule.

- (2) The name of the laboratory certified by the United States Department of Health and Human Services or its successor that performs the drug tests;
- (3) The average number of employees in connection with the construction on the public improvement;
- (4) Drug test results for the following categories including the number of positive tests and the number of negative tests: (A) Pre-employment and new hires; (B) Reasonable suspicion; (C) Post-accident; and (D) Random.

Vendor should utilize the attached Certified Drug Free Workplace Report Coversheet when submitting the report required hereunder. Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is \$100,000 or less or temporary or emergency repairs.

4. AIA DOCUMENTS: All construction contracts that will be completed in conjunction with architectural services procured under Chapter 5G of the West Virginia Code will be governed by the AIA A101-2007 and A201-2007 or the A107-2007 documents, as amended by the Supplementary Conditions for the State of West Virginia, in addition to the terms and conditions contained herein.

5. GREEN BUILDINGS MINIMUM ENERGY STANDARDS: In accordance with § 22-29-4, all new building construction projects of public agencies that have not entered the schematic design phase prior to July 1, 2012, or any building construction project receiving state grant funds and appropriations, including public schools, that have not entered the schematic design phase prior to July 1, 2012, shall be designed and constructed complying with the ICC International Energy Conservation Code, adopted by the State Fire Commission, and the ANSI/ASHRAE/IESNA Standard 90.1-2007: Provided, That if any construction project has a commitment of federal funds to pay for a portion of such project, this provision shall only apply to the extent such standards are consistent with the federal standards.

6. LOCAL LABOR MARKET HIRING REQUIREMENT: Pursuant to West Virginia Code §21-1C-1 et seq., Employers shall hire at least seventy-five percent of employees for public improvement construction projects from the local labor market, to be rounded off, with at least two employees from outside the local labor market permissible for each employer per project.

Any employer unable to employ the minimum number of employees from the local labor market shall inform the nearest office of the bureau of employment programs' division of employment services of the number of qualified employees needed and provide a job description of the positions to be filled.

If, within three business days following the placing of a job order, the division is unable to refer any qualified job applicants to the employer or refers less qualified job applicants than the number requested, then the division shall issue a waiver to the employer stating the unavailability of applicant and shall permit the employer to fill any positions covered by the waiver from outside the local labor market. The waiver shall be either oral or in writing and shall be issued within the prescribed three days. A waiver certificate shall be sent to both the employer for its permanent project records and to the public authority.

Any employer who violates any provision of this article is subject to a civil penalty of one hundred dollars per day of violation. The West Virginia Division of Labor is responsible for establishing procedures for the collection of civil penalties.

The following terms used in this section have the meaning shown below.

(1) The term "construction project" means any construction, reconstruction, improvement, enlargement, painting, decorating or repair of any public improvement let to contract in an amount equal to or greater than \$500,000. The term "construction project" does not include temporary or emergency repairs;

(2) The term "employee" means any person hired or permitted to perform hourly work for wages by a person, firm or corporation in the construction industry; The term "employee" does not include:(i) Bona fide employees of a public authority or individuals engaged in making temporary or emergency repairs;(ii) Bona fide independent contractors; or(iii) Salaried supervisory personnel necessary to assure efficient execution of the employee's work;

(3) The term "employer" means any person, firm or corporation employing one or more employees on any public improvement and includes all contractors and subcontractors;

(4) The term "local labor market" means every county in West Virginia and any county outside of West Virginia if any portion of that county is within fifty miles of the border of West Virginia;

(5) The term "public improvement" includes the construction of all buildings, roads, highways, bridges, streets, alleys, sewers, ditches, sewage disposal plants, waterworks, airports and all other structures that may be let to contract by a public authority, excluding improvements funded, in whole or in part, by federal funds.

7. DAVIS-BACON AND RELATED ACT WAGE RATES:

- The work performed under this contract is federally funded in whole, or in part. Pursuant to _____, Vendors are required to pay applicable Davis-Bacon wage rates.
- The work performed under this contract is not subject to Davis-Bacon wage rates.

8. SUBCONTRACTOR LIST SUBMISSION: In accordance with W. Va. Code § 5-22-1, the apparent low bidder on a contract valued at more than \$250,000.00 for the construction, alteration, decoration, painting or improvement of a new or existing building or structure shall submit a list of all subcontractors who will perform more than \$25,000.00 of work on the project including labor and materials. If no subcontractors who will perform more than \$25,000.00 of work are to be used to complete the project, it must be noted on the subcontractor list. Failure to submit the subcontractor list within one business day after the deadline for submitting bids shall result in disqualification of the bid. This provision does not apply to any other construction projects, such as highway, mine reclamation, water or sewer projects.

a. Required Information. The subcontractor list shall contain the following information:

- i. Bidder's name
- ii. Name of each subcontractor performing more than \$25,000 of work on the project.

iii. The license number of each subcontractor, as required by W. Va. Code § 21-11-1 et. seq.

iv. If applicable, a notation that no subcontractor will be used to perform more than \$25,000.00 of work.

b. Subcontractor List Submission Form: The subcontractor list may be submitted in any form, including the attached form, as long as the required information noted above is included. If any information is missing from the bidder's subcontractor list submission, it may be obtained from other documents such as bids, emails, letters, etc. that accompany the subcontractor list submission.

c. Submission of Subcontractor List for Solicitations with Additions/Alternates: If the solicitation contains potential additions or alternates that will be selected by the Agency after bid opening and prior to contract award, **all bidders must submit the subcontractor list to the Purchasing Division within one business day of the opening of bids for review.** A bidder's failure to submit the subcontractor list within one business day after the deadline for submitting bids shall result in disqualification of the bidder's bid.

d. Substitution of Subcontractor. Written approval must be obtained from the State Spending Unit before any subcontractor substitution is permitted. Substitutions are not permitted unless:

- i. The subcontractor listed in the original bid has filed for bankruptcy;
- ii. The subcontractor in the original bid has been debarred or suspended; or
- iii. The contractor certifies in writing that the subcontractor listed in the original bid fails, is unable, or refuses to perform his subcontract.

REQUEST FOR QUOTATION
Chiller Replacement

GENERAL CONSTRUCTION SPECIFICATIONS (No AIA Documents)

- 1. PURPOSE AND SCOPE:** The West Virginia Purchasing Division is soliciting bids on behalf of the West Virginia Lottery to establish a contract for the one time purchase of a chiller replacement as indicated in Exhibit B.

The Vendor shall furnish all materials, labor, and equipment necessary to complete all Construction Services. The Vendor shall furnish any incidental work, materials, labor, and equipment that are necessary to complete the Construction Services, even if such incidental work is not explicitly included in the specifications.

- 2. DEFINITIONS:** The terms listed below shall have the meanings assigned to them below. Additional definitions can be found in section 2 of the General Terms and Conditions and in the Project Plans as defined below.

2.1 "Construction Services" means the removal and disposal of an existing 100 ton Trane chiller, the installation of a 75 ton air-cooled scroll chiller and the startup of the new chiller as more fully described in these specifications.

2.2 "Pricing Page" means the pages contained in wvOASIS, attached hereto as Exhibit A, or included in the Project Plans upon which Vendor should list its proposed price for the Construction Services.

2.3 "Solicitation" means the official notice of an opportunity to supply the State with Construction Services that is published by the Purchasing Division.

2.4 "Project Plans" means documents developed by an architect, an engineer, the Agency, or another design professional, which are attached hereto as Exhibit B, that provide detailed instructions on how the Construction Services are to be performed. In the event that Project Plans contain drawings or other documents too large to attach in Exhibit B, Vendors can obtain copies in accordance with Section 9 of these Specifications.

- 3. ORDER OF PRECEDENCE:** This General Construction Specifications document will have priority over, and supersede, anything contained in the Project Plans.

- 4. QUALIFICATIONS:** Vendor, or Vendor's staff if requirements are inherently limited to individuals rather than corporate entities, shall have the following minimum qualifications:

4.1. Experience: Vendor, or Vendor's supervisory staff assigned to this project, must have successfully completed at least five projects that involved work similar to that described in these specifications or the Project Plans. Compliance with this experience requirement will be determined prior to contract award by the State through references provided by

REQUEST FOR QUOTATION
Chiller Replacement

the Vendor upon request, through knowledge or documentation of the Vendor's past projects, through confirmation of experience requirements from the architect assisting the State in this project, or some other method that the State determines to be acceptable. Vendor must provide any documentation requested by the State to assist in confirmation of compliance with this provision. References, documentation, or other information to confirm compliance with this experience requirement may be requested after bid opening and prior to contract award.

4.2. The vendor shall possess the proper manufacturer's certification for the particular brand of equipment that is being installed.

5. **CONTRACT AWARD:** The Contract is intended to provide Agency with a purchase price for the Construction Services. The Contract will be awarded to the lowest qualified responsible bidder meeting the required specifications. If the Pricing Pages contain alternates/add-ons, the Contract will be awarded based on the grand total of the base bid and any alternates/add-ons selected.
6. **SELECTION OF ALTERNATES:** If the Pricing Pages contain alternates/add-ons, the alternates/add-ons will be selected as follows. The alternate/add-on will be selected in the order of priority listed on the Pricing Pages. The first alternate/add-on must be selected before the second alternate/add-on can be selected and so on.
7. **PERFORMANCE:** Vendor shall perform the Construction Services in accordance with this document and the Project Plans.
8. **SUBSTITUTIONS:** Any substitution requests must be submitted in accordance with the official question and answer period described in the INSTRUCTIONS TO VENDORS SUBMITTING BIDS, Paragraph 4. Vendor Question Deadline. Vendors submitting substitution requests should submit product brochures and product specifications during the official question and answer period.
9. **PROJECT PLANS:** The checked box will apply to Project Plans for this solicitation.
- No Additional Project Plan Documents:** There are no additional Project Plans other than those attached hereto as Exhibit B or any subsequent addenda modifying Exhibit B.
- Additional Project Plan Documents:** There are additional Project Plan documents other than those attached as Exhibit B. Copies of the additional Project Plan documents not attached as Exhibit B can be obtained by contacting the entity identified below.

REQUEST FOR QUOTATION
Chiller Replacement

10. CONDITIONS OF THE WORK

10.1. Permits: The Vendor shall procure all necessary permits and licenses to comply with all applicable Federal, State, or Local laws, regulations and ordinances of any regulating body.

10.2. Existing Conditions: If discrepancies are discovered between the existing conditions and those noted in the specifications, Vendor must immediately notify the Agency's representative. Vendor must also immediately notify the Agency if suspected hazardous materials are encountered.

10.3. Standard Work Hours: The standard hours of work for this Contract will be 7:00am – 5:00pm Est. Monday - Friday excluding holidays recognized by the State of West Virginia. Any work outside of the standard hours of work must be approved in advance at the Agency's sole discretion. Authorization of work outside of the standard hours of work will not entitle Vendor to additional compensation.

10.4. Project Closeout: Project Closeout shall include the following:

10.4.1. Final Cleanup: Vendor shall perform the final cleanup activities listed below, along with any other final cleanup activities normally associated with the work performed under this Contract, prior to final inspection:

10.4.1.1. Remove from the site all unused materials, equipment and debris associated with the work.

10.4.1.2. Remove and clean from the project area all dirt, stains, oil, grease, etc. associated with the work.

10.4.1.3. The project area shall be returned to the West Virginia Lottery in the same condition as it was prior to the start of the work.

10.4.2. Final Inspection: Vendor shall participate in a final inspection with the Agency's project manager. The purpose of the final inspection will be to identify deficiencies that need to be remedied prior to Agency's final acceptance of the work. Vendor shall at all times be obligated to perform in accordance with the Contract and must take all actions necessary to ensure that work complies with requirements of Contract prior to final acceptance. Final acceptance does not waive or release Vendor from its obligation to ensure that work complies with the Contract requirements. Vendor shall

REQUEST FOR QUOTATION
Chiller Replacement

EXHIBIT B – GENERAL REQUIREMENTS

1. The existing 100 ton Trane chiller shall be disconnected from the facility HVAC system and disposed offsite.
2. The new chiller shall be installed according to the manufacturer's technical specifications and safety precautions.
3. The new chiller shall be a 75 ton, air-cooled, packaged unit, scroll type chiller such as Daikin AGZ075E or equal.
4. The new chiller shall be connected to and fully operational with the existing make-up air system that serves the facility Daikin variable refrigerant volume HVAC system. The new chiller shall also be connected to and fully operational with the existing facility Andover building automation system.
5. Delivery of materials to the site and the scheduling of all work on site shall be coordinated with the West Virginia Lottery facility manager David Oliverio.
6. All work shall be scheduled in order to not disrupt ordinary business activities such as blocking access to West Virginia Lottery property or negatively impacting business meetings and functions.
7. The contractor shall provide a factory authorized of the new chiller. The startup shall consist of testing the chiller for both hardware and software functionality. The new chiller shall operate under the control of the existing facility Building Automation System and shall be tested against the appropriate sequence of operation for functionality and compatibility. A written report shall be submitted to the West Virginia Lottery indicating that the installed chiller functions in accordance with the manufacturer's specifications and is fully compatible with the existing Building Automation System.
8. Any disruption of facility HVAC service shall be coordinated and scheduled with the West Virginia Lottery. A minimum 48 hour notice of such planned disruptions shall be provided to the West Virginia Lottery.

REQUEST FOR QUOTATION
Chiller Replacement

9. The contractor/vendor shall warrant all equipment that fail in materials or workmanship as follows:

- Compressors: Minimum of Six years from date of completion.
- Parts: Minimum of Two years from date of completion.
- Labor: Minimum of Two years from date of completion.

End of Exhibit B

BID BOND PREPARATION INSTRUCTIONS

AGENCY (A) _____
RFQ/RFP# (B) _____

- (A) WV State Agency (Stated on Page 1 "Spending Unit")
- (B) Request for Quotation Number (upper right corner of page #1)
- (C) Your Business Entity Name (or Individual Name if Sole Proprietor)
- (D) City, Location of your Company
- (E) State, Location of your Company
- (F) Surety Corporate Name
- (G) City, Location of Surety
- (H) State, Location of Surety
- (I) State of Surety Incorporation
- (J) City of Surety's Principal Office
- (K) Minimum amount of acceptable bid bond is 5% of total bid. You may state "5% of bid" or a specific amount on this line in words.
- (L) Amount of bond in numbers
- (M) Brief Description of scope of work
- (N) Day of the month
- (O) Month
- (P) Year
- (Q) Name of Business Entity (or Individual Name if Sole Proprietor)
- (R) Seal of Principal
- (S) Signature of President, Vice President, or Authorized Agent
- (T) Title of Person Signing for Principal
- (U) Seal of Surety
- (V) Name of Surety
- (W) Signature of Attorney in Fact of the Surety

Bid Bond

KNOW ALL MEN BY THESE PRESENTS, That we, the undersigned, _____ (C) of _____ (D) _____ (E) as Principal, and _____ (F) of _____ (G) _____ (H), a corporation organized and existing under the laws of the State of _____ (I) with its principal office in the City of _____ (J), as Surety, are held and firmly bound unto The State of West Virginia, as Obligee, in the penal sum of _____ (K) (\$ _____ (L)) for the payment of which, well and truly to be made, we jointly and severally bind ourselves, our heirs, administrators, executors, successors and assigns.

The Condition of the above obligation is such that whereas the Principal has submitted to the Purchasing Section of the Department of Administration a certain bid or proposal, attached hereto and made a part hereof to enter into a contract in writing for _____

_____ (M) _____

NOW THEREFORE

(a) If said bid shall be rejected, or
 (b) If said bid shall be accepted and the Principal shall enter into a contract in accordance with the bid or proposal attached hereto and shall furnish any other bonds and insurance required by the bid or proposal, and shall in all other respects perform the agreement created by the acceptance of said bid then this obligation shall be null and void, otherwise this obligation shall remain in full force and effect. It is expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated

The Surety for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of time within which the Obligee may accept such bid: and said Surety does hereby waive notice of any such extension.

WITNESS, the following signatures and seals of Principal and Surety, executed and sealed by a proper officer of Principal and Surety, or by Principal individually if Principal is an individual, the (N) day of (O) _____, 20 (P) _____.

Principal Seal _____ (Q)
 (Name of Principal)

(R) By _____ (S)
 (Must be President, Vice President, or Duly Authorized Agent)

_____ (T)
 Title

Surety Seal _____ (V)
 (Name of Surety)

(U) _____ (W)
 Attorney-in-Fact

NOTE 1: Dated Power of Attorney with Surety Seal must accompany this bid bond.

IMPORTANT – Surety executing bonds must be licensed in West Virginia to transact surety insurance, must affix its seal, and must attach a power of attorney with its seal affixed.

Agency _____
REQ.P.O# _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS, That we, the undersigned, _____
of _____, _____, as Principal, and _____
of _____, _____, a corporation organized and existing under the laws of the State of _____
with its principal office in the City of _____, as Surety, are held and firmly bound unto the State
of West Virginia, as Obligee, in the penal sum of _____ (\$ _____) for the payment of which,
well and truly to be made, we jointly and severally bind ourselves, our heirs, administrators, executors, successors and assigns.

The Condition of the above obligation is such that whereas the Principal has submitted to the Purchasing Section of the
Department of Administration a certain bid or proposal, attached hereto and made a part hereof, to enter into a contract in writing for

NOW THEREFORE,

- (a) If said bid shall be rejected, or
- (b) If said bid shall be accepted and the Principal shall enter into a contract in accordance with the bid or proposal
attached hereto and shall furnish any other bonds and insurance required by the bid or proposal, and shall in all other respects perform
the agreement created by the acceptance of said bid, then this obligation shall be null and void, otherwise this obligation shall remain in
full force and effect. It is expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no
event, exceed the penal amount of this obligation as herein stated.

The Surety, for the value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no
way impaired or affected by any extension of the time within which the Obligee may accept such bid, and said Surety does hereby
waive notice of any such extension.

WITNESS, the following signatures and seals of Principal and Surety, executed and sealed by a proper officer of Principal and
Surety, or by Principal individually if Principal is an individual, this _____ day of _____, 20_____.

Principal Seal

(Name of Principal)

By _____
(Must be President, Vice President, or
Duly Authorized Agent)

(Title)

Surety Seal

(Name of Surety)

Attorney-in-Fact

**IMPORTANT – Surety executing bonds must be licensed in West Virginia to transact surety insurance, must affix its seal, and
must attach a power of attorney with its seal affixed.**

WV-75
Created 07/18/12



State of West Virginia
PURCHASING DIVISION
Construction Bid Submission Review Form

This list has been provided for informational purposes only and is not to be construed as a complete list of request for quotation or bidding requirements for any individual construction project. This list does not and cannot include every item, mistake or oversight that could cause a contractor's bid to be disqualified. Rather, this list is intended to draw attention to some of the most common problems that the Purchasing Division encounters in the bidding process for construction projects. All potential bidders must read the request for quotation, all additional documents, and all instructions relating thereto ("Bid Documents") in their entirety to identify the actual request for quotation and bidding requirements. Failure to read the Bid Documents in their entirety and comply with the stated requirements contained therein may result in bid disqualification.

Errors That Shall Be Reason for Immediate Bid Disqualification

1. Failure to attend a mandatory pre-bid meeting
2. Failure to sign the bid
3. Failure to supply West Virginia contractor's license # on bid
4. Failure to supply a signed drug free workplace affidavit with the bid
5. Failure to supply a valid bid bond or other surety approved by the State of West Virginia
6. Failure to meet any mandatory requirement of the RFQ
7. Failure to acknowledge receipt of Addenda (only if stipulated as mandatory)
8. Failure to submit bid prior to the bid opening date and time
9. Federal debarment
10. State of West Virginia debarment or suspension

**Errors that May Be Reason for Bid Disqualification
Before Contract Award**

1. Uncontested debt to the State exceeding \$1,000.00 (must be cured prior to award)
2. Workers' Compensation or Unemployment Compensation delinquency (must be cured prior to award)
3. Not registered as a vendor with the State (must be cured prior to award)
4. Failure to obtain required bonds and/or insurance
5. Failure to provide the sub-contractor listing within 1 business day of bid opening.
6. Failure to use the provided RFQ form (only if stipulated as mandatory).

BID BOND

KNOW ALL MEN BY THESE PRESENTS, That we, the undersigned, Cimco, Inc.
of P. O. Box 480, Culloden, WV 25510-0480, as Principal, and Great American Insurance Company
of 301 E 4th Street, Cincinnati, OH 45242, a corporation organized and existing under the laws of the State of Ohio
with its principal office in the City of Cincinnati, as Surety, are held and firmly bound unto the State
of West Virginia, as Oblige, in the penal sum of Five Percent of Total Amount Bid (\$ 5%) for the payment of which,
well and truly to be made, we jointly and severally bind ourselves, our heirs, administrators, executors, successors and assigns.

The Condition of the above obligation is such that whereas the Principal has submitted to the Purchasing Section of the
Department of Administration a certain bid or proposal, attached hereto and made a part hereof, to enter into a contract in writing for
LOT1700000004 Materials and Labor to Replace the Chiller

NOW THEREFORE,

(a) If said bid shall be rejected, or
(b) If said bid shall be accepted and the Principal shall enter into a contract in accordance with the bid or proposal attached
hereto and shall furnish any other bonds and insurance required by the bid or proposal, and shall in all other respects perform the
agreement created by the acceptance of said bid, then this obligation shall be null and void, otherwise this obligation shall remain in full
force and effect. It is expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event,
exceed the penal amount of this obligation as herein stated.

The Surety, for the value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no
way impaired or affected by any extension of the time within which the Oblige may accept such bid, and said Surety does hereby
waive notice of any such extension.

IN WITNESS WHEREOF, Principal and Surety have hereunto set their hands and seals, and such of them as are corporations
have caused their corporate seals to be affixed hereunto and these presents to be signed by their proper officers, this
22nd day of February, 20 17.

Principal Corporate Seal

Cimco, Inc.

(Name of Principal)

By [Signature]

(Must be President or
Vice President)

VICE PRESIDENT

(Title)

Surety Corporate Seal

Great American Insurance Company

(Name of Surety)

[Signature]
Attorney-in-Fact

**IMPORTANT -- Surety executing bonds must be licensed in West Virginia to transact surety insurance. Raised corporate seals
must be affixed, a power of attorney must be attached.**

GREAT AMERICAN INSURANCE COMPANY®

Administrative Office: 301 E 4TH STREET • CINCINNATI, OHIO 45202 • 513-389-5000 • FAX 513-723-2740

The number of persons authorized by this power of attorney is not more than **FIVE**

No. 0 20211

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the GREAT AMERICAN INSURANCE COMPANY, a corporation organized and existing under and by virtue of the laws of the State of Ohio, does hereby nominate, constitute and appoint the person or persons named below, each individually if more than one is named, its true and lawful attorney-in-fact, for it and in its name, place and stead to execute on behalf of the said Company, as surety, any and all bonds, undertakings and contracts of suretyship, or other written obligations in the nature thereof; provided that the liability of the said Company on any such bond, undertaking or contract of suretyship executed under this authority shall not exceed the limit stated below.

Name	Address	Limit of Power
JEFFERY O'DELL	RICHARD L. HIGGINBOTHAM ALL OF	ALL
C. DAVID THOMAS	ROSEANN B. DYE-SMALLEY CHARLESTON, WEST VIRGINIA	\$75,000,000
ROBIN M. HUBBARD-SHERROD		

This Power of Attorney revokes all previous powers issued on behalf of the attorney(s)-in-fact named above. IN WITNESS WHEREOF the GREAT AMERICAN INSURANCE COMPANY has caused these presents to be signed and attested by its appropriate officers and its corporate seal hereunto affixed this 10TH day of AUGUST 2011 GREAT AMERICAN INSURANCE COMPANY



My L C. B.
Assistant Secretary

David C. Kitchin
Divisional Senior Vice President
DAVID C. KITCHIN (877-377-2105)

STATE OF OHIO, COUNTY OF HAMILTON - ss: On this 10TH day of AUGUST, 2011, before me personally appeared DAVID C. KITCHIN, to me known, being duly sworn, deposes and says that he resides in Cincinnati, Ohio, that he is a Divisional Senior Vice President of the Bond Division of Great American Insurance Company, the Company described in and which executed the above instrument; that he knows the seal of the said Company; that the seal affixed to the said instrument is such corporate seal, that it was so affixed by authority of his office under the By-Laws of said Company, and that he signed his name thereto by like authority.



KAREN L. GROSHEIM
NOTARY PUBLIC, STATE OF OHIO
MY COMMISSION EXPIRES 02-20-16

Karen L. Grosheim

This Power of Attorney is granted by authority of the following resolutions adopted by the Board of Directors of Great American Insurance Company by unanimous written consent dated June 9, 2008.

RESOLVED: That the Divisional President, the several Divisional Senior Vice Presidents, Divisional Vice Presidents and Divisional Assistant Vice Presidents, or any one of them, be and hereby is authorized, from time to time, to appoint one or more Attorneys-in-Fact to execute on behalf of the Company, as surety, any and all bonds, undertakings and contracts of suretyship, or other written obligations in the nature thereof; to prescribe their respective duties and the respective limits of their authority; and to revoke any such appointment at any time.

RESOLVED FURTHER: That the Company seal and the signature of any of the aforesaid officers and any Secretary or Assistant Secretary of the Company may be affixed by facsimile to any power of attorney or certificate of either given for the execution of any bond, undertaking, contract of suretyship, or other written obligation in the nature thereof, such signature and seal when so used being hereby adopted by the Company as the original signature of such officer and the original seal of the Company, to be valid and binding upon the Company with the same force and effect as though manually affixed.

CERTIFICATION

I, STEPHEN C. BERAHA, Assistant Secretary of Great American Insurance Company, do hereby certify that the foregoing Power of Attorney and the Resolutions of the Board of Directors of June 9, 2008 have not been revoked and are now in full force and effect.

Signed and sealed this 22nd day of February, 2017



My L C. B.
Assistant Secretary



Purchasing Division
 2019 Washington Street East
 Post Office Box 50130
 Charleston, WV 25305-0130

State of West Virginia
 Request for Quotation
 09 - Construction

Proc Folder: 288932

Doc Description: ADDENDUM NO. 1- MATERIALS & LABOR TO REPLACE CHILLER

Proc Type: Central Purchase Order

Date Issued	Solicitation Closes	Solicitation No	Version
2017-02-02	2017-02-16 13:30:00	CRFQ 0705 LOT1700000004	2

BID RECEIVING LOCATION

BID CLERK
 DEPARTMENT OF ADMINISTRATION
 PURCHASING DIVISION
 2019 WASHINGTON ST E
 CHARLESTON WV 25305
 US

VENDOR

Vendor Name, Address and Telephone Number:

FOR INFORMATION CONTACT THE BUYER

Michelle L Childers
 (304) 558-2063
 michelle.l.childers@wv.gov

Signature X

FEIN #

55-0749511-001

DATE

2/22/2017

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION

Addendum

Addendum No. 1 issued to publish and distribute the attached information to the vendor community.

Request for Quotation

The West Virginia Purchasing Division is soliciting bids on behalf of the West Virginia Lottery to establish a contract for the one time purchase of a chiller replacement as indicated in Exhibit B.

The Vendor shall furnish all materials, labor, and equipment necessary to complete all Construction Services. The Vendor shall furnish any incidental work, materials, labor, and equipment that are necessary to complete the Construction Services, even if such incidental work is not explicitly included in the specifications.

INVOICE TO		SHIP TO	
ACCOUNTS PAYABLE LOTTERY PO BOX 2067		PURCHASING LOTTERY 900 PENNSYLVANIA AVE	
CHARLESTON	WV25327-2067	CHARLESTON	WV 25302
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	MATERIALS & LABOR TO REPLACE CHILLER	0.00000			\$90,387.00

Comm Code	Manufacturer	Specification	Model #
40101714			

Extended Description :

Lump sum amount for materials and labor.

SOLICITATION NUMBER: CRFQ LOT1700000004

Addendum Number: 01

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

- Modify bid opening date and time
- Modify specifications of product or service being sought
- Attachment of vendor questions and responses
- Attachment of pre-bid sign-in sheet
- Correction of error
- Other

Description of Modification to Solicitation:

This addendum is issued to modify the solicitation per the attached documentation and the following:

1. To publish the pre-bid sign-in sheet.

No other changes.

Additional Documentation: Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.
2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

ADDENDUM ACKNOWLEDGEMENT FORM

SOLICITATION NO.: 1

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:

(Check the box next to each addendum received)

- | | |
|--|--|
| <input checked="" type="checkbox"/> Addendum No. 1 | <input type="checkbox"/> Addendum No. 6 |
| <input type="checkbox"/> Addendum No. 2 | <input type="checkbox"/> Addendum No. 7 |
| <input type="checkbox"/> Addendum No. 3 | <input type="checkbox"/> Addendum No. 8 |
| <input type="checkbox"/> Addendum No. 4 | <input type="checkbox"/> Addendum No. 9 |
| <input type="checkbox"/> Addendum No. 5 | <input type="checkbox"/> Addendum No. 10 |

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

CIMCO Inc.
Company
[Signature]
Authorized Signature
2/22/2017
Date

NOTE: This addendum acknowledgment should be submitted with the bid to expedite document processing.
Revised 6/8/2012

ATTACHMENT A

**PRE-BID CONFERENCE
SIGN IN SHEET**

Request for Quotation Number:

CRFQ LOT1714

Date:

Feb. 2, 2017

PLEASE PRINT LEGIBLY. THIS INFORMATION IS ESSENTIAL TO CONTACT THE ATTENDEES IN A TIMELY MANNER. FAILURE TO DO SO MAY RESULT IN DELAYS IN YOUR COMPANY GETTING IMPORTANT BID INFORMATION.

Firm Name:	WV LOTTERY
Firm Address:	900 PENNSYLVANIA AVENUE CHARLESTON WV 25302
Representative Attending:	BECKY JONES
Phone Number:	(304)558-0500 EXT 242
Fax Number:	(304)558-4183
Email Address:	bjones@wvlottery.com

Firm Name:	Mason + Barry, Inc.
Firm Address:	301 Smiley Dr. St Albans, WV 25177
Representative Attending:	Scott Cowley
Phone Number:	(304) 755-0791
Fax Number:	(304) 755-4610
Email Address:	scowley@masonbarry.com

Firm Name:	Mason + Barry, Inc.
Firm Address:	301 Smiley Dr. St Albans WV 25177
Representative Attending:	Terry Vaughan
Phone Number:	304-755-0781
Fax Number:	304-755-4010
Email Address:	tv Vaughan@masonbarry.com

Firm Name:	Virginia Air Distributors
Firm Address:	806 1st Ave Nitro WV 25143
Representative Attending:	Bruce Persinger
Phone Number:	304-722-7500
Fax Number:	
Email Address:	Bruce.Persinger@virginiaair.com

Firm Name:	Danhold Mech Inc
Firm Address:	PO BOX 149 Kenner WV 25218
Representative Attending:	Scott Danhold
Phone Number:	304-988-1618
Fax Number:	
Email Address:	sdanhold@danholdmech.com

Firm Name:	Cesto Technical
Firm Address:	540 Leon Sullivan Way Chas WV 25301
Representative Attending:	Paul Lancaster
Phone Number:	304-346-0549
Fax Number:	304-346-8929
Email Address:	plancaster@cestotech.com

*ccm

**PRE-BID CONFERENCE
SIGN IN SHEET**

Request for Quotation Number: _____

Date: _____

PLEASE PRINT LEGIBLY. THIS INFORMATION IS ESSENTIAL TO CONTACT THE ATTENDEES IN A TIMELY MANNER. FAILURE TO DO SO MAY RESULT IN DELAYS IN YOUR COMPANY GETTING IMPORTANT BID INFORMATION.

Firm Name:	WV LOTTERY
Firm Address:	900 PENNSYLVANIA AVENUE CHARLESTON WV 25302
Representative Attending:	BECKY JONES
Phone Number:	(304)558-0500 EXT 242
Fax Number:	(304)558-4183
Email Address:	bjones@wvlottery.com

Firm Name:	ELCO MECHANICAL
Firm Address:	1510 COONSKIN DR CHARLESTON, WV 25311
Representative Attending:	Ron King
Phone Number:	304-346-0546
Fax Number:	304-346-0548
Email Address:	RONALDKING@SUDDENLINKMAIL.COM

Firm Name:	DOUGHERTY CO.
Firm Address:	P.O. Box 1828 HAS. WV 25327
Representative Attending:	
Phone Number:	304-925-6664
Fax Number:	304-925-4280
Email Address:	briansmith@doughertywv.com

Firm Name:	Tri-State Roofing & Sheetmetal
Firm Address:	132 Harris Dr
Representative Attending:	Mike Crouch
Phone Number:	304-555-8135
Fax Number:	
Email Address:	Mcrouch@Tri-Stateservice.com

Firm Name:	D So mechanical
Firm Address:	515 3rd Ave South Charleston WV 25303
Representative Attending:	Derrick Dunlap
Phone Number:	304 744-8499
Fax Number:	304 744 8491
Email Address:	DDunlap @DSo.mech.com

Firm Name:	Alpha Mechanical Service
Firm Address:	401 27th Street Duabur, WV 25064
Representative Attending:	John Jennings
Phone Number:	304-550-5299
Fax Number:	502-400-4959
Email Address:	john.jennings@alpha-service.com

PRE-BID CONFERENCE
SIGN IN SHEET

Request for Quotation Number: _____

Date: _____

PLEASE PRINT LEGIBLY. THIS INFORMATION IS ESSENTIAL TO CONTACT THE ATTENDEES IN A TIMELY MANNER. FAILURE TO DO SO MAY RESULT IN DELAYS IN YOUR COMPANY GETTING IMPORTANT BID INFORMATION.

Firm Name:	WV LOTTERY
Firm Address:	900 PENNSYLVANIA AVENUE CHARLESTON WV 25302
Representative Attending:	BECKY JONES
Phone Number:	(304)558-0500 EXT 242
Fax Number:	(304)558-4183
Email Address:	bjones@wvlottery.com

Firm Name:	_____
Firm Address:	_____ _____ _____
Representative Attending:	_____
Phone Number:	_____
Fax Number:	_____
Email Address:	_____

Firm Name:	<i>Joe Cimco</i>
Firm Address:	<i>2336 Virginia Ave Hurricane, W.V. 25526</i>
Representative Attending:	<i>Josh Stephenson</i>
Phone Number:	<i>(304) 549-2793</i>
Fax Number:	
Email Address:	<i>JStephenson@CimcoWV.com</i>

Firm Name:	_____
Firm Address:	_____ _____ _____
Representative Attending:	_____
Phone Number:	_____
Fax Number:	_____
Email Address:	_____

Firm Name:	_____
Firm Address:	_____ _____ _____
Representative Attending:	_____
Phone Number:	_____
Fax Number:	_____
Email Address:	_____

Firm Name:	_____
Firm Address:	_____ _____ _____
Representative Attending:	_____
Phone Number:	_____
Fax Number:	_____
Email Address:	_____



Phone (304) 755-0781
 FAX (304) 755-4010
 Cell (304) 932-7204
 e-mail: tvaughan@masonbarry.com

Terry Vaughan
 Service Sales

101 Smiley Drive ♦ St. Albans, WV 25177
HVAC Solutions



(304) 755-0781
 FAX (304) 755-4010
 Email: scowley@masonbarry.com

Scott Cowley
 Sales Account Manager

301 Smiley Drive ♦ St. Albans, WV 25177
HVAC Solutions

Plumbing, Heating & Air Conditioning Piping

Elco Mechanical Contractors
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MIKE CROUCH
 HVAC Service Leader

Darnold Mechanical Inc.
 HVAC/Sheetmetal/Service

Scott Darnold
 President
 sdarnold@darnoldmech.com

PO Box 149 Kenna WV 25248
 75 Highland Lane Kenna WV 25248

304-539-0930 Cell
 304-988-1618 Office



DOUGHERTY COMPANY, INC.
 Mechanical Contractor - Established 1911
 WV034016

Brian W. Smith
 Vice President/General Manager

P.O. Box 1828 | Cell: 304-549-9009
 Charleston, WV 25327 | briansmith@doughertyco.com
 Office: 304-925-6664 Fax: 304-925-4280

DSO Mechanical LLC

Derrick Dunlap
 Service Superintendent

515 3rd Avenue
 PO Box 8482
 South Charleston, WV 25303
 Phone (304) 744-8479
 Fax (304) 744-8491
 Cell (304) 539-2651
 ddunlap@dsomech.com

Bruce Persinger
 Commercial Specialist

806 First Avenue
 Nitro, WV 25143

Phone: (304) 722-7500
 Fax: (304) 722-7223
 Web: www.virginiaair.com
 Email: brucepersinger@virginiaair.com



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Purchasing Division
 2019 Washington Street East
 Post Office Box 50130
 Charleston, WV 25305-0130

State of West Virginia
 Request for Quotation
 09 - Construction

Proc Folder: 268932

Doc Description: ADDENDUM NO. 2- MATERIALS & LABOR TO REPLACE CHILLER

Proc Type: Central Purchase Order

Date Issued	Solicitation Closes	Solicitation No	Version
2017-02-15	2017-02-23 13:30:00	CRFQ 0705 LOT1700000004	3

BID RECEIVING LOCATION

BID CLERK
 DEPARTMENT OF ADMINISTRATION
 PURCHASING DIVISION
 2019 WASHINGTON ST E
 CHARLESTON WV 25305
 US

VENDOR

Vendor Name, Address and Telephone Number:

FOR INFORMATION CONTACT THE BUYER

Michelle L Childers
 (304) 558-2063
 michelle.l.childers@wv.gov

Signature X

FEIN #

55-0749511-001

DATE

2/22/2017

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION

Addendum

Addendum No. 2 issued to publish and distribute the attached information to the vendor community

Request for Quotation

The West Virginia Purchasing Division is soliciting bids on behalf of the West Virginia Lottery to establish a contract for the one time purchase of a chiller replacement as indicated in Exhibit B.

The Vendor shall furnish all materials, labor, and equipment necessary to complete all Construction Services. The Vendor shall furnish any incidental work, materials, labor, and equipment that are necessary to complete the Construction Services, even if such incidental work is not explicitly included in the specifications.

INVOICE TO		SHIP TO	
ACCOUNTS PAYABLE LOTTERY PO BOX 2067		PURCHASING LOTTERY 900 PENNSYLVANIA AVE	
CHARLESTON	WV25327-2067	CHARLESTON	WV 25302
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	MATERIALS & LABOR TO REPLACE CHILLER	0.00000			90,387.00

Comm Code	Manufacturer	Specification	Model #
40101714			

Extended Description :

Lump sum amount for materials and labor.

SOLICITATION NUMBER: CRFQ LOT1700000004

Addendum Number: 02

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

- | Modify bid opening date and time
- | Modify specifications of product or service being sought
- | Attachment of vendor questions and responses
- | Attachment of pre-bid sign-in sheet
- | Correction of error
- | Other

Description of Modification to Solicitation:

This addendum is issued to modify the solicitation per the attached documentation and the following:

1. To modify the bid opening date to February 23, 2017 at 1:30PM, EST.

No other changes.

Additional Documentation: Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.
2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: 2

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:

(Check the box next to each addendum received)

- | | |
|--|--|
| <input type="checkbox"/> Addendum No. 1 | <input type="checkbox"/> Addendum No. 6 |
| <input checked="" type="checkbox"/> Addendum No. 2 | <input type="checkbox"/> Addendum No. 7 |
| <input type="checkbox"/> Addendum No. 3 | <input type="checkbox"/> Addendum No. 8 |
| <input type="checkbox"/> Addendum No. 4 | <input type="checkbox"/> Addendum No. 9 |
| <input type="checkbox"/> Addendum No. 5 | <input type="checkbox"/> Addendum No. 10 |

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

CIMCO, Inc.
Company
[Signature]
Authorized Signature
2/22/2017
Date

NOTE: This addendum acknowledgment should be submitted with the bid to expedite document processing.
Revised 6/8/2012



Purchasing Division
 2019 Washington Street East
 Post Office Box 50130
 Charleston, WV 25305-0130

State of West Virginia
 Request for Quotation
 09 - Construction

Proc Folder: 288932

Doc Description: ADDENDUM NO. 3- MATERIALS & LABOR TO REPLACE CHILLER

Proc Type: Central Purchase Order

Date Issued	Solicitation Closes	Solicitation No	Version
2017-02-16	2017-02-23 13:30:00	CRFQ 0705 LOT1700000004	4

BID RECEIVING LOCATION

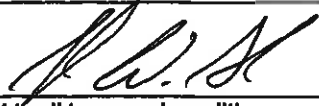
BID CLERK
 DEPARTMENT OF ADMINISTRATION
 PURCHASING DIVISION
 2019 WASHINGTON ST E
 CHARLESTON WV 25305
 US

VENDOR

Vendor Name, Address and Telephone Number:

FOR INFORMATION CONTACT THE BUYER

Michelle L Childers
 (304) 558-2063
 michelle.l.childers@wv.gov

Signature X  FEIN # 55-0749511-001 DATE 2/22/2017

All offers subject to all terms and conditions contained in this solicitation

Addendum

Addendum No. 3 issued to publish and distribute the attached information to the vendor community.

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INVOICE TO		SHIP TO	
ACCOUNTS PAYABLE		PURCHASING	
LOTTERY		LOTTERY	
PO BOX 2067		900 PENNSYLVANIA AVE	
CHARLESTON	WV25327-2067	CHARLESTON	WV 25302
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	MATERIALS & LABOR TO REPLACE CHILLER	0.00000			90,387.00

Comm Code	Manufacturer	Specification	Model #
40101714			

Extended Description :

Lump sum amount for materials and labor.

SOLICITATION NUMBER: CRFQ LOT1700000004

Addendum Number: 03

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

- Modify bid opening date and time
- Modify specifications of product or service being sought
- Attachment of vendor questions and responses
- Attachment of pre-bid sign-in sheet
- Correction of error
- Other

Description of Modification to Solicitation:

This addendum is issued to modify the solicitation per the attached documentation and the following:

1. To add and publish Exhibit C - Chiller Specifications.
2. To publish vendor questions and agency answers.

No other changes.

Additional Documentation: Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.
2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

ATTACHMENT A

Questions & Answers

CRFQ LOT17*4

Chiller Replacement

Q1) Are chiller specifications available?

A1) Yes. Please see attached specifications; Exhibit C, Part 2.

Q2) Is the performance data or schedule available for the proposed chiller (i.e. IPLV, ASHRAE 90.1 compliant, etc....)

A2) Yes. Please see attached specifications; Exhibit D.

Q3) Please confirm and or clarify the following items are required to be provided with the chiller?

A3) See answers below:

- a. Painted Base – **Agency Answer: Base shall be galvanized metal or painted metal.**
- b. Single Layer Insulation - **Agency Answer: Yes.**
- c. VFD's w/o Line Reactors (High Efficiency) – Head Pressure Control - **Agency Answer: Yes.**
- d. Condenser Coil & Base Frame Louvers - **Agency Answer: No.**
- e. Replaceable Filter Dryer w/ Discharge & Liquid Valves on refrigerant circuits. - **Agency Answer: Yes.**
- f. Shrink wrapped protection for shipment. - **Agency Answer: Yes.**
- g. BACnet MSTP Communications - **Agency Answer: Yes.**
- h. Dual Control Output for Evaporator Pumps - **Agency Answer: No.**
- i. Single Point Power w/ Disconnect - **Agency Answer: Yes.**
- j. Factory Installed Strainer - **Agency Answer: Yes.**
- k. Five (5) Year Compressor Part Warranty (Standard Option) Specifications ask for six year warranty on compressor. - **Agency Answer: Five (5) year compressor warranty.**
- l. Intelligent Equipment (Used for Diagnostic, Analysis, & Trouble Shooting) - **Agency Answer: Yes.**
- m. Rubber in Shear vibration isolators. - **Agency Answer: Yes.**

Q4) Is hot gas bypass required?

A4) No.

Q5) Is the project required to be completed in 60-Days? Chillers have a standard lead-time of 8 – 10 weeks.

A5) Project completion shall be 120 days after Notice To Proceed.

Q6) Confirm contractor is to properly dispose of the refrigerant in the existing chiller and the owner does not want to keep it.

A6) Contractor shall properly dispose of existing refrigerant.

Q7) Does the existing system have glycol and if so what type and concentration?

A7) Yes. Propylene 30%.

Q8) Are there any parts on the existing chiller to be removed and turned over to the owner for the remaining Trane chiller? If so will the contractor be responsible for this or someone else?

A8) Existing parts will be removed by others prior to the start of this contract.

Q9) On Exhibit B requirement # 4 list the existing controls as being Andover Building Automation.

Will the existing controls communicate over a Bac Net interface?

A9) Yes.

Q10) Will the crane lift have to be done on the weekend?

A10) Yes.

Q11) It was determined at the pre-bid meeting that the crane lift would need to be on weekend or holiday. Will there be a requirement for additional security and if so will the owner take care of that or is it a contractor responsibility.

A11) Additional security will not be provided by owner. Contractor shall insure that adjacent property and traffic flows are not hindered. Contractor shall secure and provide all proper permits, etc. as required.

Q12) Since the new chiller is smaller please confirm the size, type, style and manufacture of the existing electrical overcurrent protection in the main distribution panel for the circuit feeding the existing chiller?

A12) Westinghouse Enclosed Circuit Breaker. 600 Volt, 250 Amp.

Exhibit C
Chiller Specifications
West Virginia Lottery
2/14/17

PART 1: GENERAL

1.01 SUMMARY

A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled scroll compressor chillers.

1.02 REFERENCES

A. Comply with applicable Standards/Codes of AHRI 550/590, ANSI/ASHRAE 15, ETL, cETL, NEC, and OSHA as adopted by the State.

B. Units shall meet the efficiency standards of the current version of ASHRAE Standard 90.1, and FEMP standard 2012.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with the specifications.

B. Submittals shall include the following and turned in with bid:

1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections
2. Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.
3. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
4. Schematic diagram of control system indicating points for field interface/connection.
5. Diagram shall fully delineate field and factory wiring.
6. Installation and operating manuals.

1.04 QUALITY ASSURANCE

A. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the type of equipment and refrigerant offered.

B. Regulatory Requirements: Comply with the codes and standards specified.

C. Chiller manufacturer plant must be ISO Registered.

1.05 DELIVERY AND HANDLING

A. Chiller shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.

B. Comply with the manufacturer's instructions for rigging and handling equipment.

1.06 WARRANTY

A. Standard Warranty (Domestic): The refrigeration equipment manufacturer's guarantee shall be for a period of one year from date of equipment start-up but not more than 18 months from shipment. The guarantee shall provide for repair or replacement due to failure by material and workmanship that prove defective within the above period, excluding refrigerant.

B. 5 Year Parts & Labor Warranty entire unit: included

1.07 MAINTENANCE

A. Maintenance of the chillers shall be the responsibility of the owner and performed in accordance with the manufacturer's instructions.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Daikin or pre-approved equal.

2.02 UNIT DESCRIPTION

A. Provide and install as specified factory-assembled, factory-charged air-cooled scroll compressor packaged chillers in the quantity specified. Each chiller shall consist of hermetic tandem scroll compressor sets (total four compressors), brazed plate evaporator, air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation.

2.03 DESIGN REQUIREMENTS

A. Flow Range: The chiller shall have the ability to support variable flow range down to 40% of nominal design (based on AHRI conditions).

B. Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from 15F to 65F.

C. General: Provide a complete scroll compressor packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.

D. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 25%. Performance shall be in accordance with AHRI Standard 550/590.

E. Acoustics: Sound pressure levels for the unit shall not exceed the following specified levels. All manufacturers shall provide the necessary sound treatment (parts and labor) to meet these levels if required. Sound data shall be provided with the quotation. Test shall be in accordance with AHRI Standard 370.

Sound Pressure (at 30 feet)											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA
Sound Power											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA

2.04 CHILLER COMPONENTS

A. Compressor

1. The compressors shall be sealed hermetic, scroll type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability.

B. Evaporator

1. The evaporator shall be a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates.
2. The evaporator shall be protected with an external, electric resistance heater plate and insulated with 3/4" (19mm) thick closed-cell polyurethane insulation. This combination shall provide freeze protection down to -20°F (-29°C) ambient air temperature.
3. The water-side working pressure shall be a minimum of 653 psig (4502 kPa). Evaporators shall be designed and constructed according to, and listed by, Underwriters Laboratories (UL).

C. Condenser

1. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall be TEAO type with permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive, 1140 rpm. Each fan section shall be partitioned to avoid cross circulation.
2. Coil shall be all 9153 aluminum alloy microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Microchannel tubes shall be made of AL9153 aluminum alloy for long life. Tubes using AL3102 alloy shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.

D. Refrigerant Circuit

1. Each of the two refrigerant circuits shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.

E. Construction

1. Unit casing and all structural members and rails shall be fabricated of pre-painted or galvanized steel to meet ASTM B117, 1000-hour salt spray test.
2. Upper condenser coil section of unit shall have protective, 12 GA, PVC-coated, wire grille guards.

F. Control System

1. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Box shall be designed in accordance with NEMA 3R rating. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.
2. Shall include optional single-point connection to a non-fused disconnect switch with through-the-door handle and compressor circuit breakers.

G. Unit Controller

1. An advanced DDC microprocessor unit controller with a 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:
2. The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.
3. Shutdown Alarms
 - a. No evaporator water flow (auto-restart)
 - b. Sensor failures
 - c. Low evaporator pressure
 - d. Evaporator freeze protection

- e. High condenser pressure
 - f. Outside ambient temperature (auto-restart)
 - g. Motor protection system
 - h. Phase voltage protection (Optional)
4. Limit Alarms
- a. Condenser pressure stage down, unloads unit at high discharge pressures.
 - b. Low ambient lockout, shuts off unit at low ambient temperatures.
 - c. Low evaporator pressure hold, holds stage #1 until pressure rises.
 - d. Low evaporator pressure unload, shuts off one compressor.
5. Unit Enable Section
- a. Enables unit operation from either local keypad, digital input, or BAS
6. Unit Mode Selection
- a. Selects standard cooling, ice, glycol, or test operation mode
7. Analog Inputs:
- a. Reset of leaving water temperature, 4-20 mA\
 - b. Current Limit
8. Digital Inputs
- a. Unit off switch
 - b. Remote start/stop
 - c. Flow switch
 - d. Ice mode switch, converts operation and setpoints for ice production
 - e. Motor protection
9. Digital Outputs
- a. Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
 - b. Evaporator pump; field wired, starts pump when unit is set to start
10. Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.
11. Building Automation System (BAS) Interface
- a. Factory mounted DDC controller(s) shall support operation on a BACnet® network via one of the data link and as specified by the existing Building Automation System (BAS) supplier.
 - b. BACnet IP, (Annex J)
 - c. The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.
 - d. For chillers communicating over a LONMARK network, the corresponding LONMARK eXternal Interface File (XIF) shall be provided with the chiller submittal data.
 - e. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.
 - f. Contact Mason & Barry Inc to confirm compatability with Andover Controls.

2.05 OPTIONS AND ACCESSORIES

- A. The following options are to be included:
- 1. Low Ambient Control: Fan VFD allows unit operation from 32°F down to -10°F (-23.3 C).
 - 2. BAS interface; chiller will communicate with existing Andover BAS. It is chiller manufacturer's responsibility to provide all hardware and software needed to communicate with BAS. Factory chiller start

up technician will be responsible to make sure chiller interface is set up and will provide 2 year service to guarantee communication between chiller and BAS.

3. The following accessories are to be included:

- a. Rubber-in-shear vibration isolators for field installation
- b. Factory-mounted thermal dispersion type flow switch
- c. Wye strainer, to be factory installed at the evaporator inlet and sized for the design flow rate , with perforation diameter of 0.063"
- d. 115V GFI convenience outlet
- e. Wire Coil Guards
- f. Phase and Voltage Protection

PART 3: EXECUTION

3.01 INSTALLATION

- A. Install in strict accordance with manufacturer's requirements, shop drawings, and contract documents.
- B. Adjust and level chiller in alignment on supports.
- C. Install and coordinate electrical installation.
- D. Install and coordinate all control equipment.
- E. Install a field-supplied or optional manufacturer-supplied strainer in the chilled water return line at the evaporator inlet that meets manufacturer perforation size specifications.

3.02 START-UP

- A. Provide testing and starting of machine, and instruct the Owner in its proper operation and maintenance.

Exhibit D

Performance Data

W V Lottery - Chiller

PDC Chiller					
TAG	Model	Capacity (ton)	Input (kW)	Performance (EER)	IPLV (EER)
DST Air Cooled Chiller 001	AGZ075E	71.8	79.8	10.8	17.4

Evaporator					
Flow (gpm)	PD (ft H ₂ O)	EWT (°F)	LWT (°F)	Fluid Type	Glycol %
132.0	5.0	57.8	44.0	Propylene	30

Condenser	
Ambient (°F)	Altitude (ft)
95.0	0

8 Octave Band Sound Pressure at 30ft								
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	100% (Side A-Wtd)
68.0	68.0	68.0	62.0	60.0	54.0	49.0	44.0	65.0

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: 3

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:

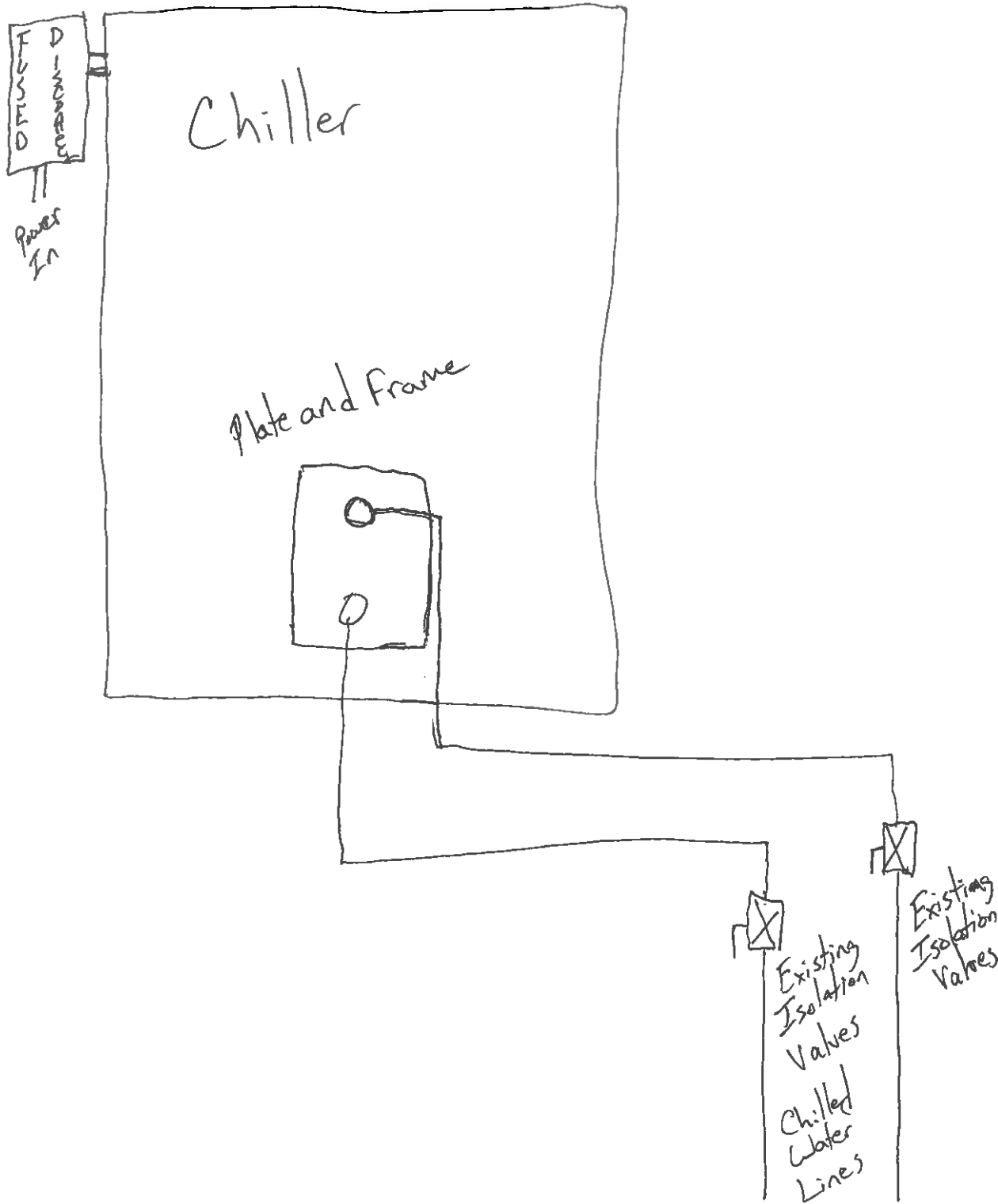
(Check the box next to each addendum received)

- | | |
|--|--|
| <input type="checkbox"/> Addendum No. 1 | <input type="checkbox"/> Addendum No. 6 |
| <input type="checkbox"/> Addendum No. 2 | <input type="checkbox"/> Addendum No. 7 |
| <input checked="" type="checkbox"/> Addendum No. 3 | <input type="checkbox"/> Addendum No. 8 |
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CIMCO, Inc.
Company
[Signature]
Authorized Signature
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Revised 6/8/2012





SUBMITTAL DATA

for

W V Lottery - Chiller

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AGZ075E_PKG_MCC_Drawing for AGZ075E13
FieldWiring_AGZE_SP_Drawing for AGZ075E.....14
IsoKit_RIS_332325101_Drawing for AGZ075E15

Technical Data Sheet for AGZ075E

Job Information		Technical Data Sheet	
Job Name	W V Lottery - Chiller		
Date	2/22/2017		
Submitted By	Matt Duncan		
Software Version	07.20		
Unit Tag	AGZ075E		



Unit Overview						
Model Number	Capacity ton	IPLV, IP* EER	Voltage	Unit Starter Type	ASHRAE 90.1	LEED EA Credit 4
AGZ075E	71.80	17.40	460 / 60.0 / 3	Across the Line	'07, '10, '13	Pass

* IPLV reflects AHRI standard rating conditions and does not change with user defined conditions.

Unit		
Unit Type	Platform	Unit Revision
Air-Cooled Scroll Compressor Chiller	High Efficiency Packaged	00
Head Pressure	Tubing	
VFD's w/o Line Reactors [High Efficiency]	Replaceable Filter Dryer with Discharge & Liquid Valves, no HGBP	
Unit Controls	Display	
Electronic Expansion Valve	On Controller only	
Refrigerant Type	Refrigerant Weight	
R410A	92 lb (per unit)	
Pump Controls		
Dual Evaporator Pumps - Dual Control Output		
Approval		
ETL/cETL, AHRI & ASHRAE 90.1		

Evaporator	
Water Volume:	7.9 gal
Connection Hand:	Universal Connection - Facing out back
Connection Size:	3.0 in
Insulation:	Single Layer Insulation to Suction at each Compressor

Entering Fluid Temperature	Leaving Fluid Temperature	Fluid Type	Glycol Concentration	Fluid Flow	Fluid Flow (with glycol) Min / Max	Pressure Drop	Fouling Factor
57.80 °F	44.00 °F	Water & Propylene	30.0 %	132.0 gpm	115.3 / 307.4 gpm	5.70 ft H ₂ O	0.000100 °F.ft ² h/Btu

Note: Evaporator Pressure Drop includes strainer

Condenser				
Coil Fins:	MicroChannel			
Guards:	Condenser Coil Wire Grilles only			
Design Ambient Air Temperature	Altitude	Fan Diameter	Fan Motor Horsepower	Minimum Design Ambient Temperature
95.0 °F	0 ft	30.0 in	2.0 hp	35.0 °F

Technical Data Sheet for AGZ075E

Unit Performance										
Design										
Capacity			Input Power		Efficiency			IPLV,IP*		
71.80 ton			79.80 kW		10.80 EER			17.40 EER		
Performance Points rated at AHRI Ambient Relief										
Point #	% Load	Unit			Evaporator				Condenser	
		Capacity ton	Input Power kW	Efficiency EER	Fluid Flow gpm	Pressure Drop ft H ₂ O	Entering Fluid Temperature °F	Leaving Fluid Temperature °F	Ambient Air Temperature °F	Altitude ft
1	100.0	71.80	79.80	10.80	132.0	5.00	57.80	44.00	95.0	0
2	75.0	53.80	43.70	14.80	132.0	5.00	54.30	44.00	80.0	0
3	50.0	35.90	22.90	18.80	132.0	5.00	50.90	44.00	65.0	0
4	25.0	17.90	10.30	21.00	132.0	5.00	47.40	44.00	55.0	0

* IPLV reflects AHRI standard rating conditions and does not change with user defined conditions

Note: Evaporator Pressure Drop includes strainer

Sound (with no fan rotation)									
Sound Pressure (at 30 feet)									
63 Hz dB	125 Hz dB	250 Hz dB	500 Hz dB	1 kHz dB	2 kHz dB	4 kHz dB	8 kHz dB	Overall dBA	
68	68	68	62	60	54	49	44	65	
Sound Power									
63 Hz dB	125 Hz dB	250 Hz dB	500 Hz dB	1 kHz dB	2 kHz dB	4 kHz dB	8 kHz dB	Overall dBA	
95	95	95	89	87	81	76	71	92	

Octave band is non 'A' weighted and overall readings are 'A' weighted. Sound data rated in accordance with AHRI Standard-370

Physical				
Unit				
Length*	Height	Width*	Shipping Weight*	Operating Weight*
150 in	99 in	88 in	4388 lb	4451 lb

* Shipping and operating weights do not include the weights of any Options or Accessories. Contact Chiller Applications for additional information

Technical Data Sheet for AGZ075E

Electrical

Unit Electrical Data				
Voltage	Starter Type	Fan Motor Quantity	LRA Fan Motor (each)	FLA Fan Motors (each)
460 / 60.0 / 3	Across the Line	6	18A	3.6A

Power Connection Type:	Single Point Disconnect Switch with Circuit Protection
Short Circuit Current Rating:	5 kA
Phase Voltage:	Phase & Under/Over Voltage Protection with LED

Single Point Power Connection	
MCA:	148.7 A
Fuse Size (recommended):	175 A
Fuse Size (maximum):	175 A
Connector Wire Range:	(1) 6-350

Compressor Electrical Data				
Compressor Type	Compressor Quantity		Starter Type	
Scroll	4		Across the Line	
Circuit #:	1		2	
Compressor #:	1	3	2	4
RLA:	30.8 A	30.8 A	26.9 A	30.8 A
Inrush Current:	229 A	229 A	173 A	229 A

Note: Power wiring connections to the chiller may be done with either copper or aluminum wiring. Wire should be sized per NEC and/or local codes. Wire sizing and wire count must fit in the power connection lug sizing listed in latest installation manual. Please contact your local sales office for more information.

Options


Basic Unit	
Control Box Ambient:	High Ambient with Exhaust Fans (125°F maximum)
Control	
Communication:	BACnet MS/TP
Electrical	

Ground Fault:	Unit Ground Fault Protection
Unit Options:	115V Convenience Outlet
Water Flow Indicator:	With Factory Installed Strainer & Flow Indication (Thermal Dispersion)

Warranty

Unit Startup	By Others
Standard Warranty:	1st Year Entire Unit Parts plus Labor on Compressor
First Year Labor Warranty:	Parts & Labor
Extended Compressor Warranty:	Compressor Only; extended 4 years parts & labor

AHRI Certification

 Certified in accordance with the AHRI Air-Cooled Water-Chilling Packages Using Vapor Compression Cycle Certification Program, which is based on AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI). Unit containing freeze protection fluids in the condenser or in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] is certified when rated per the Standard with water. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Accessories

Optional	
Part Number	Description
332325101	RIS Isolator Kit; AGZ: Packaged, Microchannel, Al&Cu Fins, 030-070E (non-Seismic), 25-65D, 30-65C; M'Chnl, 75-100E (non-S'mc); Al Fin, 70C/D; Remote, Al&Cu Fin, 30-70E (non-S'mc); Pump Pkg, M'Chnl&Al Fin, 30-65E (non-S'mic); Cu Fin, 30-55E(non-S'mic)



Intelligent Equipment®

There is no substitute

A whopping 40% of your building's energy expenses are tied to HVAC management. But most control solutions and building automation systems provide only limited insight into unit performance, hampering your ability to control that expense. Until now.

Intelligent Equipment from Daikin Applied gives you unprecedented visibility into your Daikin HVAC equipment. For less than it costs to run your smart phone, Intelligent Equipment provides direct access to 150 data points on a Daikin rooftop unit or chiller, all in real time. No other solution gives you the freedom and control to monitor and manage your equipment as deeply, freely, accurately, and efficiently. Not even a building automation system.

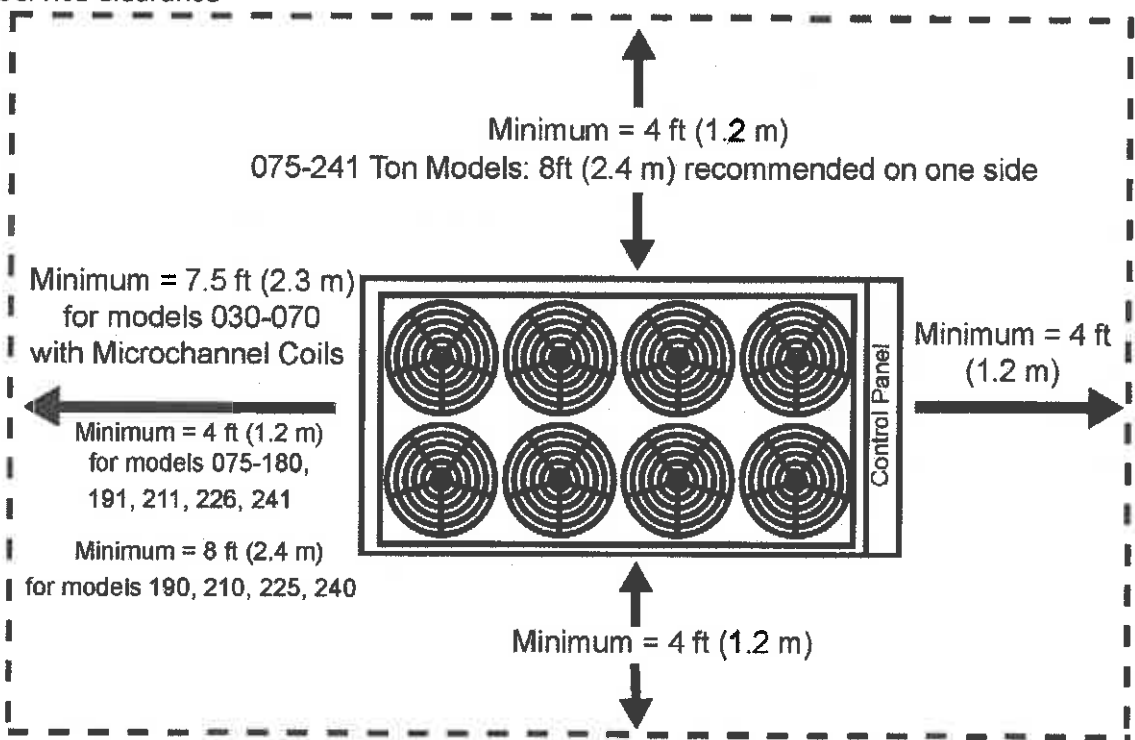
Intelligent Equipment is fully compatible with BAS; if you have a BAS, you can still benefit from Intelligent Equipment. But it's also unique: Intelligent Equipment is an equipment solution, not a building solution. By working at the unit level, IE provides several distinct benefits over a BAS, without expensive additional programming.

	Intelligent Equipment	Building Automation System
Preventative unit maintenance	Included	Not available
Unit Diagnostics	Notifies you of the exact issue	Limited to general alarm data points
Energy usage	Based on unit consumption	Requires a custom metering solution
Data storage	Unlimited	Limited to system memory capacity
Data trending	Trend any point back to unit start-up; decide what to trend at any point in lifecycle	Trend only the points in stored memory without custom programming; must decide what you want to trend before you can measure it
Data access	You have direct access and control who sees your data	BAS company has direct access
User interface	Designed to be easy to use	Most require skilled technicians to use
Cost	Plug and Play capability eliminates traditional BAS engineering, design, and installation costs	Requires higher costs for programming, design, and installation
Integration for new units	Pre-configured at factory and ready to turn on at commissioning; plug and play installation saves time and money, and allows equipment to be immediately accessed for start-up and commissioning.	Must be engineered at site during commissioning; access to data is not available during equipment startup and commissioning.
Unit-specific graphics	Pre-configured and matched to custom built equipment specifications.	Extensive programming and engineering time required to create unit-specific graphics.

**Contact us to get a free demonstration of Intelligent Equipment.
Get 90 days of free access, with your first year paid subscription.
Call 800-432-1342 today for a free demonstration.**

QA

AGZ-E Service Clearance



Job Number: XRA010
Job Name: W V Lottery - Chiller
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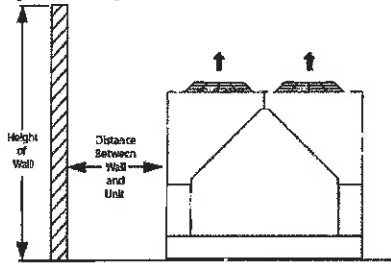
Product Drawing		Unit Tag: AGZ075E		Sales Office: Mason & Barry, Inc.			 13600 Industrial Park Blvd. Minneapolis, MN 55441 www.DaikinApplied.com Software Version: 07.20
Product: Air-Cooled Scroll Chiller		Project Name: W V Lottery - Chiller		Sales Engineer: Scott Cowley			
Model: AGZ-E		Feb. 22, 2017	Ver/Rev:	Sheet: 1 of 1	Scale: NTS	Tolerance: +/- 1.0"	
No change to this drawing may be made unless approved in writing by Daikin Applied. Purchaser must determine that the equipment is fit and sufficient for the job specifications.							

AGZ-E Close Spacing Performance

Case 1: Building or Wall on One Side of Unit

Assumes a solid height wall taller than unit. Refer to Case 4 for partial wall openings.

Building or Wall on One Side of Unit



For models AGZ030-100E, maintain a 4 feet minimum from a wall of any height.

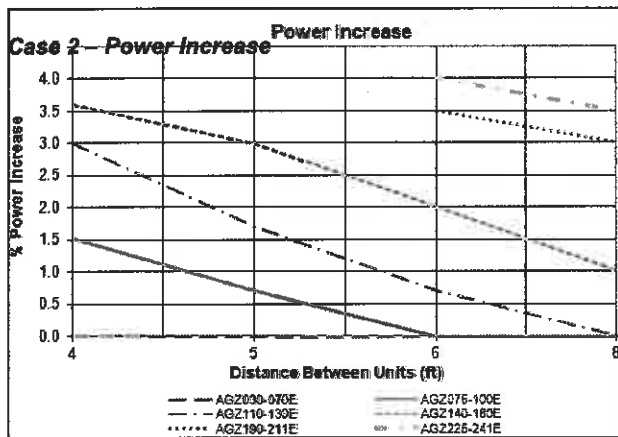
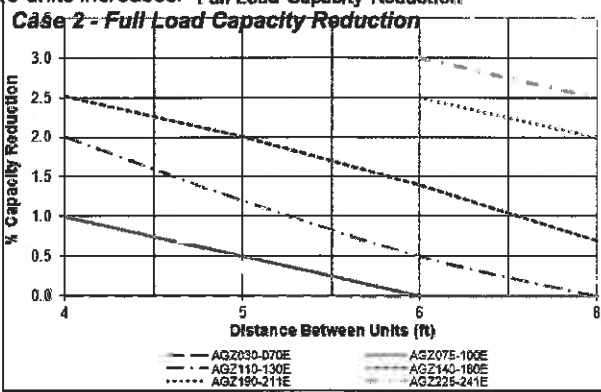
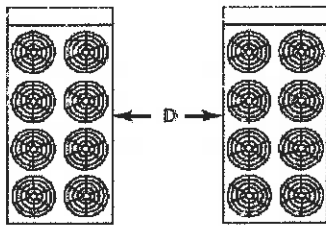
For models AGZ110-130E, maintain a 6 feet minimum from a wall of any height.

For models AGZ140-241E, maintain an 8 feet minimum from a wall of any height.

Case 2: Two Units, Side-by-Side

For models 030-180, there must be a minimum of 4 feet between two units placed side-by-side; however, performance may be affected at this distance. For models 190-211, the minimum is 6 feet as closing spacing may cause air recirculation and elevated condenser pressure. Assuming the requirement of one side having at least 8 feet of service clearance is met, Case 2 figures show performance adjustments as the distance between two units increases. Full Load Capacity Reduction

Two Units, Side-by-Side



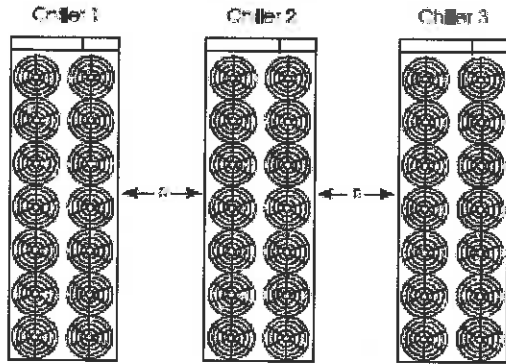
Product Drawing	Unit Tag: AGZ075E					
Product: Air-Cooled Scroll Chiller	Project Name: W V Lottery - Chiller					
Model: AGZ-E	Sales Office: Mason & Barry, Inc.			13600 Industrial Park Blvd. Minneapolis, MN 55441		
Sales Engineer: Scott Cowley	Feb. 22, 2017	Ver/Rev:	Sheet 1 of 1	Scale: NTS	Tolerance: +/-1.0"	Dwg Units: in [mm]
Software Version: 07.20 No change to this drawing may be made unless approved in writing by Daikin Applied. Purchaser must determine that the equipment is fit and sufficient for the job specifications.						

AGZ-E Close Spacing_Drawing for AGZ075E

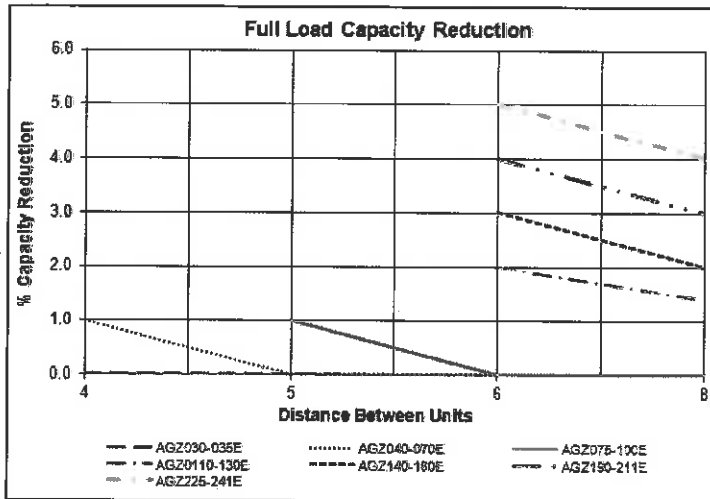
Case 3: Three or More Units, Side-by-Side

For all models, there must be a minimum distance between any units placed side-by-side; however, performance may be affected at this distance. Minimum distances are: models 030 to 070 - 4 feet, models 075 to 100 - 5 feet, models 110 to 241 - 6 feet. The Case 3 charts below depict Case 3 performance adjustments as the distance between units increases. Data shown is for the middle unit with a unit on each side. See Case 2 adjustment factors for the two outside units.

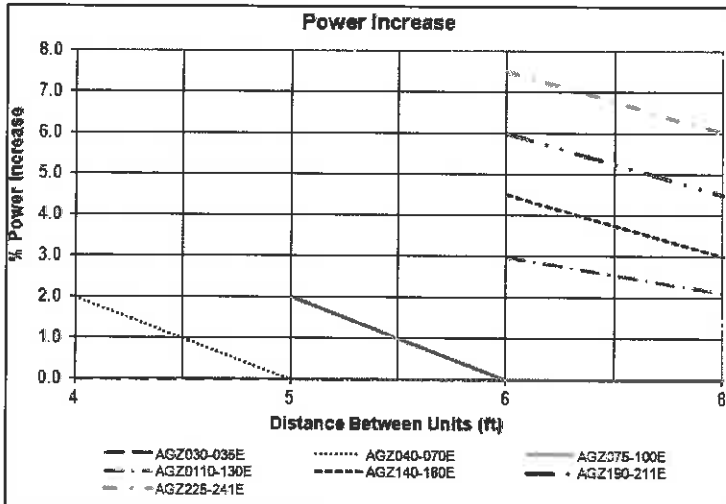
Three or More Units, Side-by-Side



Case 3 - Full Load Capacity Reduction



Case 3 - Power Increase

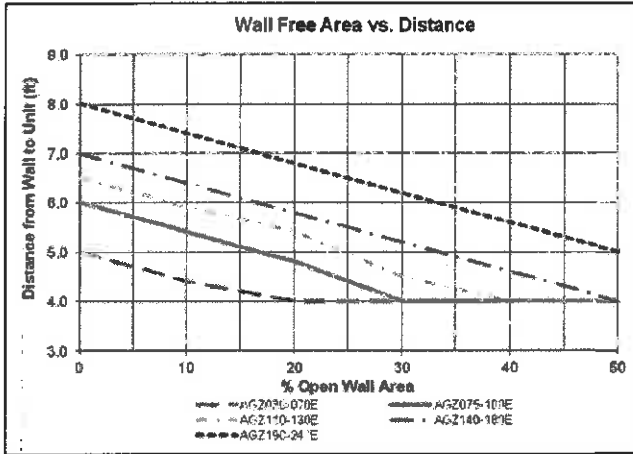


AGZ-E Close Spacing_Drawing for AGZ075E

Case 4: Open Screening Walls

Decorative screening walls are often used to help conceal a unit either on grade or on a rooftop. When possible, design these walls such that the combination of their open area and distance from the unit (see chart below) do not require performance adjustment. If the wall opening percentage is less than recommended for the distance to the unit, it should be considered a solid wall. It is assumed that the wall height is equal to or less than the unit height when mounted on its base support. If the wall height is greater than the unit height, see Case 5: Pit Installation for performance adjustment factors. The distance from the sides of the unit to the side walls must be sufficient for service, such as opening control panel doors. For uneven wall spacing, the distance from the unit to each wall can be averaged providing no distance is less than 4 feet. Values are based on walls on all four sides.

Case 4 - Allowable Wall Open Area



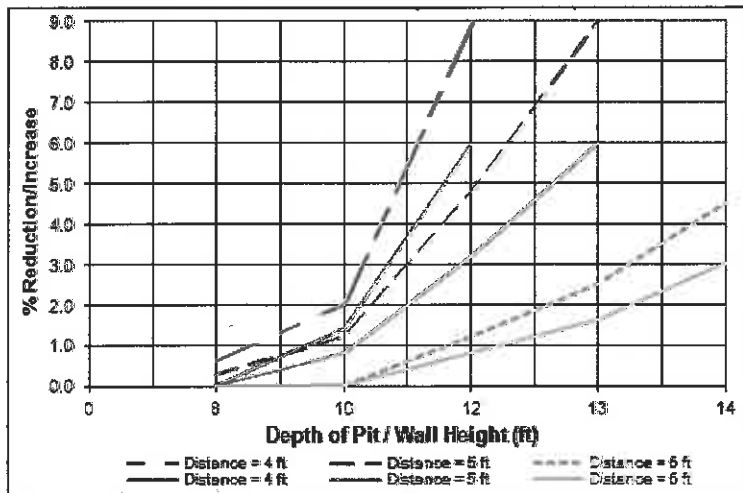
circulation and restriction and require care that sufficient air clearance is maintained. A solid wall surrounding a unit is substantially a pit and this data should

Steel grating is sometimes used to cover a pit to prevent accidental falls or trips into the pit. The grating material and installation design must be strong enough to prevent such accidents, yet provide abundant open area to avoid recirculation problems. Have any pit installation reviewed by the Daikin Applied sales representative prior to installation to ensure it has sufficient air-flow characteristics and approved by the installation design engineer to avoid risk of accident.

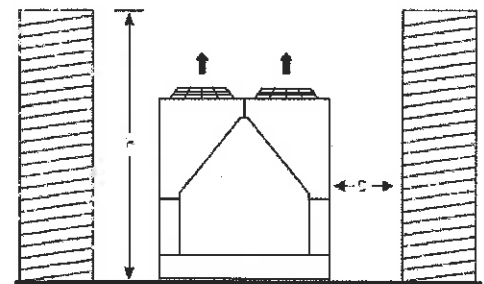
Models AGZ030-070E:

The Case 5 figures for models AGZ030-070E show adjustment factors for pit/wall heights of 4 feet, 5 feet, and 6 feet.

Case 5 - Full Load Capacity Reduction and Power Increase (AGZ030E-070E)



Case 5- Pit Installation



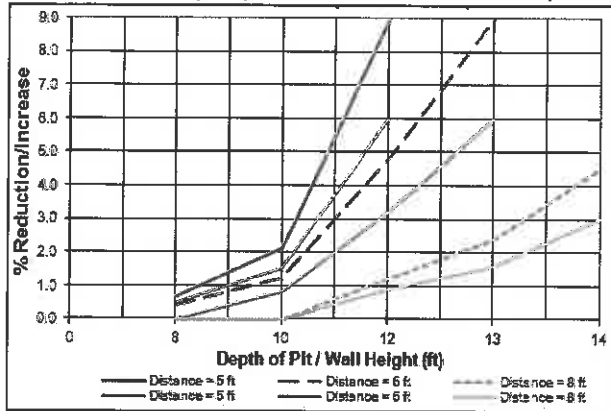
KEY:
 - - - - - : Power Increase
 _____ : Capacity Reduction

AGZ-E Close Spacing_Drawing for AGZ075E

Models AGZ075-130E:

The Case 5 figures for models AGZ075-130E show adjustment factors for pit/wall heights of 5 feet, 6 feet, and 8 feet.

Case 5 - Full Load Capacity Reduction and Power Increase (AGZ075-130E)



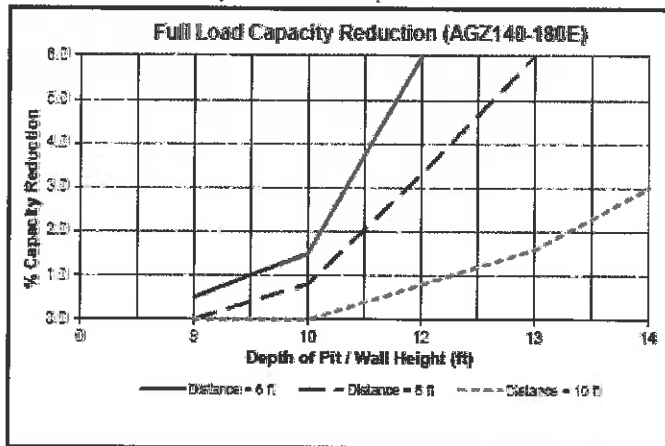
KEY:

----- : Power Increase
 _____ : Capacity Reduction

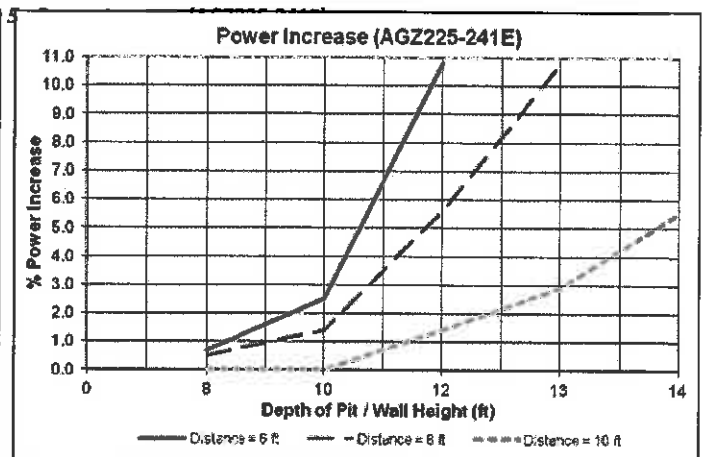
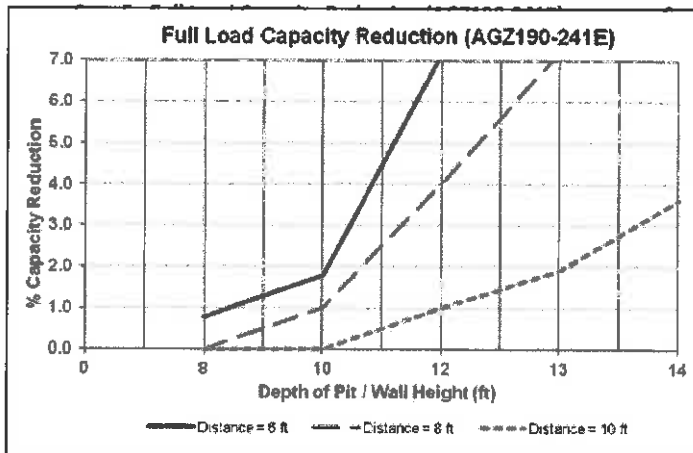
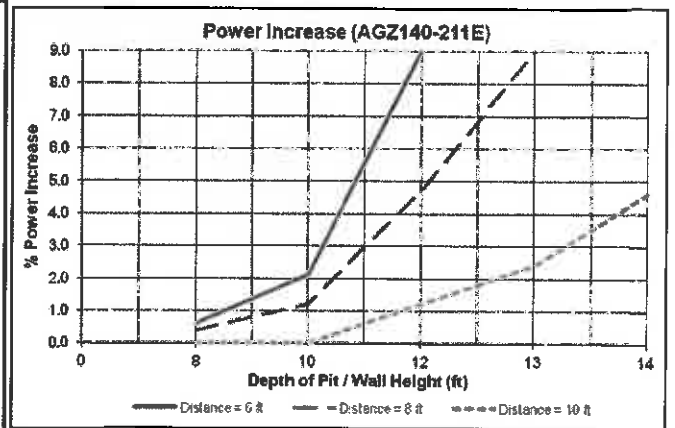
Models AGZ140-241E:

The Case 5 figures for models AGZ140-241E show adjustment factors for pit/wall heights of 6 feet, 8 feet, and 10 feet.

Case 5 - Full Load Capacity Reduction (AGZ140-180E)



Case 5 - Power Increase (AGZ140-211E)



AGZ-E Guards: Condenser Coil Wire Grilles, Painted Base

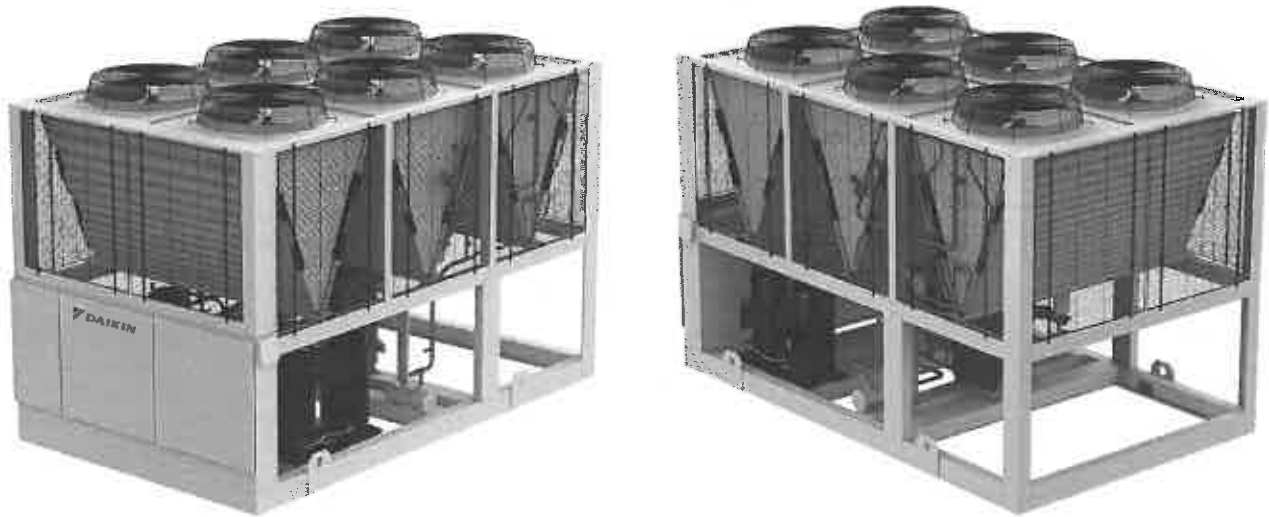



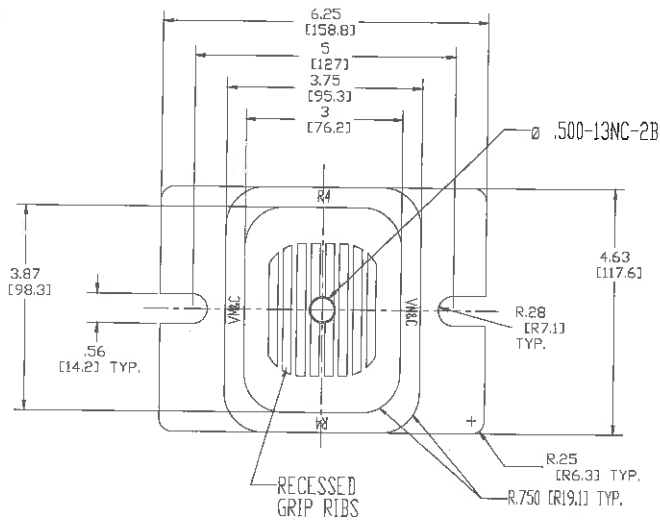
Diagram Notes
 Diagram simulates wrap, grille and louver options as selected only. Refrigeration components may vary depending on selected options.

Job Number: XRA010
 Job Name: W V Lottery - Chiller
 Page: 12 of 16
 Prepared Date: 2/22/2017
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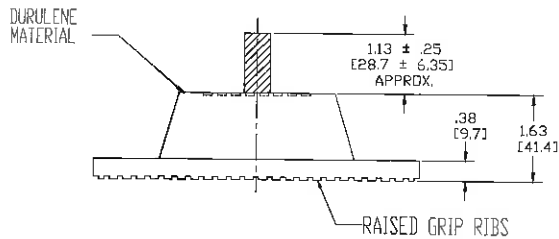
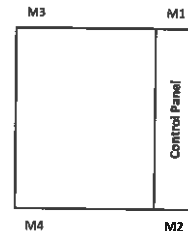
Product Drawing		Unit Tag: AGZ075E		Sales Office: Mason & Barry, Inc.			 13600 Industrial Park Blvd. Minneapolis, MN 55441 www.DaikinApplied.com Software Version: 07.20
Product: Air-Cooled Scroll Chiller		Project Name: W V Lottery - Chiller		Sales Engineer: Scott Cowley			
Model: AGZ075-100E		Feb. 22, 2017	Ver/Rev:	Sheet: 1 of 1	Scale: N/A	Tolerance: N/A	
No change to this drawing may be made unless approved in writing by Daikin Applied. Purchaser must determine that the equipment is fit and sufficient for the job specifications.							

Rubber-in-Shear (RIS) Isolator Kit

Dimension



Mounting Location			
M1	M2	M3	M4
Brown	Brown	Brown	Brown



Job Number: XRA010
Job Name: W V Lottery - Chiller

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Prepared Date:

2/22/2017
www.DaikinApplied.com

Product Drawing	Unit Tag: AGZ075E	Sales Office: Mason & Barry, Inc.	
Accessory: Rubber-in-Shear (RIS) Isolator Kit	Project Name: W V Lottery - Chiller	Sales Engineer: Scott Cowley	
Kit Part Number: 332325101	Feb. 22, 2017	Ver/Rev:	Sheet: 1 of 1
No change to this drawing may be made unless approved in writing by Daikin Applied. Purchaser must determine that the equipment is fit and sufficient for the job specifications.		Scale: NTS	Tolerance: +/- 1.0"
		Dwg Units: in [mm]	
		13600 Industrial Park Blvd. Minneapolis, MN 55441 www.DaikinApplied.com Software Version: 07.20	



Installation, Operation, and Maintenance Manual

IOM 1206-7

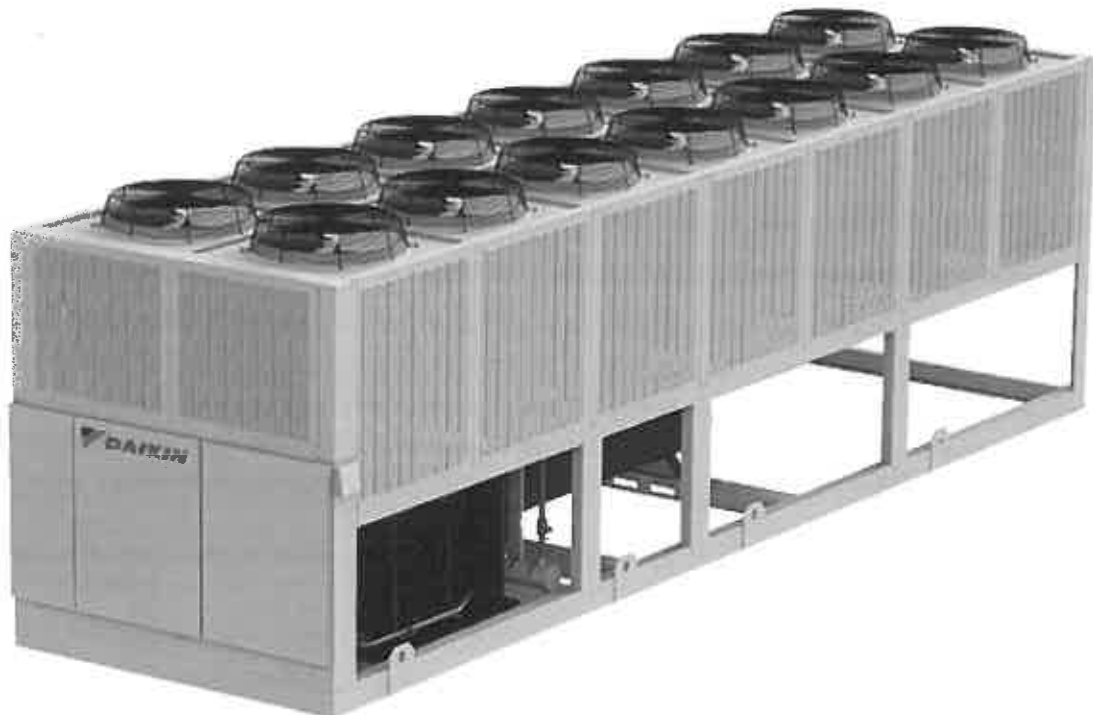
Group: Chiller

Part Number: IOM1206-7

Date: July 2016

Trailblazer™ Air-Cooled Scroll Chillers

Model AGZ, E Vintage
30 to 240 Tons (100 to 840 kW)
HFC-410A Refrigerant
50/60 Hz



Installation and Application Information	3	Circuit Functions	70
Refrigerant Schematics	15	Alarms	79
Dimensions and Weights - Packaged Units	20	Using the Controller	83
Refrigerant Charge	28	Optional Low Ambient Fan VFD	86
Isolator Information	29	Startup and Shutdown Procedures	92
Pressure Drop Data	32	Component Operation	94
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Unit Controller Operation	43	Troubleshooting Chart	102
Sequence of Operation	54	Warranty Registration Form (Scroll)	104
Unit Functions	61	Limited Product Warranty	109

Manufactured in an ISO 9001 & ISO 14001 certified facility



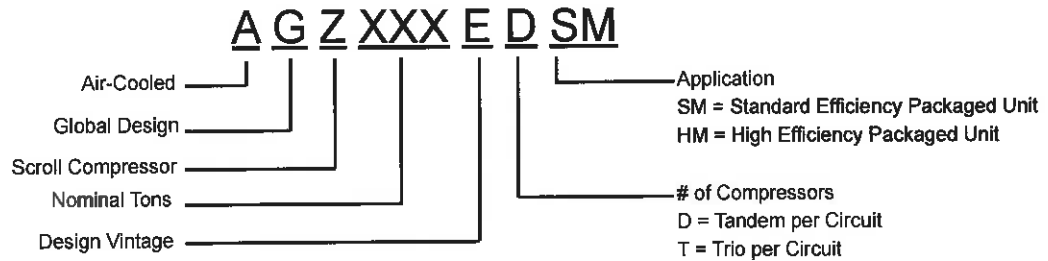
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General Description

Daikin Trailblazer™ air-cooled water chillers are complete, self-contained, automatic chillers designed for outdoor installation. Packaged units are completely assembled, factory wired, charged, and tested.

The electrical control center includes all equipment protection and operating controls necessary for dependable automatic operation.

NOMENCLATURE



WARNING
Installation is to be performed by qualified personnel who are familiar with local codes and regulations.

Additional Manual

This manual covers the installation, of dual circuit, AGZ-EH packaged, scroll compressor chillers using R-410A.

Information for units with either the pump package or remote evaporator options can be found at www.DaikinApplied.com.

Inspection

Check all items carefully against the bill of lading. Inspect all units for damage upon arrival. Report shipping damage and file a claim with the carrier. Check the unit nameplate before unloading, making certain it agrees with the power supply available. Daikin Applied is not responsible for physical damage after the unit leaves the factory.

Handling

Be careful to avoid rough handling of the unit. Do not push or pull the unit from anything other than the base. Block the pushing vehicle away from the unit to prevent damage to the sheet metal cabinet and end frame (see Figure 1).

To lift the unit, 2-1/2" (64mm) diameter lifting eyes are provided on the base of the unit. Arrange spreader bars and cables to prevent damage to condenser coils or cabinet (see Figure 2).

CAUTION
All lifting locations must be used to prevent damage to unit.

DANGER
Improper rigging, lifting, or moving of a unit can result in property damage, severe personal injury or death. Follow rigging and moving instructions carefully. Do not stand beneath the unit while it is lifted or being installed.

Figure 1: Suggested Pushing Arrangement

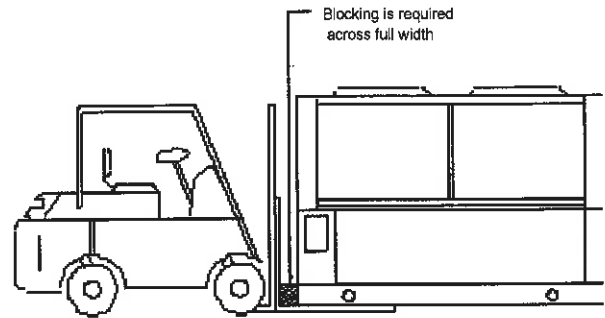
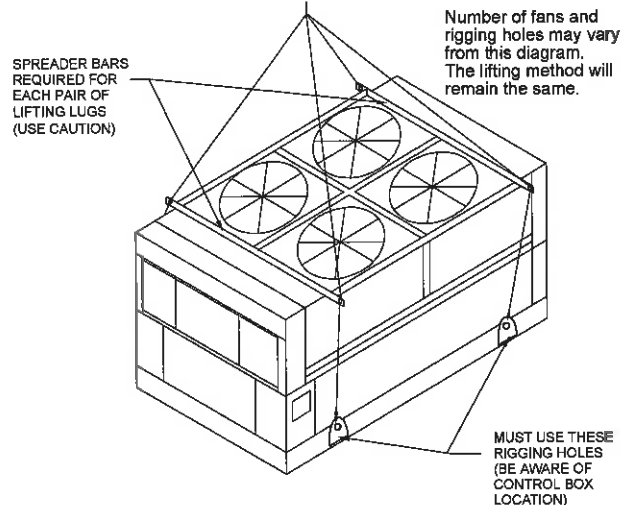


Figure 2: Required Lifting Arrangement



CAUTION
Sharp edges and coil surfaces are a potential injury hazard. Avoid contact with them.

Operating and Standby Limits

Table 1: Operating Limits

Maximum standby ambient temperature	131°F (55°C)
Maximum operating ambient temperature	105°F (41°C)
-with optional high ambient package (see information under High Ambient Operation)	125°F (52°C)
Minimum operating ambient temperature (standard control)	32°F (0°C)
Minimum operating ambient temperature (with optional low-ambient control)	-10°F (-23°C)
Leaving chilled water temperature	40°F to 65°F (4°C to 18°C)
Leaving chilled fluid temperatures (with anti-freeze) - Note that in cases of high ambient temperature, the lowest leaving water temperature settings may be outside of the chiller operating envelope; consult Daikin Tools to ensure chiller is capable of the required lift.	15°F to 65°F (-9°C to 18°C)
Operating chilled water delta-T range	6°F to 16°F (3.3°C to 8.9°C)
Maximum evaporator operating inlet fluid temperature	81°F (27°C)
Maximum evaporator non-operating inlet fluid temperature	100°F (38°C)

Unit Placement

Trailblazer™ units are for outdoor applications and can be mounted either on a roof or at ground level. For roof mounted applications, install the unit on a steel channel or I-beam frame to support the unit above the roof. For ground level applications, install the unit on a substantial base that will not settle. Use a one-piece concrete slab with footings extended below the frost line. Be sure the foundation is level within 0.5" (13 mm) over its length and width. The foundation must be strong enough to support the unit weight - see "Dimensions and Weights - Packaged Units" on page 20.

Service Clearance

Sides

- **30-70 Ton Models:** Minimum of 4 feet (1.2 meters)
- **75-240 Ton Models:** It is highly recommended to provide a minimum of 8 feet (2.4 meters) on one side to allow for coil replacement. Coils can be removed from the top, allowing a minimum of 4 feet (1.2 meters) of side clearance; however, the unit performance may be derated.

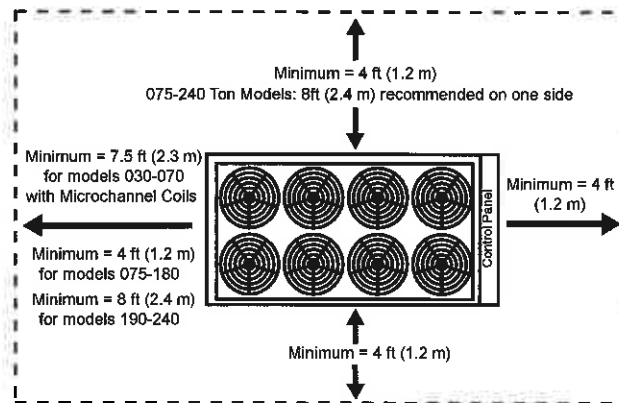
Control Panel End

- **All Models:** Minimum of 4 feet (1.2 meters)

Opposite Control Panel End

- **30-70 Ton Models with Microchannel Coils:** Minimum of 7.5 feet (2.3 meters)
- **75-180 Ton Models:** Minimum of 4 feet (1.2 meters)
- **190-240 Ton Models:** Minimum of 8 feet (2.4 meters) for evaporator removal

Figure 3: Service Clearance



Spacing Requirements

Sufficient clearance must be maintained between the unit and adjacent walls or other units to allow the required unit air flow to reach the coils. Failure to do so will result in a capacity reduction and an increase in power consumption. No solid obstructions are allowed above the unit at any height, see page 7 for details.

Graphs on the following pages give the minimum clearance for different types of installations and also capacity reduction and power increase if closer spacing is used. The clearance requirements shown are a general guideline and cannot account for all scenarios. Such factors as prevailing winds, additional equipment within the space, design outdoor air temperature, and numerous other factors may require more clearance than what is shown.

Case 1: Building or Wall on One Side of Unit

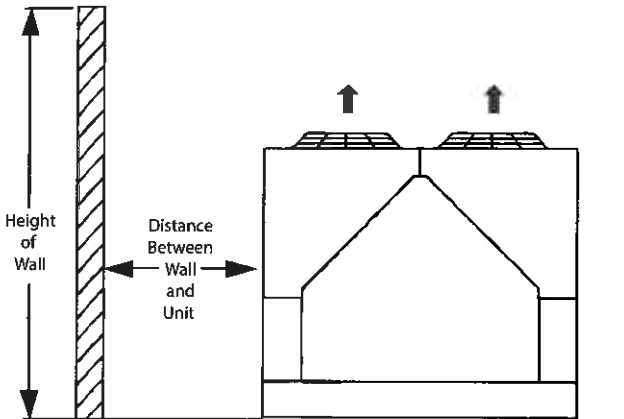
NOTE: Assumes a solid height wall taller than unit. Refer to Case 4 for partial wall openings.

For models AGZ030-100E, maintain a 4 feet minimum from a wall of any height.

For models AGZ110-130E, maintain a 6 feet minimum from a wall of any height.

For models AGZ140-240E, maintain a 8 feet minimum from a wall of any height.

Figure 4: Building or Wall on One Side of Unit



Case 2: Two Units, Side-by-Side

For models 030-180, there must be a minimum of 4 feet between two units placed side-by-side; however, performance may be affected at this distance. For models 190-240, the minimum is 6 feet as closing spacing may cause air recirculation and elevated condenser pressure. Assuming the requirement of one side having at least 8 feet of service clearance is met, Case 2 figures show performance adjustments as the distance between two units increases.

Figure 5: Two Units, Side-by-Side

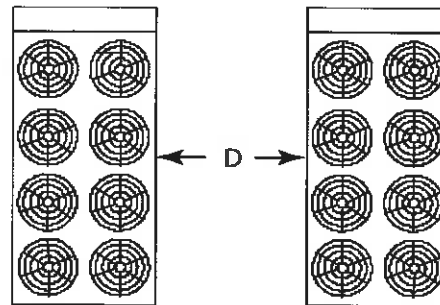


Figure 6: Case 2 - Full Load Capacity Reduction

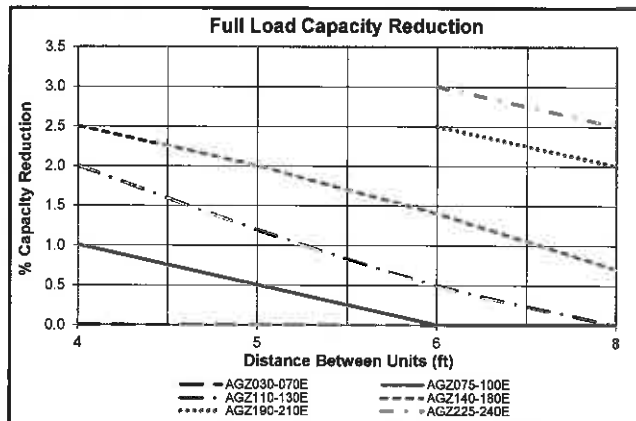
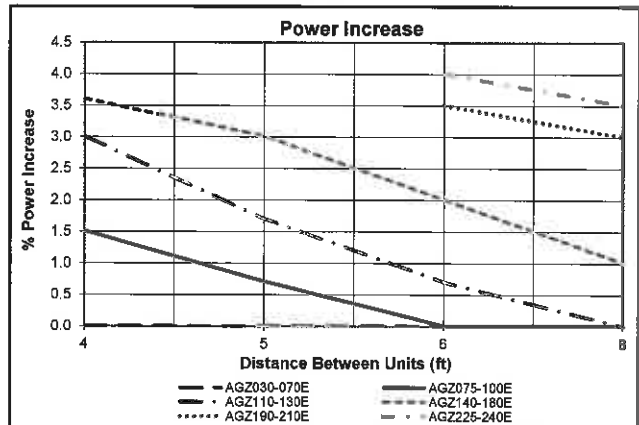


Figure 7: Case 2 - Power Increase



Case 3: Three or More Units, Side-by-Side

For all models, there must be a minimum distance between any units placed side-by-side; however, performance may be affected at this distance. Minimum distances are: models 030 to 070 - 4 feet, models 075 to 100 - 5 feet, models 110 to 240 - 6 feet. Figure 9 and Figure 10 depict Case 3 performance adjustments as the distance between units increases.

NOTE: Data in Figure 9 and Figure 10 is for the middle unit with a unit on each side. See Case 2 adjustment factors for the two outside units.

Figure 8: Three or More Units, Side-by-Side

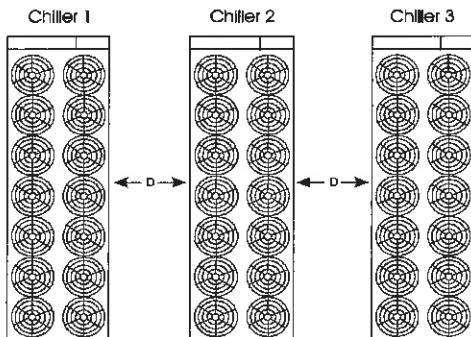


Figure 9: Case 3 - Full Load Capacity Reduction

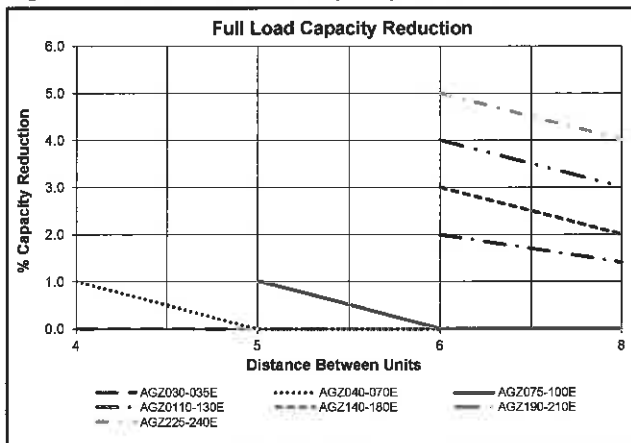
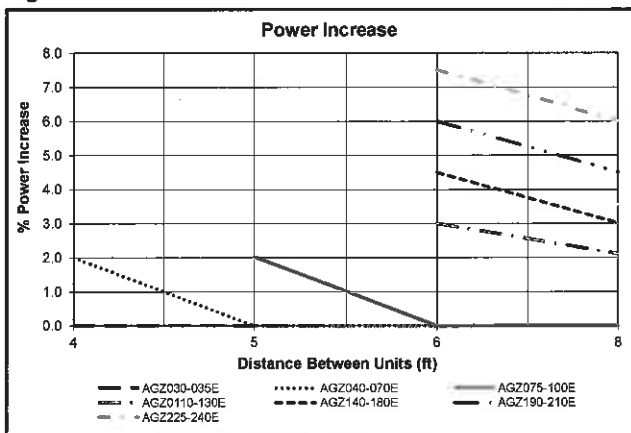


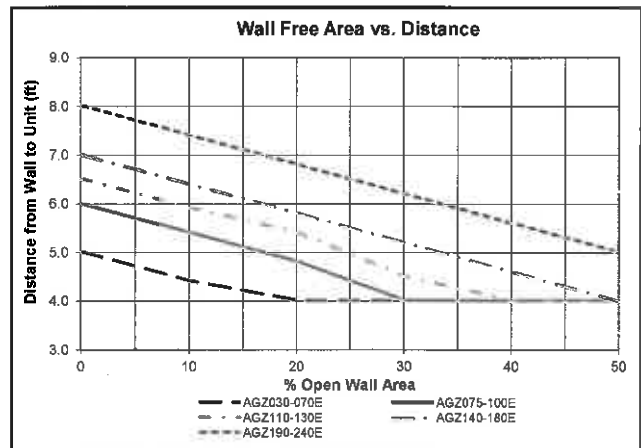
Figure 10: Case 3 - Power Increase



Case 4: Open Screening Walls

Decorative screening walls are often used to help conceal a unit either on grade or on a rooftop. When possible, design these walls such that the combination of their open area and distance from the unit (see Figure 11) do not require performance adjustment. If the wall opening percentage is less than recommended for the distance to the unit, it should be considered as a solid wall. It is assumed that the wall height is equal to or less than the unit height when mounted on its base support. If the wall height is greater than the unit height, see Case 5: Pit Installation for performance adjustment factors. The distance from the sides of the unit to the side walls must be sufficient for service, such as opening control panel doors. For uneven wall spacing, the distance from the unit to each wall can be averaged providing no distance is less than 4 feet. Values are based on walls on all four sides.

Figure 11: Case 4 - Allowable Wall Open Area



Case 5: Pit Installation

Pit installations can cause operating problems resulting from air recirculation and restriction and require care that sufficient air clearance is provided, safety requirements are met and service access is provided. A solid wall surrounding a unit is substantially a pit and this data should be used.

Steel grating is sometimes used to cover a pit to prevent accidental falls or trips into the pit. The grating material and installation design must be strong enough to prevent such accidents, yet provide abundant open area to avoid recirculation problems. Have any pit installation reviewed by the Daikin Applied sales representative prior to installation to ensure it has sufficient air-flow characteristics and approved by the installation design engineer to avoid risk of accident.

Models AGZ030-070E:

The Case 5 figures for models AGZ030-070E show adjustment factors for pit/wall heights of 4 feet, 5 feet, and 6 feet.

Figure 12: Case 5 - Full Load Capacity Reduction (AGZ030E-070E)

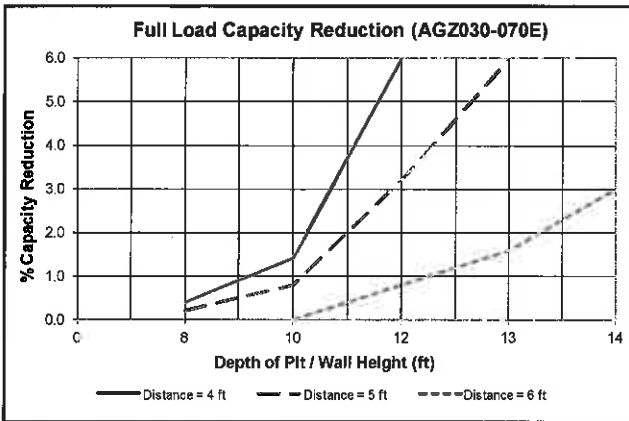


Figure 13: Case 5 - Power Increase (AGZ030-070E)

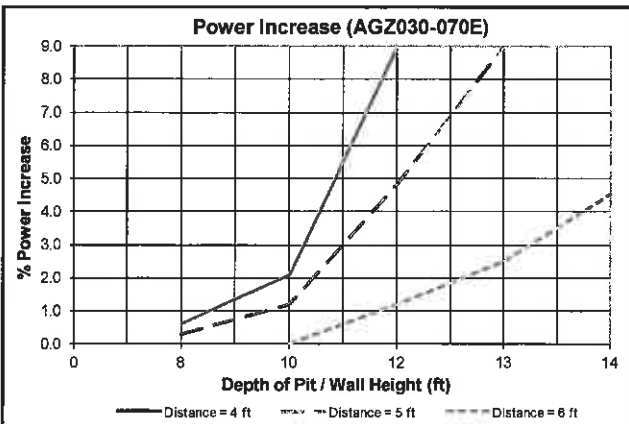
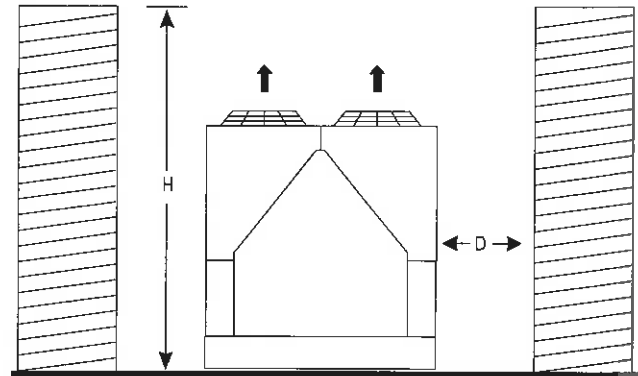


Figure 14: Case 5 - Pit Installation



Models AGZ075-130E:

The Case 5 figures for models AGZ075-130E show adjustment factors for pit/wall heights of 5 feet, 6 feet, and 8 feet.

Figure 15: Case 5 - Full Load Capacity Reduction (AGZ075-130E)

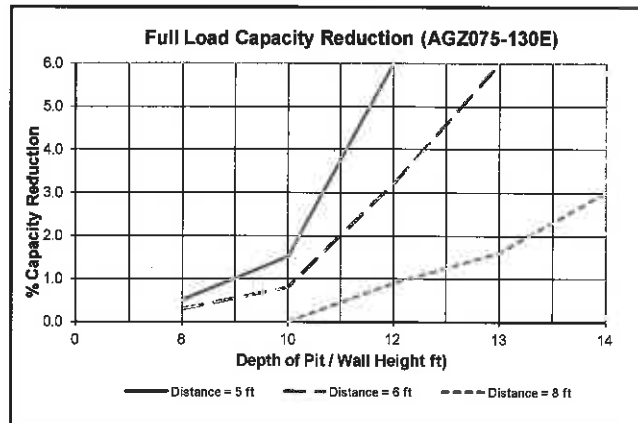
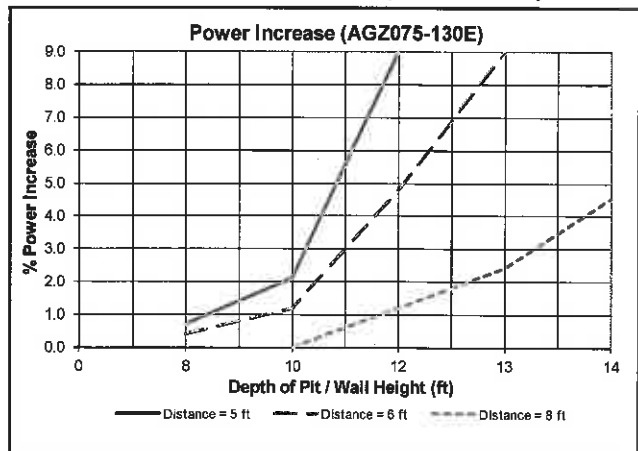


Figure 16: Case 5 - Power Increase (AGZ075-130E)



Models AGZ140-240E:

The Case 5 figures for models AGZ140-240E show adjustment factors for pit/wall heights of 6 feet, 8 feet, and 10 feet.

Figure 17: Case 5 - Full Load Capacity Reduction (AGZ140-180E)

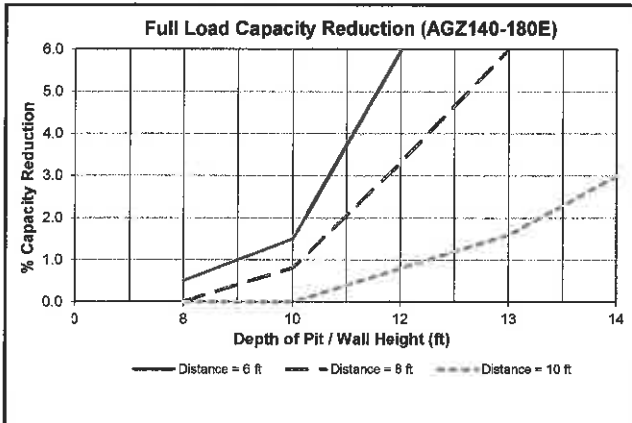


Figure 19: Case 5 - Power Increase (AGZ140-210E)

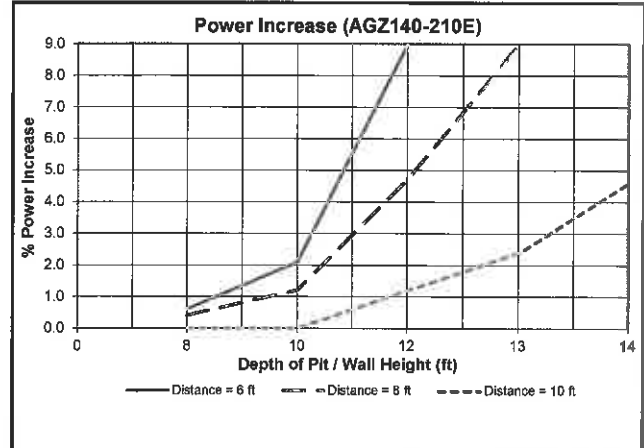


Figure 18: Case 5 - Full Load Capacity Reduction (AGZ190-240E)

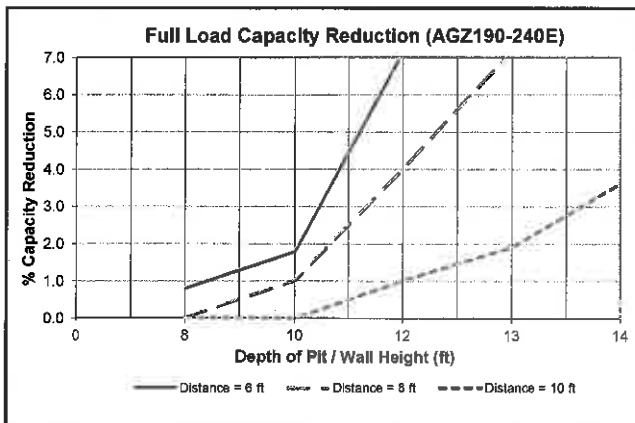
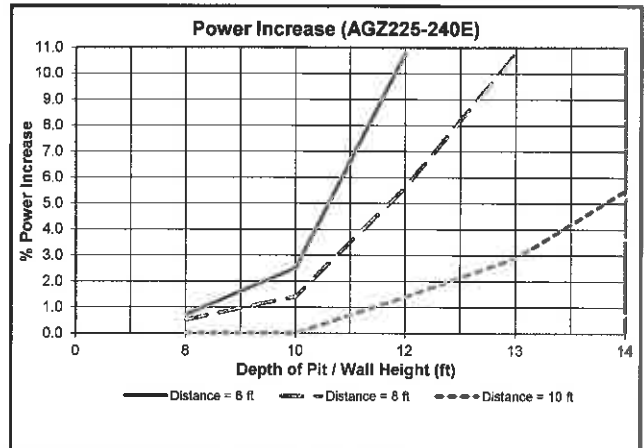


Figure 20: Case 5 - Power Increase (AGZ225-240E)



Chilled Water Piping

CAUTION

To prevent damage to the evaporator and potential chiller failure, a supply strainer is required in the inlet water piping which connects to this evaporator. This strainer must be installed prior to operation of the chilled liquid pumps.

Field installed water piping to the chiller **must** include:

- A cleanable strainer installed at the water inlet to the evaporator to remove debris and impurities before they reach the evaporator. Install cleanable strainer within 5 feet (1500 mm) of pipe length from the evaporator inlet connection and downstream of any welded connections (no welded connections between strainer and evaporator).
- AGZ-E models 030-180 require a strainer with perforations no larger than 0.063" (1.6 mm) diameter and models 190-240 require a strainer with perforations no larger than 0.125" (3.175 mm) diameter. See the Inlet Strainer Guidelines on page 10 for more information.
- A water flow switch must be installed in the horizontal piping of the supply (evaporator outlet) water line to avoid evaporator freeze-up under low or no flow conditions. The flow switch may be ordered as a factory-installed option, a field-installed kit, or may be supplied and installed in the field. See page 12 for more information.
- Piping for units with brazed-plate evaporators must have a drain and vent connection provided in the bottom of the lower connection pipe and to the top of the upper connection pipe respectively, see Figure 21. These evaporators do not have drain or vent connections due to their construction. Purge air from the water system before unit start-up to provide adequate flow through the evaporator.
- Adequate piping support, independent from the unit,

to eliminate weight and strain on the fittings and connections.

It is **recommended** that the field installed water piping to the chiller include:

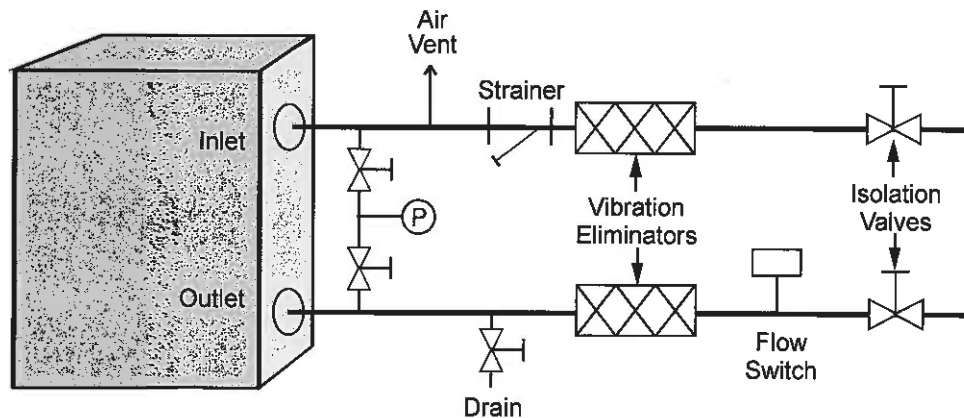
- Thermometers at the inlet and outlet connections of the evaporator.
- Water pressure gauge connection taps and gauges at the inlet and outlet connections of the evaporator for measuring water pressure drop.
- Shutoff valves are necessary to isolate the unit from the piping during unit servicing.
- Minimum bends and changes in elevation to minimize pressure drop.
- An expansion tank or regulating valve to maintain adequate water pressure
- Vibration eliminators in both the supply and return water lines to reduce transmissions to the building.
- Flush the system water piping thoroughly before making connections to the unit evaporator.
- Piping insulation, including a vapor barrier, helps prevent condensation and reduces heat loss.
- Regular water analysis and chemical water treatment for the evaporator loop is recommended immediately at equipment start-up.

NOTE: Failure to follow these measures may result in performance and reliability issues.

WARNING

Daikin Applied recommends against the use of PVC and CPVC piping for chilled water systems. In the event the pipe is exposed to POE oil used in the refrigerant system, the pipe can be chemically damaged and pipe failure can occur.

Figure 21: Typical Piping, Brazed-Plate Evaporator



WELDED PIPE CONNECTIONS ARE NOT ALLOWED BETWEEN THE STRAINER AND EVAPORATOR DUE TO THE CHANCE OF SLAG ENTERING THE EVAPORATOR

Figure 22: Typical Piping, Shell and Tube Evaporator

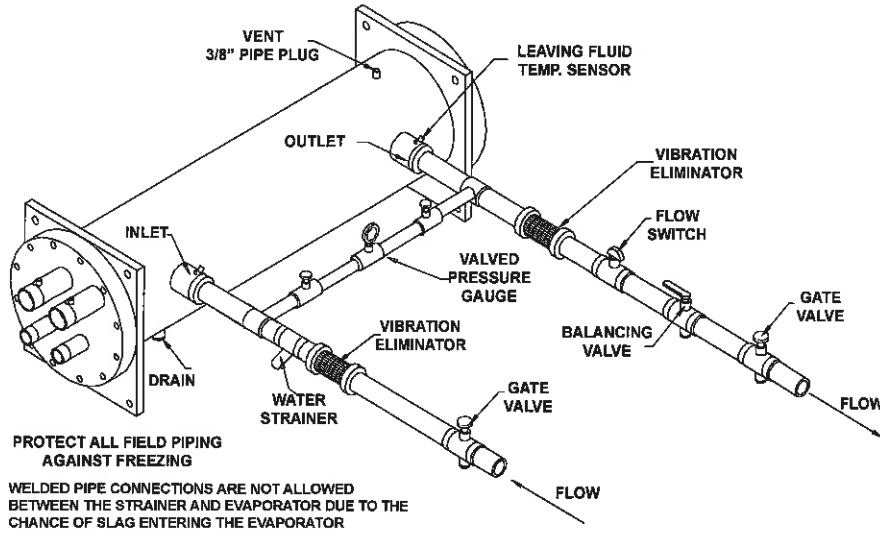


Figure 23: Factory Installed Strainer

Inlet Strainer Guidelines

An inlet water strainer kit must be installed in the chilled water piping before the evaporator inlet. Several paths are available to meet this requirement:

1. Factory installed option is available - models 030 to 180.
2. A field-installed kit shipped-loose with the unit is available for all unit sizes and consists of:
 - Y-type area strainer with 304 stainless steel perforated basket, Victaulic pipe connections and strainer cap [a strainer with perforations no larger than 0.063" (1.6 mm) diameter for AGZ-E models 030-180, a strainer with perforations no larger than 0.125" (3.175 mm) diameter for AGZ-E models 190-240].
 - Extension pipe with two Schrader fittings that can be used for a pressure gauge and thermal dispersion flow switch. The pipe provides sufficient clearance from the evaporator for strainer basket removal.
 - 1/2-inch blowdown valve
 - Two grooved clamps

Both are sized per Table 2 and with the pressure drop shown in the Strainer Pressure Drop graph. Connection sizes are given in the Dimensions and Weights section on page 20.

3. A field-supplied strainer that meets specification and installation requirements of this manual.

Table 2: Strainer Data

Trailblazer™ Model	Strainer Size in (mm)	Minimum perforation size in (mm)	Factory Installed Option	Field Installed Option
030-070E	2.5 (64)	0.063 (1.6)	Y	Y
075-130E	3.0 (76)	0.063 (1.6)	Y	Y
140-180E	4.0 (102)	0.063 (1.6)	Y	Y
190-240E	8.0 (203)	0.125 (3.175)	N	Y

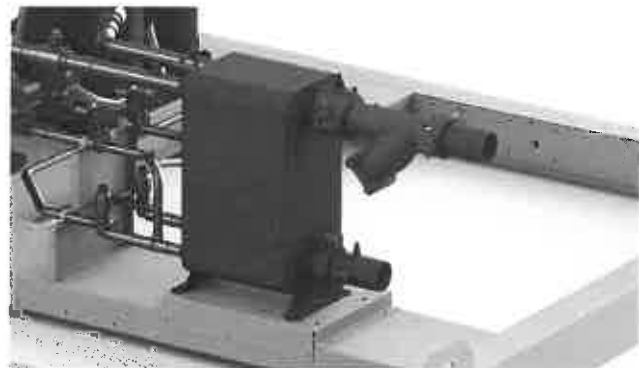
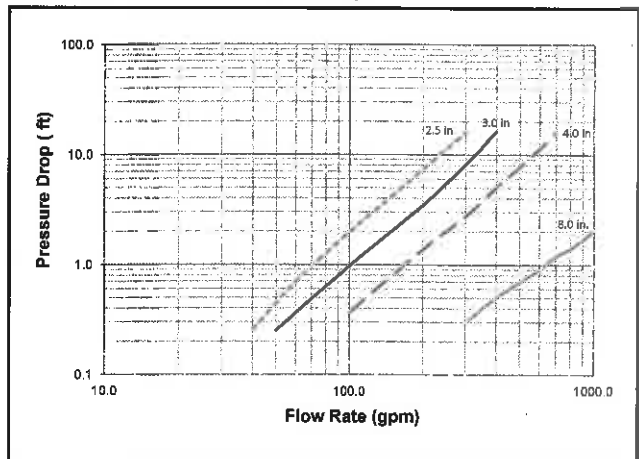


Figure 24: Strainer Pressure Drop



Water Flow Limitations

Constant Evaporator Flow

The evaporator flow rates and pressure drops shown on page 33 for various system designs. The maximum flow rate and pressure drop are based on a 6°F temperature drop. Flow rates above the maximum values will result in unacceptable pressure drops and can cause excessive erosion, potentially leading to failure.

The minimum flow and pressure drop is based on a full load evaporator temperature drop of 16°F. Evaporator flow rates below the minimum values can result in laminar flow causing low pressure alarms, scaling and poor temperature control.

Variable Evaporator Flow

Reducing evaporator flow in proportion to load can reduce system power consumption. The rate of flow change should be a maximum of 10 percent of the flow per minute. For example, if the maximum design flow is 200 gpm and it will be reduced to a flow of 140 gpm, the change in flow is 60 gpm. Ten percent of 200 gpm equals 20 gpm change per minute, or a minimum of three minutes to go from maximum to desired flow. The water flow through the evaporator must remain between the minimum and maximum values listed in Table 11 on page 33. If flow drops below the minimum allowable, large reductions in heat transfer can occur. If the flow exceeds the maximum rate, excessive pressure drop and tube erosion can occur. See unit set point information in See Variable Evaporator Flow on page 61.

System Water Considerations

All chilled water systems need adequate time to recognize a load change, respond to the change and stabilize to avoid undesirable short cycling of the compressors or loss of temperature control. In air conditioning systems, the potential for short cycling usually exists when the building load falls below the minimum chiller plant capacity or on close-coupled systems with very small water volumes. Some of the things the designer should consider when looking at water volume are the minimum cooling load, the minimum chiller plant capacity during the low load period and the desired cycle time for the compressors. Assuming that there are no sudden load changes and that the chiller plant has reasonable turndown, a rule of thumb of "gallons of water volume equal to two to three times the chilled water gpm flow rate" is often used. A storage tank may have to be added to the system to reach the recommended system volume. Refer to AG 31-003 for method of calculating "Minimum Chilled Water Volume".

The water quality provided by the owner/occupant/operator/user to a chiller system should minimize corrosion, scale buildup, erosion, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment. Water systems should be cleaned and flushed prior to the chiller installation. Water testing and treatment should be verified during initial chiller installation/commissioning and maintained on a continuous basis by water treatment professionals (see Limited Product Warranty on inside of back cover).

CAUTION

The use of detergents, chemicals, and additives in the chiller system water may adversely affect chiller performance and potentially lead to repair costs not covered by warranty. Any decision to use these products is at the discretion of the owner/occupant/operator/user as such they assume full liability/responsibility for any damage that may occur due to their use.

Evaporator Freeze Protection

Evaporator freeze-up can be a concern in the application of air-cooled water chillers in areas experiencing below freezing temperatures. To protect against freeze-up, insulation and an electric heater are furnished with the evaporator. Models 030 through 180 have an external plate heater and thermostat. Models 190 through 240 have immersion heaters with a thermostat. These heaters help protect the evaporator down to -20°F (-29°C) ambient air temperature. The evaporator heater cable is factory wired to the 115 volt control circuit transformer in the control box. A 115V power source for the heater and controls may also be supplied from a separate power feed to maximize unit protection if desired. Refer to the field wiring diagram on page 35 for additional information on supplying a separate 115V power feed.


Operation of the heaters is automatic through the sensing thermostat that energizes the evaporator heaters for protection against freeze-up. Unless the evaporator is drained in the winter or contains an adequate concentration of anti-freeze, the disconnect switch to the evaporator heater must not be open.

Although the evaporator is equipped with freeze protection, it does not protect water piping external to the unit or the evaporator itself if there is a power failure or heater burnout, or if the chiller is unable to control the chilled water pumps. Use one of the following recommendations for additional freeze protection:

1. If the unit will not be operated during the winter, drain the evaporator and chilled water piping and flush with glycol.
2. Add a glycol solution to the chilled water system. Burst protection should be approximately 10°F below minimum design ambient temperature.
3. Insulate the exposed piping.
4. Add thermostatically controlled heat by wrapping the lines with heat tape.
5. When glycol is added to the water system for freeze protection, the refrigerant suction pressure will be lower, cooling performance less, and water side pressure drop greater. If the percentage of glycol is high, or if propylene is used instead of ethylene glycol, the added pressure drop and loss of performance could be substantial. When Glycol or Ice are selected as Unit Mode, the MicroTech[®] III control will automatically reset the available range for the Leaving Water Temperature, Freezestat and Evaporator Pressure settings.

Chilled Water Pump

It is important that the chilled water pumps be wired to, and controlled by, the chiller's microprocessor. When equipped with optional dual pump output, the chiller controller has the capability to selectively send the signal to a pump relay (by others) to start pump A or B or automatically alternate pump selection and also has standby operation capability. The controller will energize the pump whenever at least one circuit on the chiller is enabled to run, whether there is a call for cooling or not. This helps ensure proper unit start-up sequence. The pump will also be turned on when the water temperature goes below the Freeze Setpoint for longer than a specified time to help prevent evaporator freeze-up. Connection points are shown in the Field Wiring Diagram beginning on page 35.

 **CAUTION**

Adding glycol or draining the system is the recommended method of freeze protection. If the chiller does not have the ability to control the pumps and the water system is not drained in temperatures below freezing, catastrophic evaporator failure may occur.

Failure to allow pump control by the chiller may cause the following problems:

1. If any device other than the chiller attempts to start the chiller without first starting the pump, the chiller will lock out on the No Flow alarm and require manual reset.
2. If the chiller evaporator water temperature drops below the "Freeze setpoint" the chiller will attempt to start the water pumps to avoid evaporator freeze. If the chiller does not have the ability to start the pumps, the chiller will alarm due to lack of water flow.
3. If the chiller does not have the ability to control the pumps and the water system is not to be drained in temperatures below freezing or contain glycol, the chiller may be subject to catastrophic evaporator failure due to freezing. The freeze rating of the evaporator is based on the evaporator heater and pump operation. The external brazed plate heater or shell and tube immersion heater itself may not be able to properly protect the evaporator from freezing without circulation of water.

Flow Switch

All chillers require a chilled water flow switch to check that there is adequate water flow through the evaporator and to shut the unit down if there isn't. There are two options for meeting this requirement.

1. A factory-mounted thermal dispersion flow switch.
2. A "paddle" type flow switch is available from Daikin Applied for field mounting and wiring. Wire from switch terminals Y and R to the unit control panel terminals shown on the field wiring diagrams, page 35 and page 36. Mount the flow switch in the leaving water line to shut down the unit when water flow is interrupted. A flow switch is an equipment protection control and should never be used to cycle a unit.

Installation should be per manufacturer's instructions included with the switch. Flow switches should be calibrated to shut off the unit when operated below the minimum listed flow rate for the unit as listed on page 33.

There is also a set of normally closed contacts on the switch that can be used for an indicator light or an alarm to indicate when a "no flow" condition exists. Freeze protect any flow switch that is installed outdoors. Differential pressure switches are not recommended for outdoor installation. They can freeze and not indicate a no-flow conditions.

Glycol Solutions

The use of a glycol/water mixture in the evaporator to prevent freezing will reduce system capacity and efficiency, as well as increase pressure drop. The system capacity, required glycol solution flow rate, and pressure drop with glycol may be calculated using the following formulas and tables.

$$\text{Glycol Flow Rate (gpm)} = \frac{\text{Capacity Tons} \times \text{Flow Correction Factor}}{0.00429 \times \Delta T}$$

1. **Capacity** - Multiply the capacity based on water by the Capacity correction factor from Table 3 or Table 4.
2. **Flow** - Multiply the water evaporator flow by the Flow correction factor from Table 3 or Table 4 to determine the increased evaporator flow due to glycol. If the flow is unknown, it can be calculated from the above equation.
3. **Pressure drop** - Multiply the water pressure drop from Table 11 by Pressure Drop correction factor from Table 3 or Table 4. High concentrations of propylene glycol at low temperatures may cause unacceptably high pressure drops.
4. **Power** - Multiply the water system power by Power correction factor from Table 3 or Table 4.

Test coolant with a clean, accurate glycol refractometer to determine the freezing point. Obtain percent glycol from the freezing point table below. It is recommended that a minimum of 25% solution by weight be used for protection against corrosion or that additional compatible inhibitors be added. Concentrations above 35% do not provide any additional burst protection and should be carefully considered before using.

Reset the freeze stat setting to 6 °F (3.3 °C) below the leaving chilled water setpoint temperature after the glycol percentage is verified safe for the application.

CAUTION

Do not use an automotive-grade antifreeze. Industrial grade glycols must be used. Automotive antifreeze contains inhibitors which will cause plating on the copper tubes within the chiller evaporator. The type and handling of glycol used must be consistent with local codes.

High Ambient Operation

Trailblazer™ units for high ambient operation (105°F to 125°F, 40°C to 52°C) require the addition of the optional high ambient package that includes a small fan with a filter in the air intake to cool the control panel.

All units with the optional VFD low ambient fan control automatically include the high ambient option. Note that in cases of high ambient temperature, capacity could be reduced or the lowest leaving water temperature settings may be outside of the chiller operating envelope; consult with a Daikin Applied sales representative to ensure chiller is capable of the required lift.

Table 3: Ethylene Glycol Factors

E.G. %	Freeze Point		Cap	Power	Flow	PD
	°F	°C				
10	26	-3.3	0.997	0.999	1.028	1.090
20	18	-7.8	0.993	0.997	1.059	1.216
30	7	-14	0.987	0.995	1.094	1.379
40	-7	-22	0.981	0.993	1.132	1.557
50	-28	-33	0.972	0.990	1.174	1.811

Table 4: Propylene Glycol Factors

P.G. %	Freeze Point		Cap	Power	Flow	PD
	°F	°C				
10	26	-3.3	0.995	0.998	1.011	1.025
20	19	-7.2	0.988	0.995	1.030	1.150
30	9	-13	0.979	0.992	1.056	1.375
40	-5	-21	0.968	0.988	1.090	1.701
50	-27	-33	0.955	0.983	1.131	2.128

Low Ambient Operation

Compressor staging is adaptively determined by system load, ambient air temperature, and other inputs to the MicroTech® III control. The standard minimum ambient temperature is 32°F (0°C). A low ambient option with fan VFD allows operation down to -10°F (-23°C). The minimum ambient temperature is based on still conditions where the wind is not greater than 5 mph. Greater wind velocities will result in reduced discharge pressure, increasing the minimum operating ambient temperature. Field installed louvers are available and recommended to help allow the chiller to operate effectively down to the ambient temperature for which it was designed.

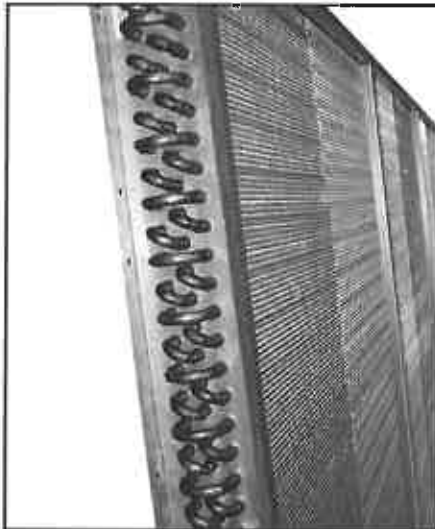
Condenser Coil Options and Coating Considerations

The standard coils on the Trailblazer™ chiller are an all aluminum alloy microchannel design with a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. The microchannel coils are designed to withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.

Should the standard microchannel coil not meet the corrosion requirements for the application, additional coil options are available.

Aluminum fin/copper tube coils consist of 3/8 inch (10 mm) seamless copper tubes mechanically bonded into plate-type aluminum fins. The fins have full drawn collars to completely cover the tubes. The aluminum fin/copper tube option is best suited for non-corrosive environments, and can be repaired onsite. This option is only available for models AGZ030-070E.

Figure 25: Aluminum Fin/Copper Tube Coils



BlackFin™ coils include aluminum fins pre-coated with a durable phenolic epoxy coating. In addition to providing a durable coating on the fin material, the BlackFin™ coils provide and epoxy barrier between the aluminum fin stock and the copper tube, to prevent the galvanic corrosion that can occur between the dissimilar metals. This option will provide a 1000+ hour salt spray rating per ASTM B117-90. The BlackFin™ option provides enhanced protection in mildly corrosive environments. This option is only available for models AGZ030-070E.

Copper-fin coils consist of 3/8 inch (10 mm) seamless copper tubes mechanically bonded into plate-type copper fins. The fins have full drawn collars to completely cover the tubes. Since the fin and the tube materials are similar, the opportunity for galvanic corrosion is eliminated. The copper fin/copper tube option may be used in marine environments; however this option is not well suited for industrial or chemical atmospheric contamination. This option is only available for models AGZ030-070E.

ElectroFin® coil coating is a water-based extremely flexible and durable epoxy polymer coating uniformly applied to all coil surfaces through a multi-step, submerged electrostatic coating process. ElectroFin® condenser coils provide a 5000+ hour salt spray resistance per ASTM B117-90, applied to both the coil and the coil frames. The ElectroFin® coated coils also receive a UV-resistant urethane top-coat to provide superior resistance to degradation from direct sunlight. This coil coating option provides the best overall protection against corrosive marine, industrial or combined atmospheric contamination. This coating option may be applied to any of the untreated coil options offered, to provide excellent longevity and resistance to corrosion.

Table 5: Coil/Coating Selection Matrix

Coil Option	Non-Corrosive ¹	Unpolluted Marine ²	Industrial ³	Combined Marine-Industrial ⁴
Standard Microchannel	+++	-	-	-
Alum. Fin/Copper Tube ⁵	+++	-	-	-
Copper Fin/Copper Tube ⁵	+++	+++	-	-
BlackFin™ ⁵	+++	+	+	-
ElectroFin®	+++	+++	+++	++

NOTE:

1. Non-corrosive environments may be estimated by the appearance of existing equipment in the immediate area where the chiller is to be placed.
2. Marine environments should take into consideration proximity to the shore as well as prevailing wind direction.
3. Industrial contaminants may be general or localized, based on the immediate source of contamination (i.e. diesel fumes due to proximity to a loading dock).
4. Combined marine-industrial are influenced by proximity to shore, prevailing winds, general and local sources of contamination.
5. Available for models AGZ030-070E only.

Figure 26: AGZ030-070E Package Chiller with Microchannel

AGZ030-070E PACKAGE CHILLER
MICROCHANNEL ALUMINUM COIL

NOTE:
PIPING SHOWN FOR ONE SYSTEM OF UNIT.
UNIT HAS TWO INDEPENDENT SYSTEMS.

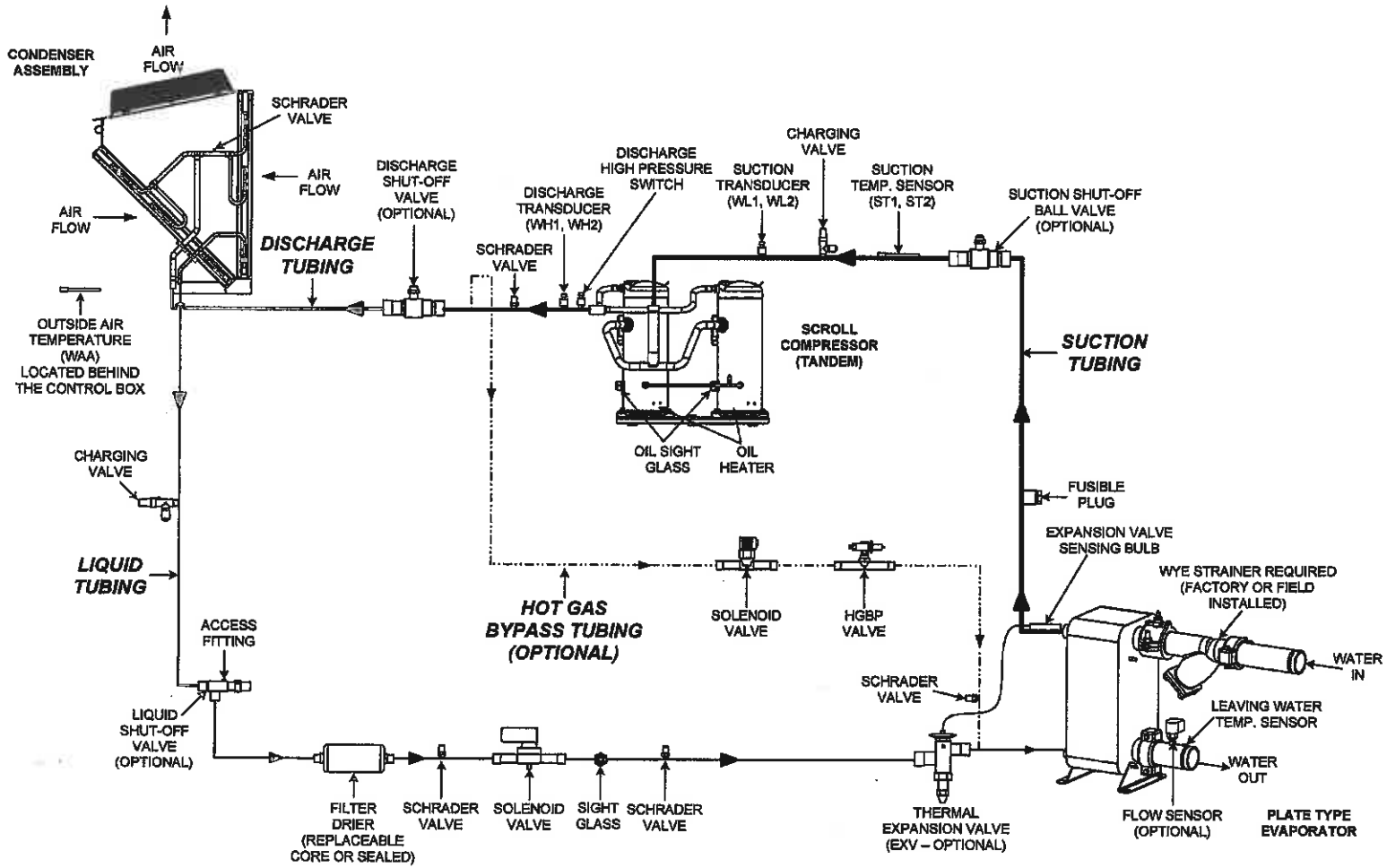


Figure 27: AGZ075-100E Package Chiller with Microchannel

**AGZ075-100E PACKAGE CHILLER
MICROCHANNEL ALUMINUM COIL**

NOTE: PIPING SHOWN FOR ONE SYSTEM OF UNIT. UNITS HAVE TWO INDEPENDENT SYSTEMS.

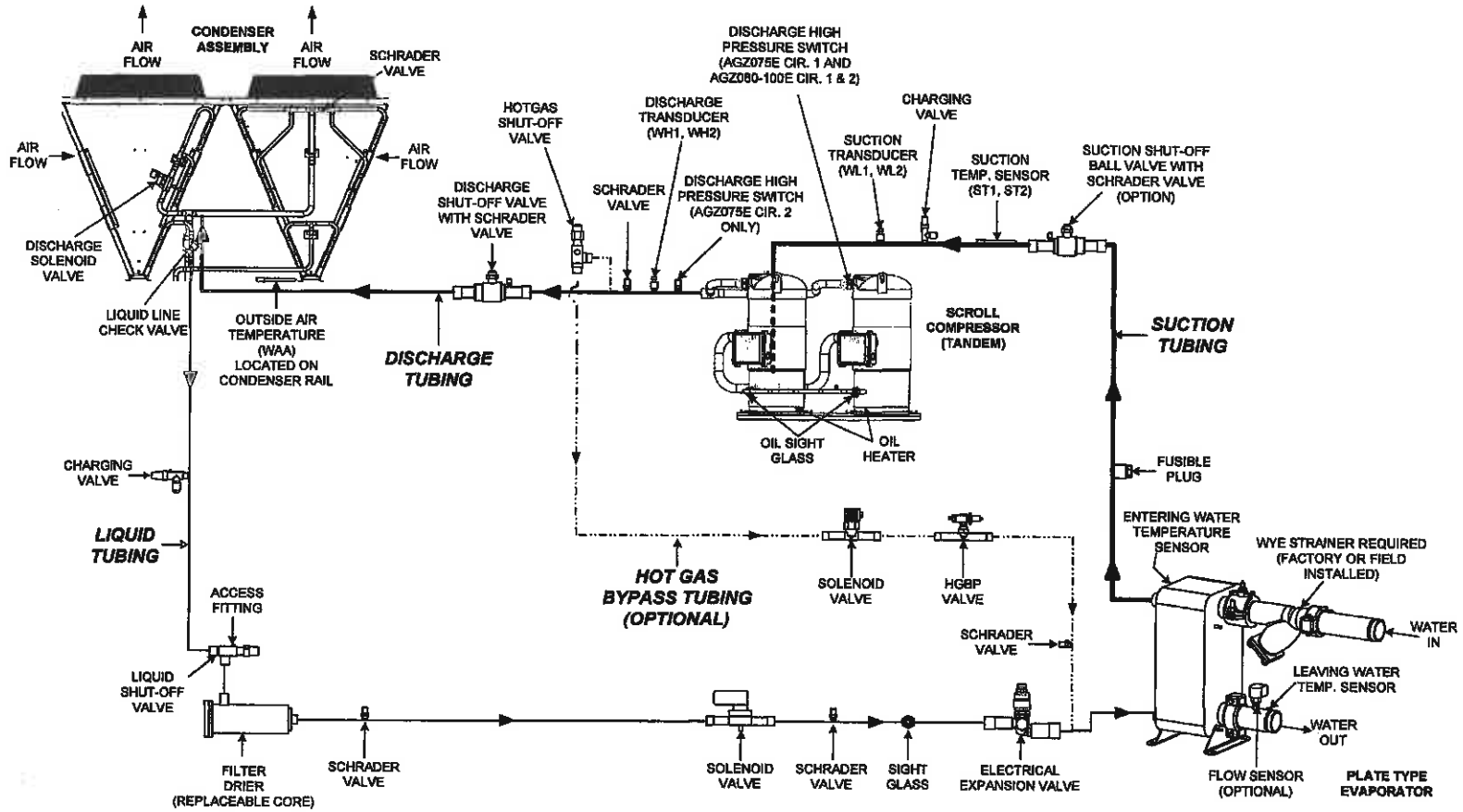


Figure 28: AGZ110-130E Package Chiller with Microchannel

**AGZ110-130E PACKAGE CHILLER
MICROCHANNEL ALUMINUM COIL**

NOTE: PIPING SHOWN FOR ONE SYSTEM OF UNIT. UNITS HAVE TWO INDEPENDENT SYSTEMS.

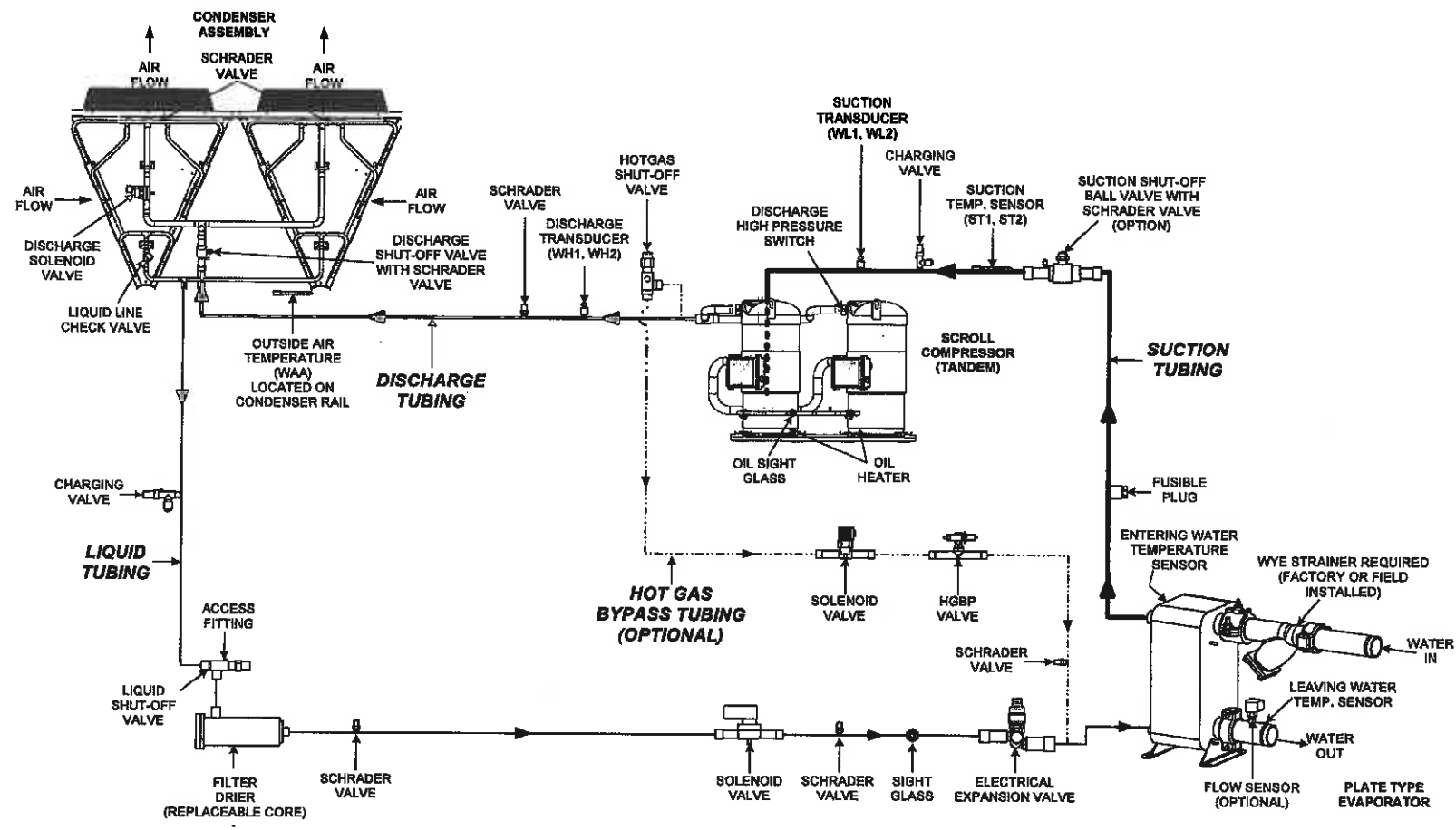


Figure 29: AGZ140-180E Package Chiller with Microchannel

**AGZ140-180E PACKAGE CHILLER
MICROCHANNEL ALUMINUM COIL**

NOTE: PIPING SHOWN FOR ONE SYSTEM OF UNIT. UNITS HAVE TWO INDEPENDENT SYSTEMS.

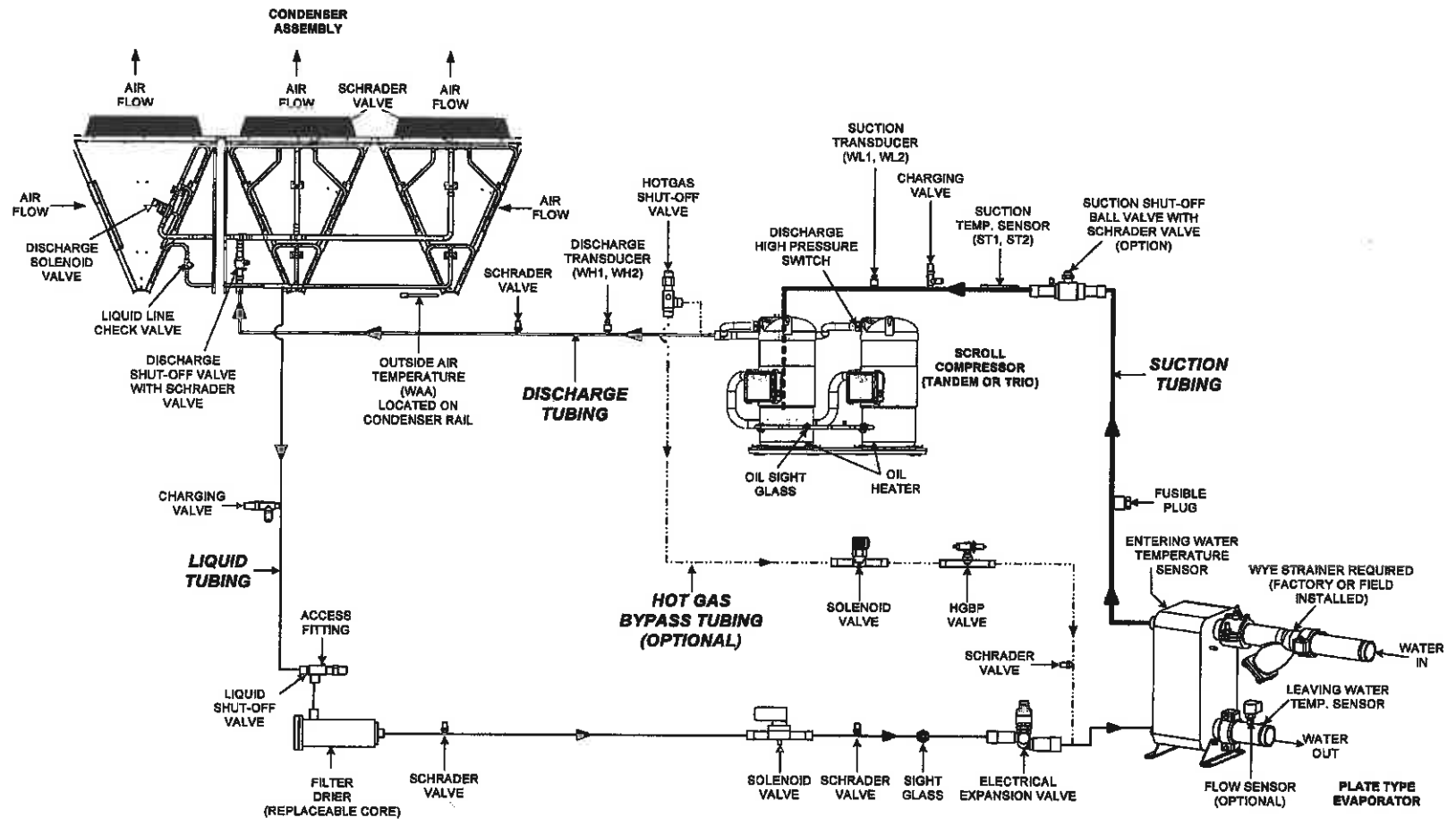
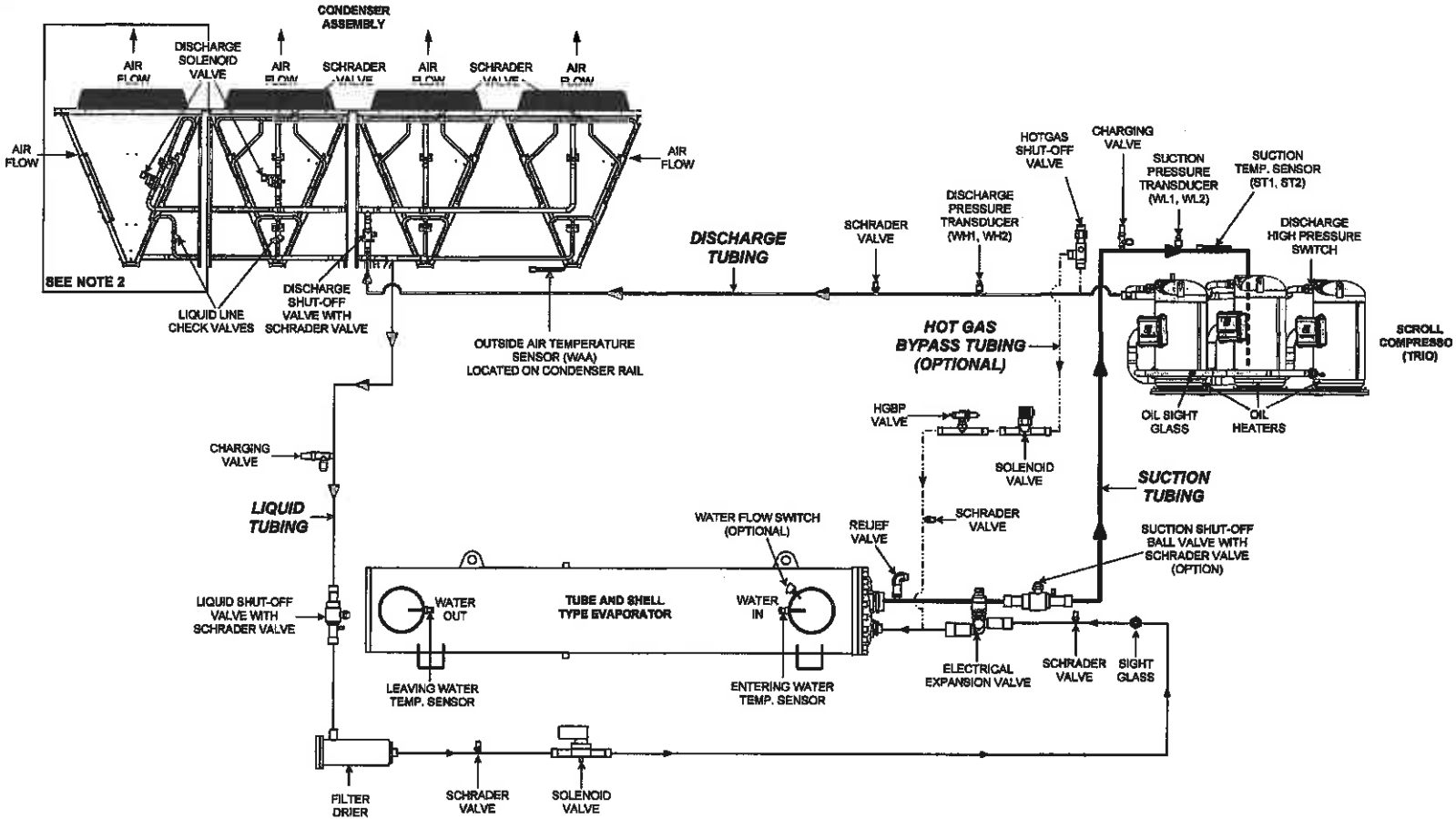


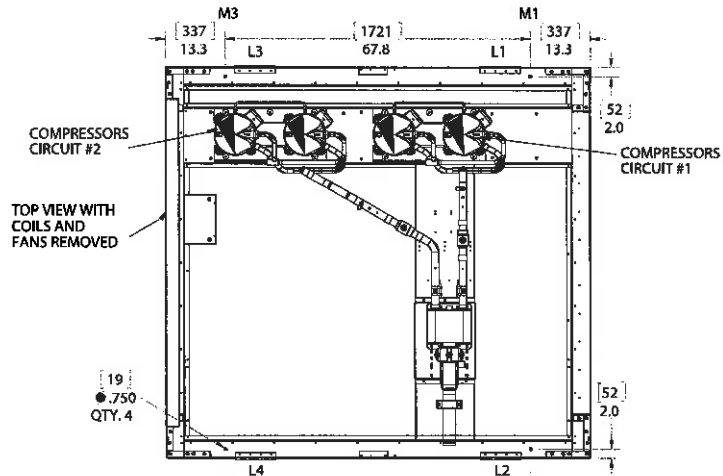
Figure 30: AGZ190-240E Package Chiller with Microchannel

**AGZ190-240E PACKAGE CHILLER
MICROCHANNEL ALUMINUM COIL**

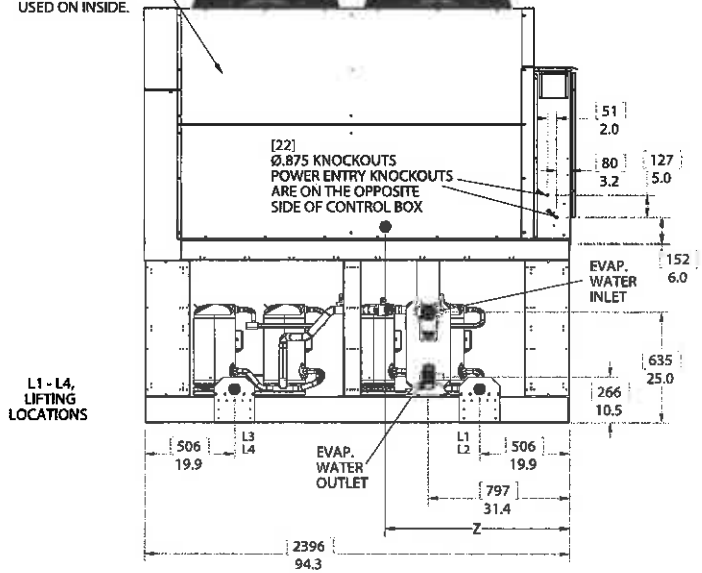
- NOTES:
 1. PIPING SHOWN FOR ONE SYSTEM OF UNIT. UNITS HAVE TWO INDEPENDENT SYSTEMS.
 2. THE CONDENSER ASSEMBLY SHOWN IS OF CIRCUIT 1 OF THE AGZ225-240E 14 FAN UNIT. THE AGZ190-210E DOES NOT HAVE THE V-COIL ASSEMBLY THAT'S MARKED OFF.



M1 - M4, ISOLATOR MOUNTING HOLE LOCATIONS ON BOTTOM SURFACE OF UNIT BASE



BLANK PANELS ARE USED ON UNIT SIDES. SLOPED 50° COILS USED ON INSIDE.



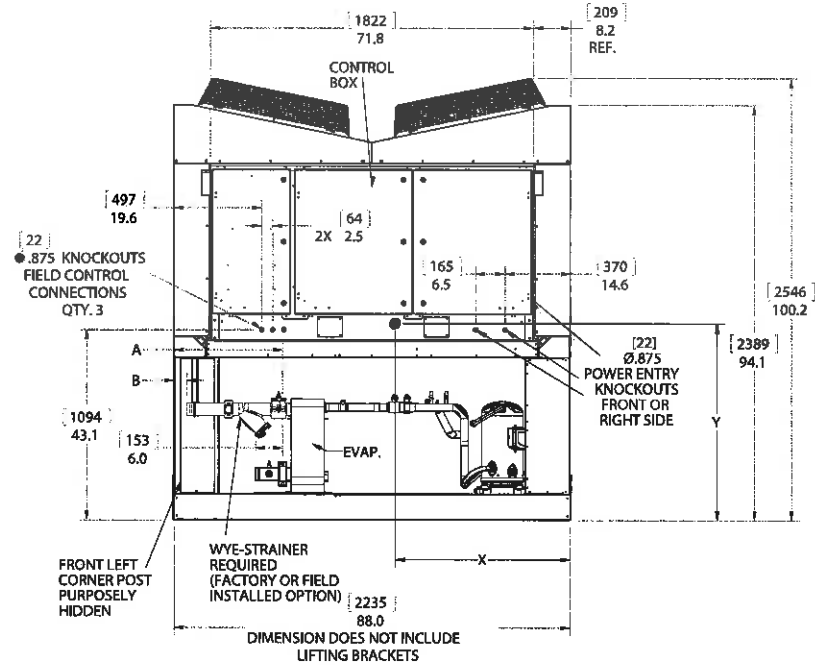
[22] Ø.875 KNOCKOUTS POWER ENTRY KNOCKOUTS ARE ON THE OPPOSITE SIDE OF CONTROL BOX

334547101 0B
AGZ-E, 4 FANS

NOTE: LIFTING WEIGHTS ARE BASED ON UNIT SHIPPING WEIGHTS.
MOUNTING WEIGHTS ARE BASED ON UNIT OPERATING WEIGHT WITH EVAPORATOR WATER INCLUDED.
SHIPPING AND OPERATING WEIGHTS DO NOT INCLUDE THE WEIGHTS OF ANY OPTIONS OR ACCESSORIES.

PACKAGE UNITS WITH MICROCHANNEL COILS			
UNIT MODEL	CG LOCATION, IN (MM)		
	X	Y	Z
AGZ030E	38.9 (988)	44.5 (1130)	40.9 (1039)
AGZ035E	39.7 (1008)	45.5 (1156)	38.1 (968)

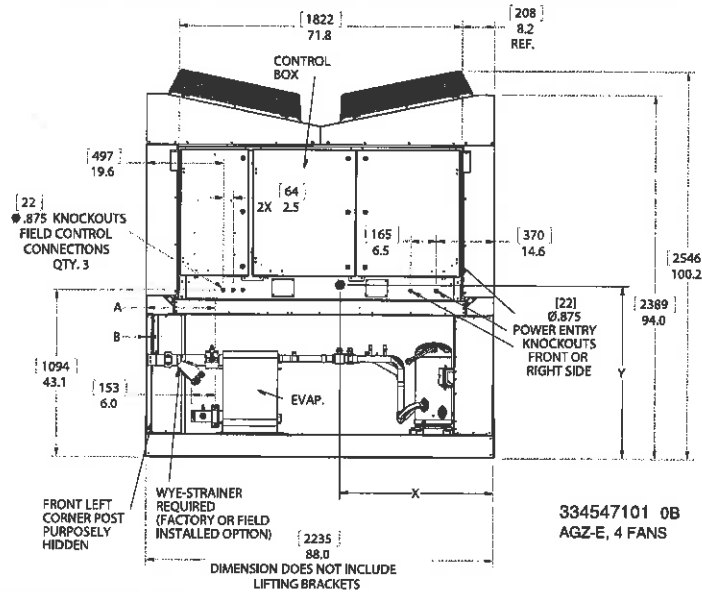
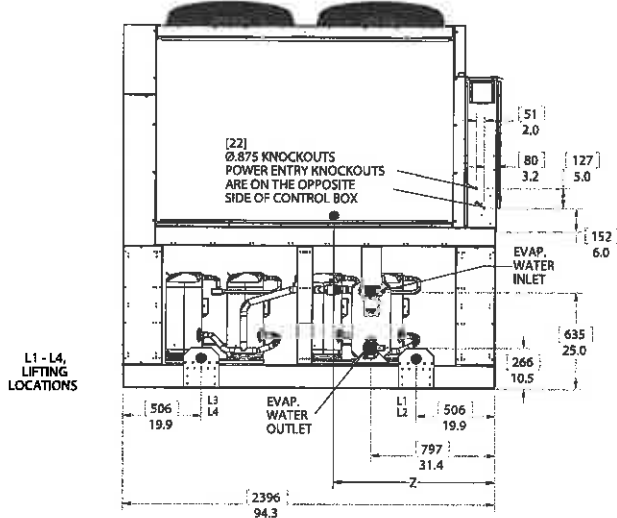
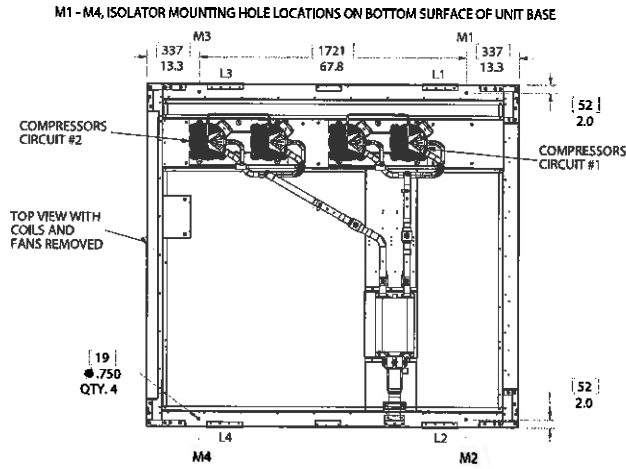
UNIT MODEL	EVAP. DIMENSIONS IN (MM)		CONNECTION SIZE (VICTAULIC)
	A	B	
AGZ030E	24.2 (615)	2.9 (74)	2.5 (64)
AGZ035E	23.5 (597)	2.2 (56)	2.5 (64)



PACKAGE UNITS WITH MICROCHANNEL COILS										
UNIT MODEL	SHIPPING WEIGHT	OPERATING WEIGHT	LIFTING (SHIPPING) WEIGHT BY CORNER LBS (KG)				MOUNTING (OPERATING) WEIGHT LBS (KG)			
	LBS (KG)	LBS (KG)	L1	L2	L3	L4	M1	M2	M3	M4
AGZ030E	2947 (1337)	2960 (1343)	1011 (459)	799 (362)	635 (288)	502 (228)	980 (445)	775 (352)	673 (305)	532 (241)
AGZ035E	2873 (1303)	2887 (1310)	1051 (477)	861 (391)	528 (240)	433 (196)	1005 (456)	824 (374)	581 (264)	476 (216)

Figure 31: AGZ030E - AGZ035E





PACKAGE UNITS WITH MICROCHANNEL COILS			
UNIT MODEL	CG LOCATION, IN (MM)		
	X	Y	Z
AGZ040E	39.8 (1011)	45.9 (1166)	38.4 (975)
AGZ046E	38.9 (988)	44.5 (1130)	41.2 (1047)
AGZ050E	39.1 (993)	44.9 (1141)	41.2 (1047)
AGZ056E	39.1 (993)	44.8 (1138)	41.2 (1047)
AGZ060E	39.2 (996)	44.6 (1133)	41.1 (1044)
AGZ066E	39.2 (996)	44.6 (1133)	41.1 (1044)
AGZ070E	36.8 (935)	41.8 (1062)	42.6 (1082)

UNIT MODEL	EVAP. DIMENSIONS IN (MM)		CONNECTION SIZE (VICTAULIC)
	A	B	
AGZ040E	22.8 (579)	1.5 (38)	2.5 (64)
AGZ046E	21.4 (544)	0.11 (3)	2.5 (64)
AGZ050E	20 (508)	2.7 (69)	2.5 (64)
AGZ056E	19.3 (490)	2.0 (51)	2.5 (64)
AGZ060E	17.6 (447)	0.3 (8)	2.5 (64)
AGZ066E	17.6 (447)	0.3 (8)	2.5 (64)
AGZ070E	17.6 (447)	0.3 (8)	2.5 (64)

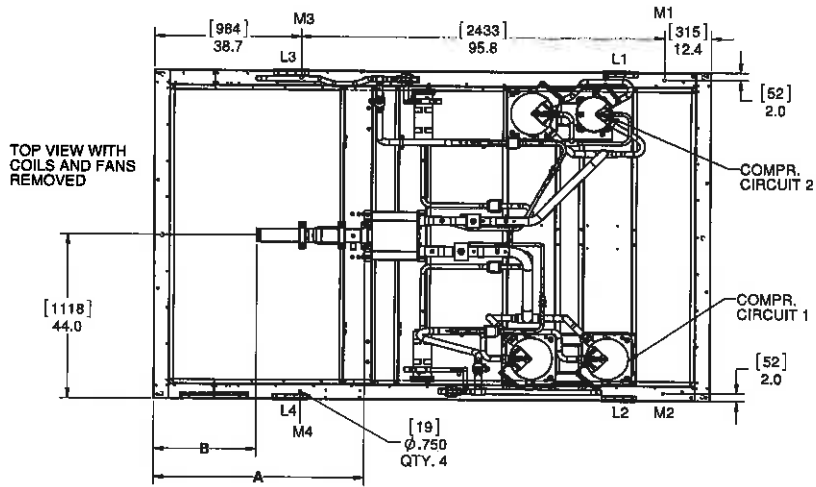
PACKAGE UNITS WITH MICROCHANNEL COILS										
UNIT MODEL	SHIPPING WEIGHT	OPERATING WEIGHT	LIFTING (SHIPPING) WEIGHT BY CORNER LBS (KG)				MOUNTING (OPERATING) WEIGHT LBS (KG)			
	LBS (KG)	LBS (KG)	L1	L2	L3	L4	M1	M2	M3	M4
AGZ040E	2948 (1337)	2964 (1345)	1067 (484)	881 (400)	548 (249)	453 (206)	1022 (464)	844 (383)	601 (273)	496 (225)
AGZ046E	3094 (1403)	3112 (1412)	1051 (477)	832 (377)	676 (307)	535 (243)	1021 (463)	809 (367)	715 (324)	567 (257)
AGZ050E	3093 (1403)	3114 (1413)	1049 (476)	837 (380)	671 (304)	536 (243)	1020 (463)	814 (369)	712 (323)	568 (258)
AGZ056E	3106 (1409)	3128 (1419)	1052 (477)	840 (381)	675 (306)	539 (245)	1023 (464)	817 (371)	716 (325)	572 (260)
AGZ060E	3130 (1420)	3155 (1431)	1059 (480)	851 (386)	676 (307)	543 (246)	1031 (468)	828 (376)	718 (326)	577 (262)
AGZ066E	3130 (1420)	3155 (1431)	1059 (480)	851 (386)	676 (307)	543 (246)	1031 (468)	828 (376)	718 (326)	577 (262)
AGZ070E	3472 (1575)	3497 (1586)	1180 (535)	847 (384)	842 (382)	604 (274)	1157 (525)	830 (377)	880 (399)	631 (286)

NOTE: LIFTING WEIGHTS ARE BASED ON UNIT SHIPPING WEIGHTS.
MOUNTING WEIGHTS ARE BASED ON UNIT OPERATING WEIGHT WITH EVAPORATOR WATER INCLUDED.
SHIPPING AND OPERATING WEIGHTS DO NOT INCLUDE THE WEIGHTS OF ANY OPTIONS OR ACCESSORIES.

Figure 32: AGZ040E - AGZ070E

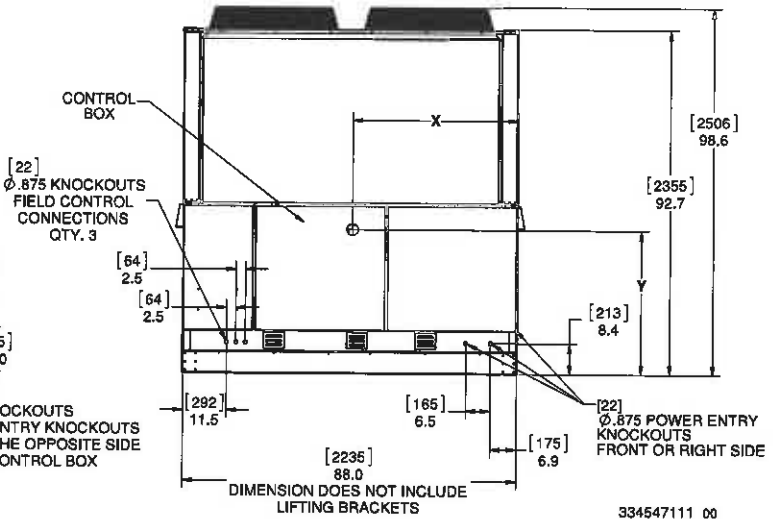
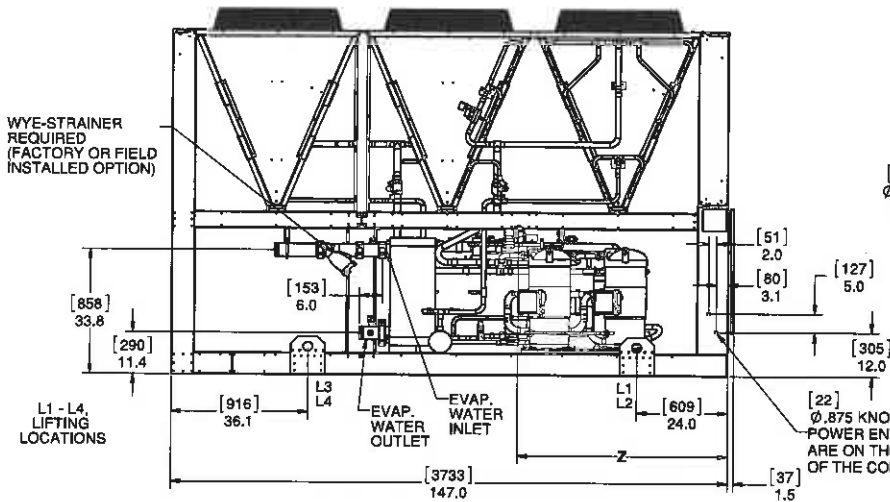
Figure 33: AGZ075E - AGZ100E

M1 - M4, ISOLATOR MOUNTING HOLE LOCATIONS ON BOTTOM SURFACE OF UNIT BASE.



UNIT MODEL	CG LOCATION, IN (MM)		
	X	Y	Z
AGZ075E	45.3 (1151)	38.6 (980)	56.2 (1427)
AGZ080E	44.2 (1122)	39.2 (995)	56.5 (1435)
AGZ090E	44.2 (1122)	39.2 (995)	55.0 (1397)
AGZ100E	43.6 (1108)	38.9 (988)	56.7 (1415)

UNIT MODEL	EVAP. DIMENSIONS IN (MM)		CONNECTION SIZE, IN.
	A	B	
AGZ075E	55.6 (1412)	27.1 (688)	3.0 (76)
AGZ080E	54.4 (1382)	25.9 (658)	
AGZ090E	54.4 (1382)	25.9 (658)	
AGZ100E	51.6 (1311)	23.1 (587)	



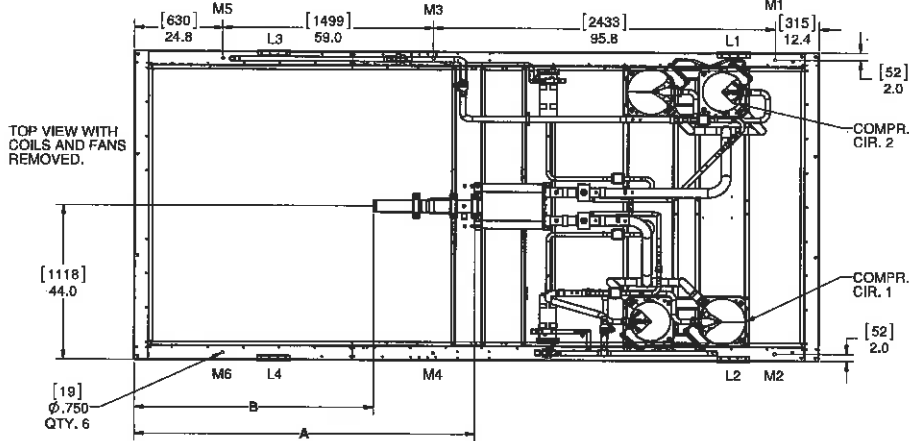
334547111 00
AGZ-E, 6 FANS

UNIT MODEL	SHIPPING WEIGHT	OPERATING WEIGHT	LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG)				MOUNTING (OPERATING) WEIGHT, LBS (KG)			
	LBS (KG)	LBS (KG)	L1	L2	L3	L4	M1	M2	M3	M4
AGZ075E	4388 (1990)	4451 (2019)	1341 (608)	1420 (644)	790 (358)	837 (380)	1173 (532)	1242 (563)	989 (449)	1047 (475)
AGZ080E	4510 (2046)	4579 (2077)	1407 (638)	1418 (643)	840 (381)	846 (384)	1232 (559)	1241 (563)	1049 (476)	1057 (479)
AGZ090E	4540 (2059)	4609 (2091)	1456 (660)	1466 (665)	806 (366)	812 (368)	1278 (579)	1285 (583)	1020 (463)	1028 (466)
AGZ100E	4696 (2130)	4780 (2168)	1505 (683)	1480 (671)	863 (391)	848 (385)	1322 (600)	1299 (589)	1089 (494)	1070 (485)

NOTE: LIFTING WEIGHTS ARE BASED ON UNIT SHIPPING WEIGHTS.
MOUNTING WEIGHTS ARE BASED ON UNIT OPERATING WEIGHT WITH EVAPORATOR WATER INCLUDED.
SHIPPING AND OPERATING WEIGHTS DO NOT INCLUDE THE WEIGHTS OF ANY OPTIONS OR ACCESSORIES.

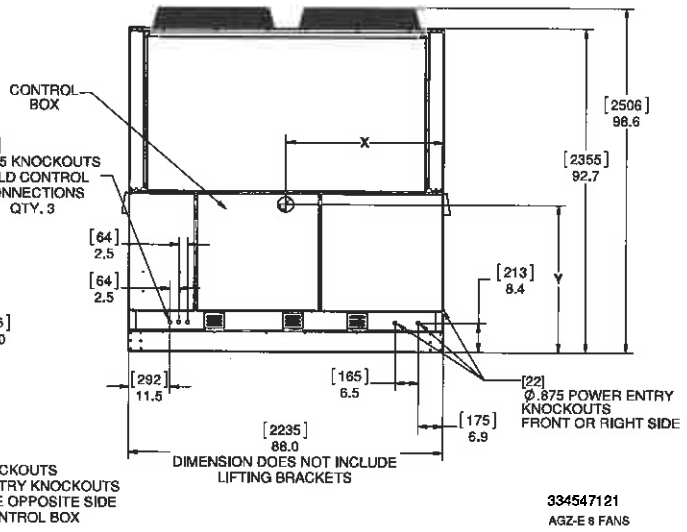
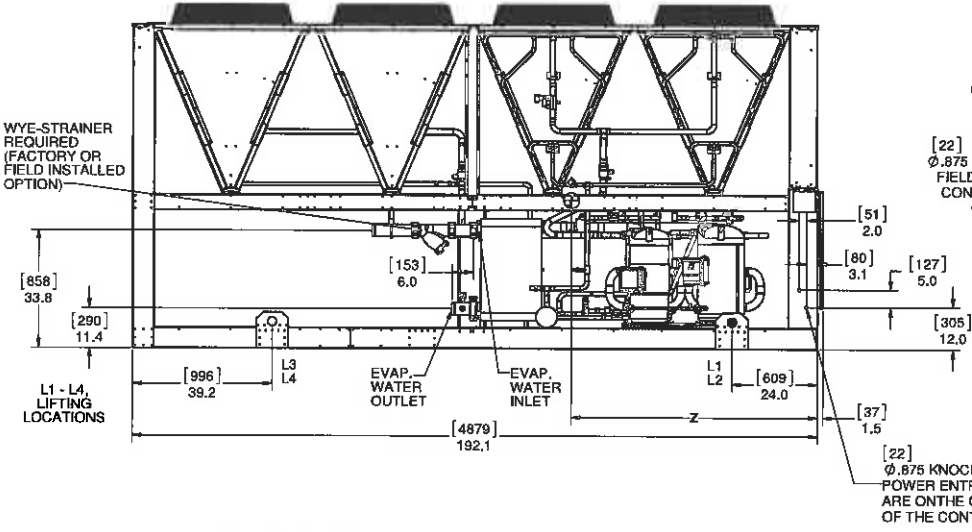
Figure 34: AGZ110E - AGZ130E

M1 - M6, ISOLATOR MOUNTING HOLE LOCATIONS ON BOTTOM SURFACE OF UNIT BASE.



UNIT MODEL	CG LOCATION, IN (MM)		
	X	Y	Z
AGZ110E	44.1 (1120)	42.1 (1069)	69.0 (1753)
AGZ120E	44.1 (1120)	43.3 (1100)	66.4 (1687)
AGZ130E	43.1 (1095)	41.0 (1041)	68.3 (1735)

UNIT MODEL	EVAP. DIMENSIONS, IN (MM)		CONNECTION SIZE, IN.
	A	B	
AGZ110E	95.5 (2426)	69.1 (1755)	3.0 (76)
AGZ120E	93.9 (2385)	67.5 (1715)	
AGZ130E	92.0 (2337)	65.5 (1664)	



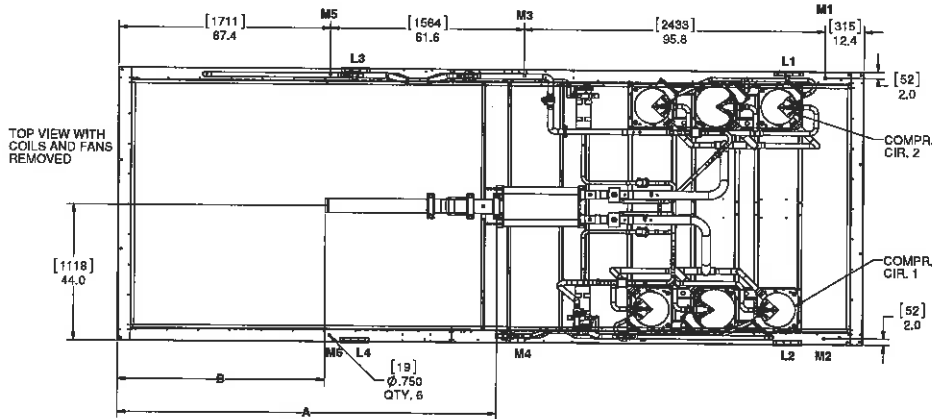
334547121
AGZ-E 8 FANS

UNIT MODEL	SHIPPING WEIGHT	OPERATING WEIGHT	LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG)				MOUNTING (OPERATING) WEIGHT, LBS (KG)					
	LBS (KG)	LBS (KG)	L1	L2	L3	L4	M1	M2	M3	M4	M5	M6
AGZ110E	5437 (2466)	5528 (2508)	1762 (799)	1769 (802)	951 (431)	955 (433)	1424 (646)	1430 (649)	845 (383)	849 (385)	489 (222)	491 (223)
AGZ120E	5696 (2584)	5796 (2629)	1907 (865)	1915 (869)	935 (424)	939 (426)	1548 (702)	1555 (705)	878 (398)	882 (400)	465 (211)	467 (212)
AGZ130E	5792 (2627)	5903 (2678)	1941 (880)	1863 (845)	1015 (460)	974 (442)	1575 (714)	1511 (685)	920 (417)	883 (401)	517 (235)	496 (225)

NOTE: LIFTING WEIGHTS ARE BASED ON UNIT SHIPPING WEIGHTS.
MOUNTING WEIGHTS ARE BASED ON UNIT OPERATING WEIGHT WITH EVAPORATOR WATER INCLUDED.
SHIPPING AND OPERATING WEIGHTS DO NOT INCLUDE THE WEIGHTS OF ANY OPTIONS OR ACCESSORIES.

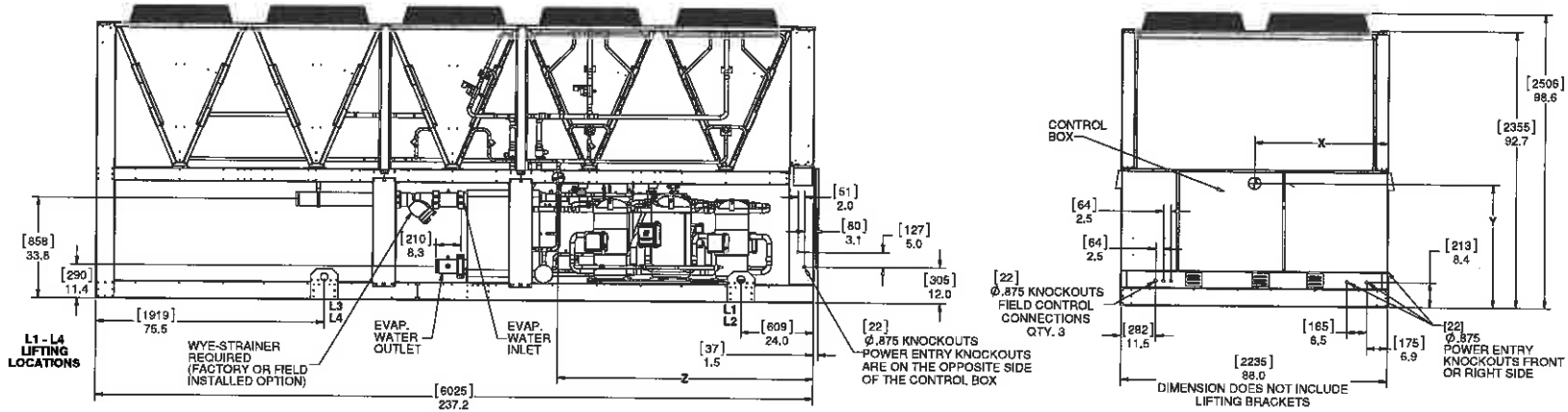
Figure 36: AGZ170E - AGZ180E

M1 - M4. ISOLATOR MOUNTING HOLE LOCATIONS ON BOTTOM SURFACE OF UNIT BASE.



334547131
AGZE 10FANS

UNIT MODEL	CG LOCATION, IN (MM)			EVAP. DIMENSIONS, IN (MM)		CONNECTION SIZE, IN.
	X	Y	Z	A	B	
AGZ170E	43.2 (1096)	40.4 (1026)	83.6 (2123)	119 (3022)	64.3 (1634)	4.0 (102)
AGZ180E	44.1 (1119)	39.4 (1000)	82.8 (2103)	117 (2971)	62.4 (1584)	4.0 (102)



UNIT MODEL	SHIPPING WEIGHT LBS (KG)	OPERATING WEIGHT LBS (KG)	LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG)				MOUNTING (OPERATING) WEIGHT, LBS (KG)					
			L1	L2	L3	L4	M1	M2	M3	M4	M5	M6
AGZ170E	7170 (3252)	7307 (3314)	2072 (940)	1995 (905)	1581 (717)	1522 (690)	1571 (713)	1512 (686)	1197 (543)	1152 (523)	958 (434)	920 (417)
AGZ180E	7412 (3362)	7580 (3429)	2121 (962)	2127 (965)	1580 (717)	1584 (718)	1613 (732)	1617 (733)	1210 (549)	1214 (551)	951 (431)	954 (433)

NOTE: LIFTING WEIGHTS ARE BASED ON UNIT SHIPPING WEIGHTS.
MOUNTING WEIGHTS ARE BASED ON UNIT OPERATING WEIGHT WITH EVAPORATOR WATER INCLUDED.
SHIPPING AND OPERATING WEIGHTS DO NOT INCLUDE THE WEIGHTS OF ANY OPTIONS OR ACCESSORIES.

Figure 37: AGZ190E - AGZ210E

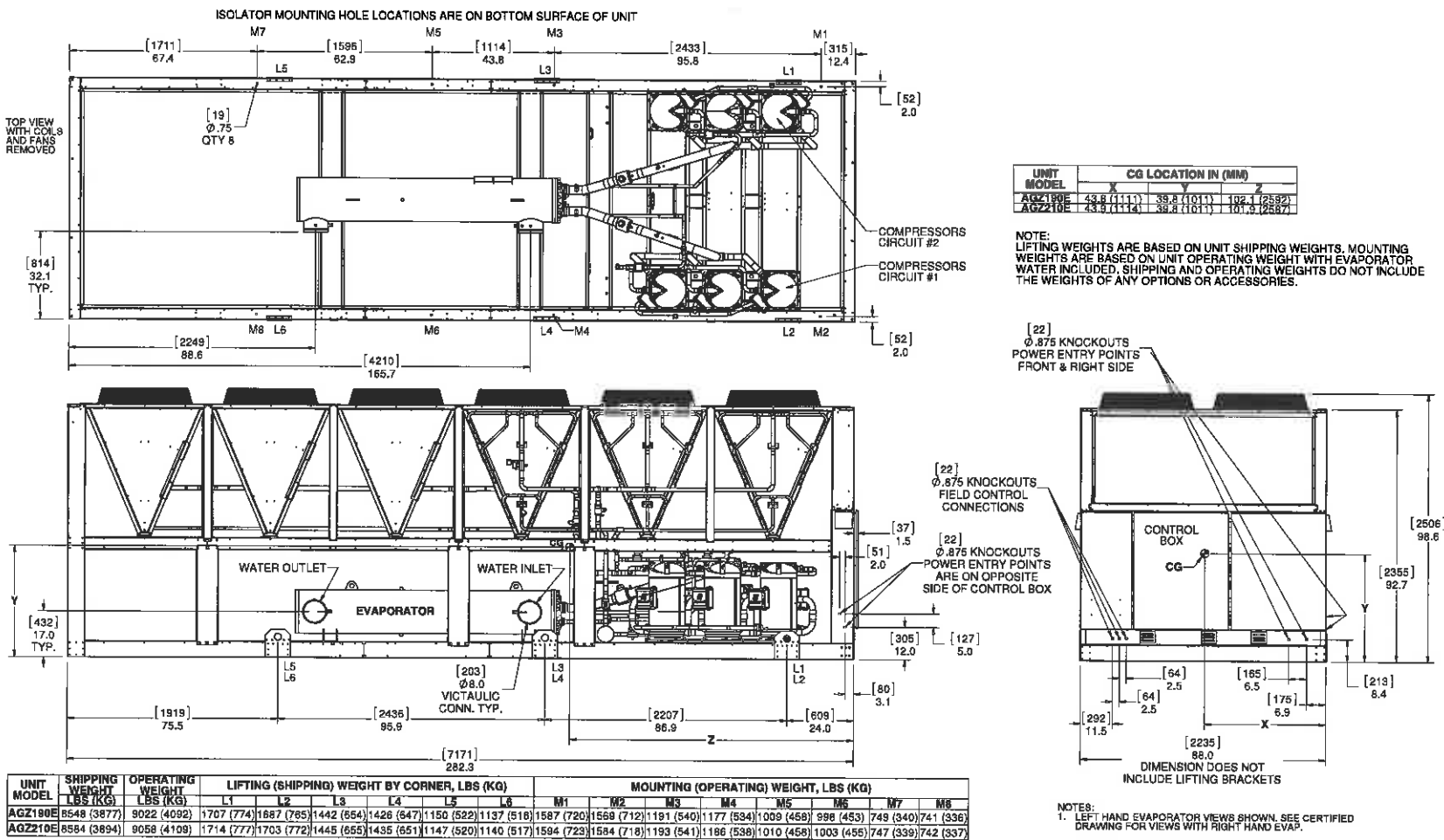
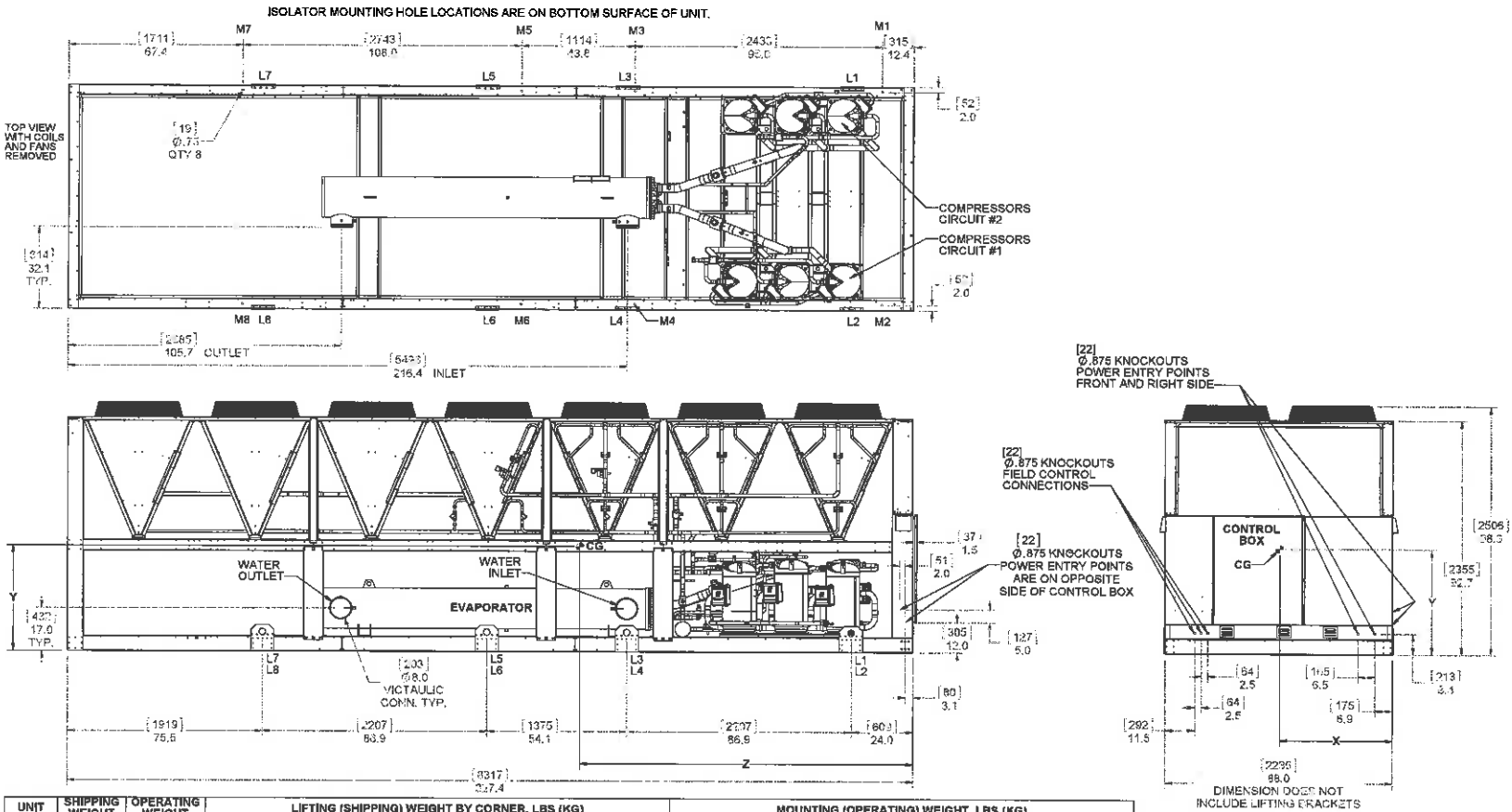


Figure 38: AGZ225E - AGZ240E



UNIT MODEL	SHIPPING WEIGHT LBS (KG)	OPERATING WEIGHT LBS (KG)	LIFTING (SHIPPING) WEIGHT BY CORNER, LBS (KG)								MOUNTING (OPERATING) WEIGHT, LBS (KG)							
			L1	L2	L3	L4	L5	L6	L7	L8	M1	M2	M3	M4	M5	M6	M7	M8
AGZ225E	9501 (4310)	10206 (4627)	1419 (644)	1403 (636)	1248 (568)	1234 (560)	1141 (518)	1128 (512)	970 (440)	959 (435)	1410 (640)	1394 (632)	1309 (594)	1294 (587)	1262 (572)	1248 (566)	1148 (521)	1135 (515)
AGZ240E	9589 (4349)	10298 (4667)	1443 (655)	1433 (650)	1260 (572)	1251 (567)	1146 (520)	1138 (516)	963 (437)	956 (434)	1433 (650)	1422 (645)	1320 (599)	1310 (594)	1269 (576)	1259 (571)	1141 (518)	1133 (514)

UNIT MODEL	CG LOCATION IN (MM)		
	X	Y	Z
AGZ225E	43.7 (1710)	40.7 (1604)	126.6 (3216)
AGZ240E	43.8 (1713)	40.8 (1606)	125.9 (3188)

NOTE:
LIFTING WEIGHTS ARE BASED ON UNIT SHIPPING WEIGHTS. MOUNTING WEIGHTS ARE BASED ON UNIT OPERATING WEIGHT WITH EVAPORATOR WATER INCLUDED. SHIPPING AND OPERATING WEIGHTS DO NOT INCLUDE THE WEIGHTS OF ANY OPTIONS OR ACCESSORIES.

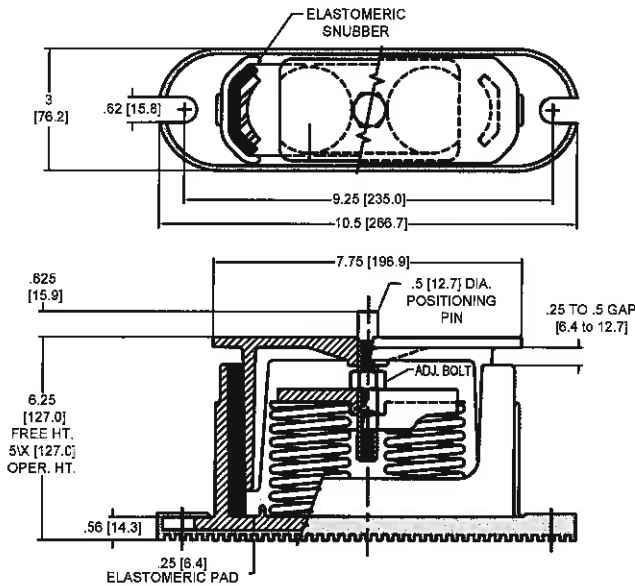
INSTR. CERTIFIED DWG, AGZ-E 14 FANS
PART NUMBER 334547141

NOTES:
1. LEFT HAND EVAPORATOR VIEWS SHOWN. SEE SHEET 2 FOR VIEWS WITH RIGHT HAND EVAP.

Table 6: Refrigerant Charge - Microchannel Units

Unit Models	Microchannel Coil Unit Operating Charge - lbs (kg)			
	Replaceable Core Filter Drier		Sealed Filter Drier	
	Circuit 1	Circuit 2	Circuit 1	Circuit 2
030E	17 (7.7)	17 (7.7)	15 (6.8)	15 (6.8)
035E	16 (7.3)	16 (7.3)	14 (6.4)	14 (6.4)
040E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
045E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
050E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
055E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
060E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
065E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
070E	23 (10.5)	23 (10.5)	21 (9.5)	21 (9.5)
075E	46 (20.9)	46 (20.9)		
080E	46 (20.9)	46 (20.9)		
090E	48 (21.8)	48 (21.8)		
100E	49 (22.3)	49 (22.3)		
110E	64 (29.1)	64 (29.1)		
120E	65 (29.5)	65 (29.5)		
130E	65 (29.5)	65 (29.5)		
140E	76 (34.5)	76 (34.5)		
150E	76 (34.5)	76 (34.5)		
161E	78 (35.4)	78 (35.4)		
170E	80 (36.3)	80 (36.3)		
180E	80 (36.3)	80 (36.3)		
190E	90 (40.9)	90 (40.9)		
210E	94 (42.7)	94 (42.7)		
225E	110 (49.9)	110 (49.9)		
240E	114 (51.8)	114 (51.8)		

Figure 39: Spring Isolator



In all cases, set the unit in place and level. If antiskid pads are used do not use hold down bolts. If hold down bolts are used do not use anti-skid pads.

When spring isolators are required, install springs running under the main unit supports. Unit should be installed on blocks or shims at the listed free height. Isolator springs should not be loaded until the installation is complete, then adjust the springs to the vendor listed compression gap for the load point. When securing the isolator, do not over-tighten the mounting bolts. Over-tightening may result in cracking of the cast isolator housing and will have a negative impact on the isolation effect.

Installation of spring isolators requires flexible piping connections and at least three feet of flexible electrical conduit to avoid straining the piping and transmitting vibration and noise.

Mounting locations for each model can be found in the "Dimensions and Weights - Packaged Units" section of this document, starting on page 20.

Optional seismic isolator information begins on page 31.

Contact a Daikin Applied sales representative for isolator information related to units with other fin materials.

Figure 40: Rubber-in-Shear (RIS) Isolator

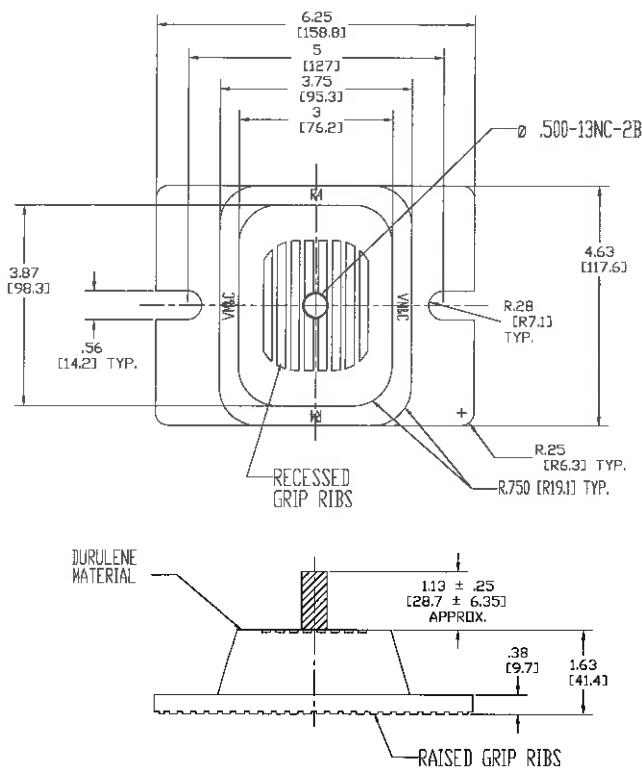


Table 7: Isolator Kits

AGZ-E Model	Microchannel - Packaged Units	
	Spring Isolators	RIS Isolators
030	332320102	332325101
035	332320102	332325101
040	332320102	332325101
045	332320132	332325101
050	332320132	332325101
055	332320132	332325101
060	332320132	332325101
065	332320132	332325101
070	332320132	332325101
075	332320117	332325101
080	332320117	332325101
090	332320117	332325101
100	332320117	332325101
110	332320123	332325113
120	332320124	332325113
130	332320124	332325113
140	332320106	332325113
150	332320106	332325113
161	332320111	332325113
170	332320111	332325113
180	332320111	332325113
190	332320108	332325114
210	332320108	332325114
225	332320126	332325114
240	332320126	332325114

Table 8: Isolator Information - Microchannel Units

AGZ-E Model	Rubber-In-Shear (RIS) Mounts								Spring Isolator Mountings							
	M1	M2	M3	M4	M5	M6	M7	M8	M1	M2	M3	M4	M5	M6	M7	M8
030	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Black	Black
035	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Black	Black
040	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Black	Black
045	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Dk Prple	Black	Dark Grn	Dk Prple	Black	Black
050	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Dk Prple	Black	Dark Grn	Dk Prple	Black	Black
055	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Dk Prple	Black	Dark Grn	Dk Prple	Black	Black
060	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Dk Prple	Black	Dark Grn	Dk Prple	Black	Black
065	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Dk Prple	Black	Dark Grn	Dk Prple	Black	Black
070	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dk Prple	Dk Prple	Black	Dark Grn	Dk Prple	Black	Black
075	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn
080	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn
090	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn
100	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Black	Black	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn
110	Red	Red	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Dark Grn	Dark Grn	Dk Prple	Dk Prple	Red	Red	Dark Grn	Dark Grn
120	Red	Red	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Gray	Gray	Dk Prple	Dk Prple	Red	Red	Dark Grn	Dark Grn
130	Red	Red	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Gray	Gray	Dk Prple	Dk Prple	Red	Red	Dark Grn	Dark Grn
140	Red	Red	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dk Prple	Dk Prple	Dark Grn	Dark Grn
150	Red	Red	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dk Prple	Dk Prple	Dark Grn	Dark Grn
161	Red	Red	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn
170	Red	Red	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn
180	Red	Red	Brown	Brown	Brown	Brown	Dark Grn	Dk Prple	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn
190	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Black	Black
210	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Black	Black
225	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn
240	Red	Red	Brown	Brown	Brown	Brown	Brown	Brown	Gray	Gray	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn	Dark Grn

Figure 41: Seismic Spring Isolators

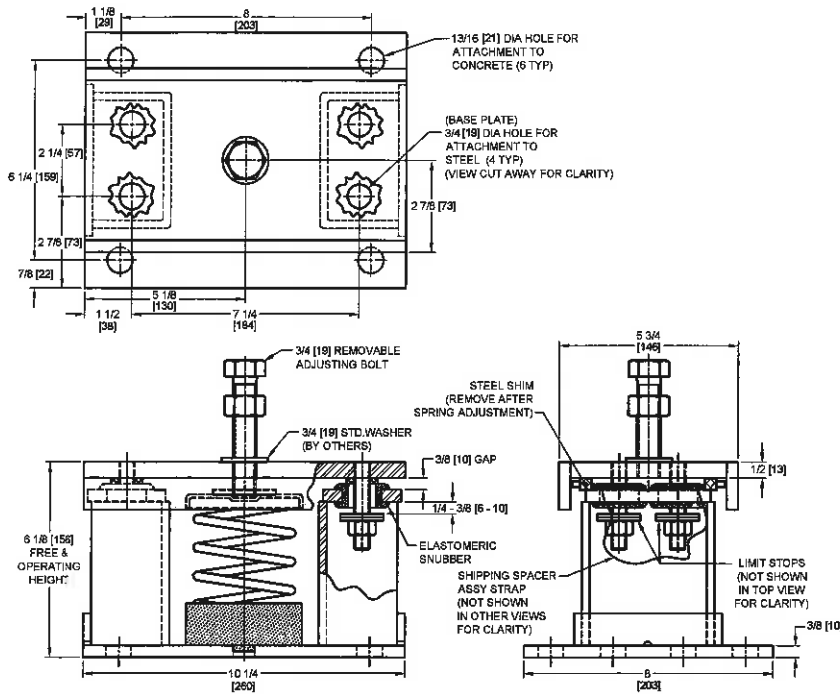


Figure 42: Seismic Neoprene Isolation Pads

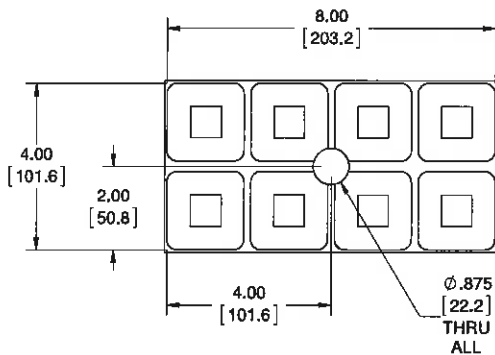


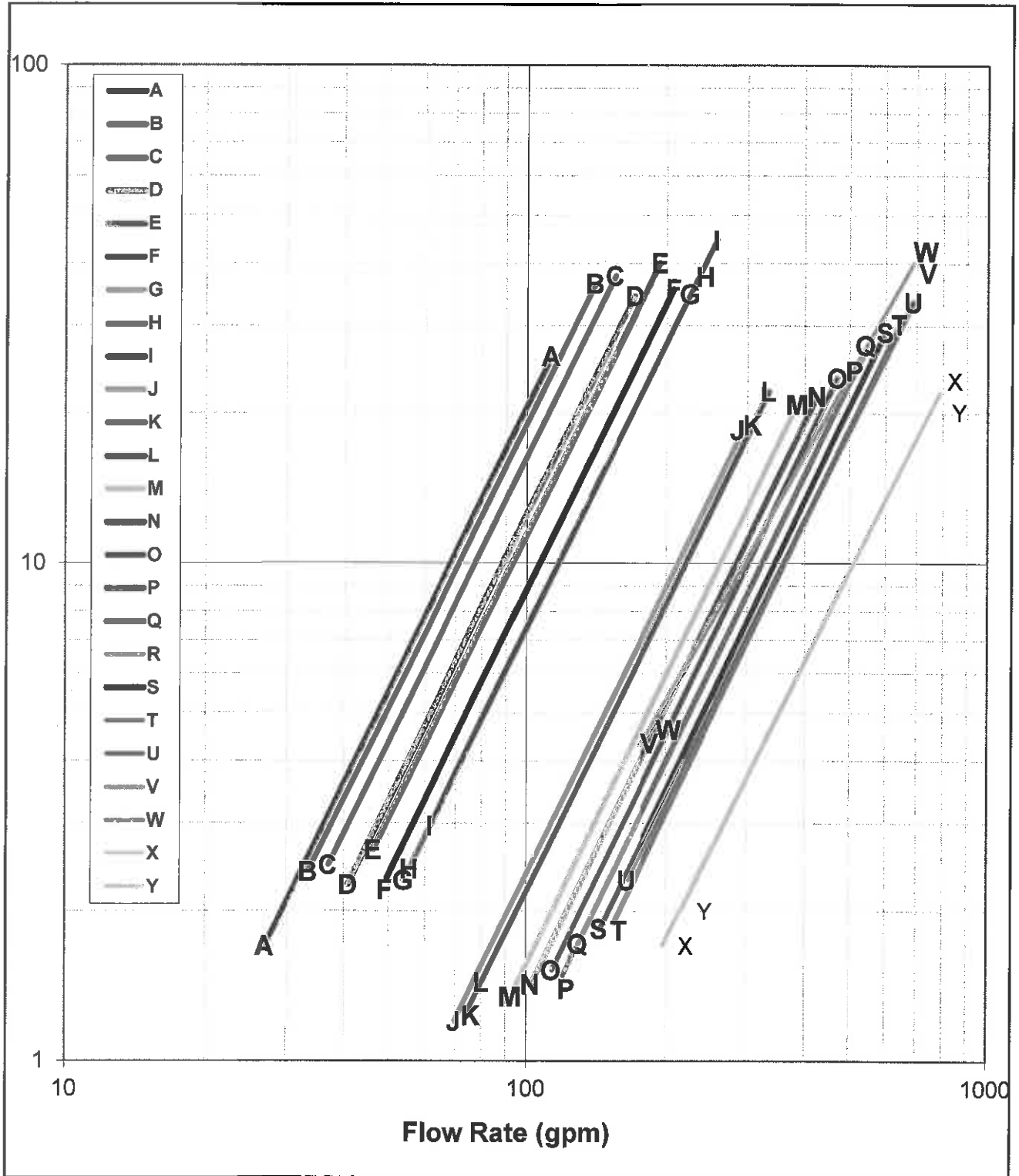
Table 9: Seismic Isolator Kit Numbers

AGZ-E Model	Packaged Unit - Aluminum Fins	
	Neoprene Pads	Spring Isolators
030	334549001	334548801
035	334549001	334548801
040	334549001	334548801
045	334549001	334548801
050	334549001	334548801
055	334549001	334548801
060	334549001	334548801
065	334549001	334548801
070	334549001	334548802

Table 10: Seismic Isolator Information

AGZ-E Model	Neoprene Pads								Spring Isolators							
	M1	M2	M3	M4	M5	M6	M7	M8	M1	M2	M3	M4	M5	M6	M7	M8
030	Brown	Brown	Brown	Brown	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan
035	Brown	Brown	Brown	Brown	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan
040	Brown	Brown	Brown	Brown	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan
045	Brown	Brown	Brown	Brown	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan
050	Brown	Brown	Brown	Brown	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan
055	Brown	Brown	Brown	Brown	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan
060	Brown	Brown	Brown	Brown	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan
065	Brown	Brown	Brown	Brown	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan	Pink	Pink	Tan	Tan
070	Brown	Brown	Brown	Brown	Pink	Pink	Tan	Tan	Pink	Pink	Pink	Tan	Pink	Pink	Tan	Tan

Figure 43: Pressure Drop Curves



NOTE: Data table on next page.

Table 11: Pressure Drop Data

Curve Ref.	Model	Part Load Minimum Flow (Variable Flow Systems Only)				Full Load Minimum Flow (Applies to Constant and Variable Flow Systems)				Fixed and Variable Flow Systems							
		Minimum Flow Rate ²				Minimum Flow Rate ¹				Nominal Flow Rate				Maximum Flow Rate			
		IP		SI		IP		SI		IP		SI		IP		SI	
		GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa	GPM	DP ft.	lps	DP kpa
A	030E	27.0	1.7	1.7	5.1	42.2	4.0	2.7	12.0	67.4	9.8	4.3	29.4	112.4	26.0	7.1	77.7
B	035E	33.5	2.4	2.1	7.1	52.4	5.6	3.3	16.7	83.8	13.7	5.3	40.9	139.6	36.4	8.8	108.7
C	040E	37.1	2.5	2.3	7.4	57.9	5.8	3.7	17.3	92.6	14.2	5.8	42.5	154.4	37.7	9.7	112.6
D	045E	40.9	2.3	2.6	6.8	63.9	5.3	4.0	15.8	102.2	13.2	6.5	39.4	170.4	34.4	10.8	102.7
E	050E	46.4	2.7	2.9	7.9	72.5	6.2	4.6	18.5	115.9	15.2	7.3	45.3	193.2	40.0	12.2	119.6
F	055E	49.7	2.3	3.1	7.0	77.7	5.5	4.9	16.3	124.3	13.4	7.8	40.0	207.2	35.6	13.1	106.2
G	060E	54.0	2.3	3.4	6.9	84.3	5.4	5.3	16.1	134.9	13.1	8.5	39.3	224.8	34.7	14.2	103.6
H	065E	55.5	2.4	3.5	7.3	86.7	5.7	5.5	17.0	138.7	13.9	8.8	41.4	231.2	36.6	14.6	109.3
I	070E	61.5	3.0	3.9	8.8	96.1	6.9	6.1	20.6	153.8	16.9	9.7	50.4	256.4	44.5	16.2	133.0
J	075E	69.8	1.2	4.4	3.6	109.1	2.8	6.9	8.4	174.5	6.9	11.0	20.5	290.8	18.2	18.3	54.3
K	080E	73.8	1.2	4.7	3.7	115.4	2.9	7.3	8.6	184.6	7.1	11.6	21.3	307.6	18.9	19.4	56.6
L	090E	80.1	1.4	5.1	4.3	125.1	3.4	7.9	10.1	200.2	8.3	12.6	24.8	333.6	22.1	21.0	66.1
M	100E	92.4	1.3	5.8	4.0	144.3	3.2	9.1	9.5	230.9	7.8	14.6	23.3	384.8	20.8	24.3	62.2
N	110E	102.0	1.4	6.4	4.2	159.5	3.3	10.1	9.9	255.1	8.2	16.1	24.4	425.2	21.6	26.8	64.6
O	120E	113.1	1.5	7.1	4.5	176.7	3.6	11.1	10.7	282.7	8.8	17.8	26.4	471.2	23.5	29.7	70.3
P	130E	119.5	1.5	7.5	4.4	186.8	3.5	11.8	10.4	298.8	8.6	18.9	25.7	498.0	22.9	31.4	68.3
Q	140E	128.9	1.7	8.1	5.1	201.5	4.0	12.7	12.1	322.3	9.9	20.3	29.7	537.2	26.4	33.9	79.0
R	150E	143.6	1.8	9.1	5.5	224.4	4.4	14.2	13.0	359.0	10.8	22.7	32.4	598.4	29.1	37.8	87.0
S	161E	143.6	1.8	9.1	5.5	224.4	4.4	14.2	13.0	359.0	10.8	22.7	32.4	598.4	29.1	37.8	87.0
T	170E	154.1	1.9	9.7	5.6	240.8	4.5	15.2	13.4	385.2	11.2	24.3	33.4	642.0	30.2	40.5	90.2
U	180E	164.8	2.3	10.4	6.9	257.6	5.3	16.2	15.9	412.1	12.8	26.0	38.3	686.8	33.5	43.3	99.9
V	190E	176.0	4.3	11.1	12.9	275.0	8.9	17.3	26.6	439.9	19.1	27.8	57.1	691.6	40.1	43.6	119.8
W	210E	181.7	4.5	11.5	13.4	284.0	9.3	17.9	27.8	454.3	20.2	28.7	60.4	691.6	40.1	43.6	119.8
X	225E	197.1	1.7	12.4	5.1	308.0	3.9	19.4	11.7	492.7	9.3	31.1	27.8	789.0	22.1	49.8	66.2
Y	240E	216.4	2.0	13.7	6.1	338.1	4.6	21.3	13.9	541.0	11.0	34.1	33.0	789.0	22.1	49.8	66.2

NOTE: 1. Full load flow minimum is the minimum allowable flow at full load conditions, and/or for a constant flow system.
 2. Part Load flow minimum is the minimum allowable flow for a partially loaded unit, which is only applicable a variable flow system. Flow may only be reduced proportionally to load, i.e. a flow reduction of 25% from the design flow rate is only allowable if the chiller load is reduced by 25%.

Electrical Data Notes

1. Power wiring connections to the chiller may be done with either copper or aluminum wiring. Copper wire should be sized per NEC and/or local codes. Aluminum wire should be installed in accordance with NECA/AA 10402012, Standard for Installing Aluminum Building Wire and Cable (ANSI). Wire sizing and wire count must fit in the power connection lug sizing shown in the Electrical Data tables starting on page 37.
2. Unit wire size ampacity (MCA) is equal to 125% of the largest compressor-motor RLA plus 100% of RLA of all other loads in the circuit.
3. Recommended Fuse Sizes are selected at approximately 175% of the largest compressor RLA, plus 100% of all other loads in the circuit.
4. Maximum Fuse or breaker size is equal to 225% of the largest compressor RLA, plus 100% of all other loads.
5. The control transformer is furnished and no separate 115V power is required. For both single and multi-point power connections, the control transformer is in circuit #1 with control power wired from there to circuit #2. In multi-point power, disconnecting power to circuit #1 disconnects control power to the unit.
6. Wire sizing amps is 15 amps if a separate 115V power supply is used for the control circuit.
7. Single-point power supply requires a single disconnect to supply electrical power to the unit. This power supply must either be fused or use a circuit breaker.
8. All field wire lug range values given in Electrical Data starting on page 37 apply to 75°C rated wire per NEC.
9. Must be electrically grounded according to national and local electrical codes.

CAUTION

A static discharge while handling circuit boards can cause damage to components. Use a static strap before performing any service work. Never unplug cables, circuit board terminal blocks, or power plugs while power is applied to the panel.

Circuit Breakers

Factory installed compressor circuit breakers are standard on units with single point power supply only. This option provides compressor short circuit protection and makes servicing easier

Voltage Limitations:

1. Within 10 percent of nameplate rating.
2. Voltage unbalance not to exceed 2% with a resultant current unbalance of 6 to 10 times the voltage unbalance per NEMA MG-1, 2009 Standard Rev. 1-2010.

Panel High Short Circuit Current Rating

(Previously known as “withstand rating”). The entire control panel is designed for short circuit current rating as shown in Table 12. In the event of a short circuit, the damage is contained within the control panel enclosure.

Table 12: Standard and HSCCR Panel Ratings

Panel Type	208V / 230V	380V / 400V / 460V	575V
Standard	5kA	5kA	5kA
HSCCR	65kA	65kA	25kA

Electrical Control Center

Operating and equipment protection controls and motor starting components are separately housed in a centrally located, weather resistant control panel with hinged and tool-locked doors. In addition to the MicroTech® III controller described in the next sections, the following components are housed in the panel:

- Power terminal blocks, multi-point connection standard
- Control, input, and output terminal block
- Control transformer
- Optional disconnect switch (through-the-door handle)
- Compressor motor inherent thermal and overload protection is standard
- Optional phase voltage monitor with under/over voltage and phase reversal protection
- Fan contactors with short circuit protective devices.
- Optional ground fault protection
- FanTrol™ fan staging head pressure control system
- Power connections are per Table 13

Power Connections

Table 13: Power Connection Availability

Power Connection	Power Block	Disc. Swt.	Comp. Circuit Breakers	Panel High Short Circuit Current Rating
Optional Single Point	Std.	Opt.	Std.	Opt.
Standard Multi-Point	Std.	Opt.	Not Avail.	Opt.

Switching from line voltage to generator power and vice versa requires that the chiller must either be shut down or the power must be off for more than a second to avoid sending out of phase voltage to the operating motors. A properly installed Synchronized Transfer Switch is the only time that a transfer can be done while the chiller is running.

DANGER

Disconnect, lockout and tag all power to the unit before servicing condenser fan motors or compressors. Failure to do so can cause bodily injury or death.

Figure 44: Typical Field Wiring Diagram (Single-Point Connection)

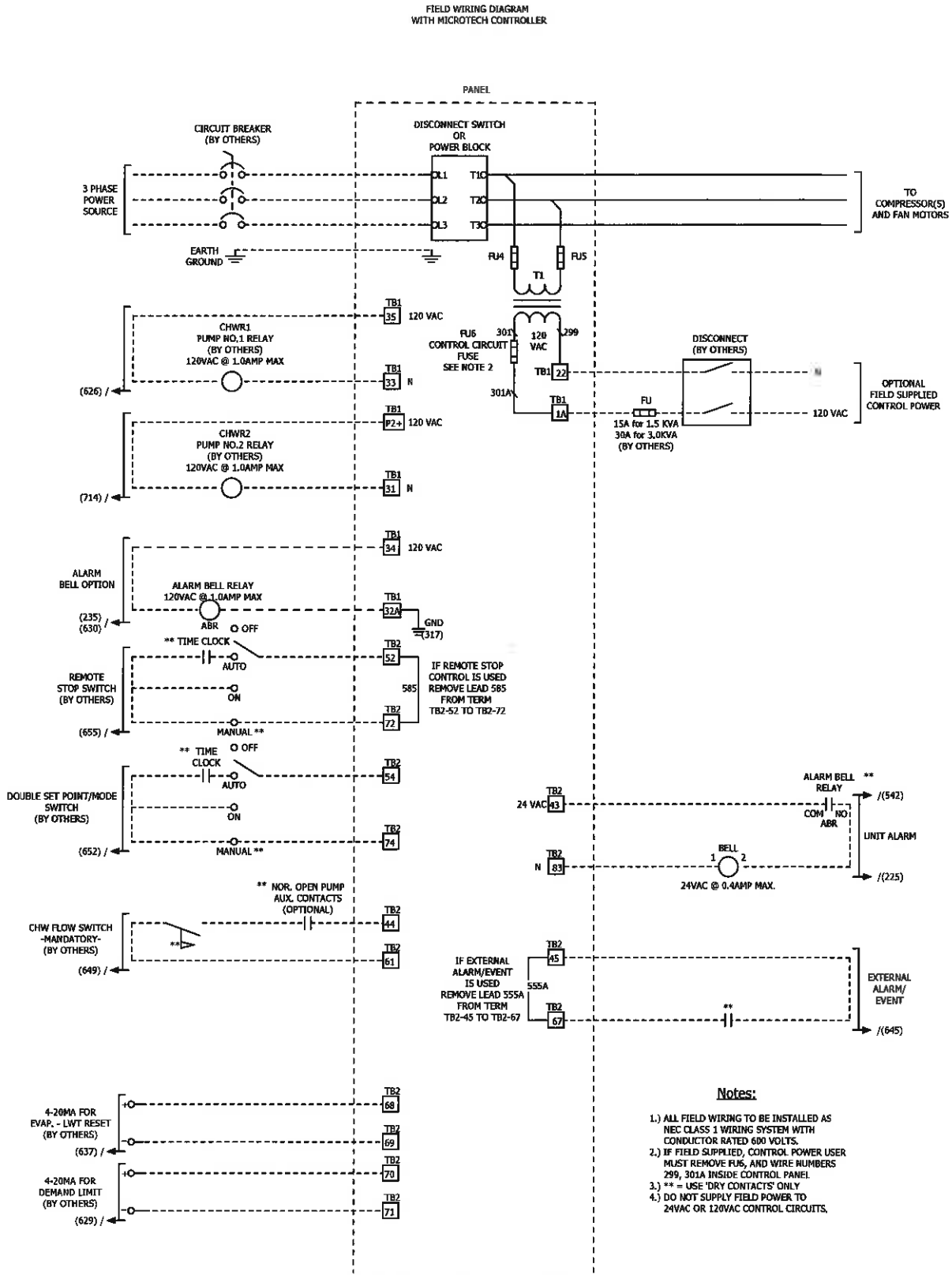


Figure 45: Typical Field Wiring Diagram (Multi-Point Connection)

Note: Separate grounding is required if fed from different transformers. Otherwise a single ground is acceptable.

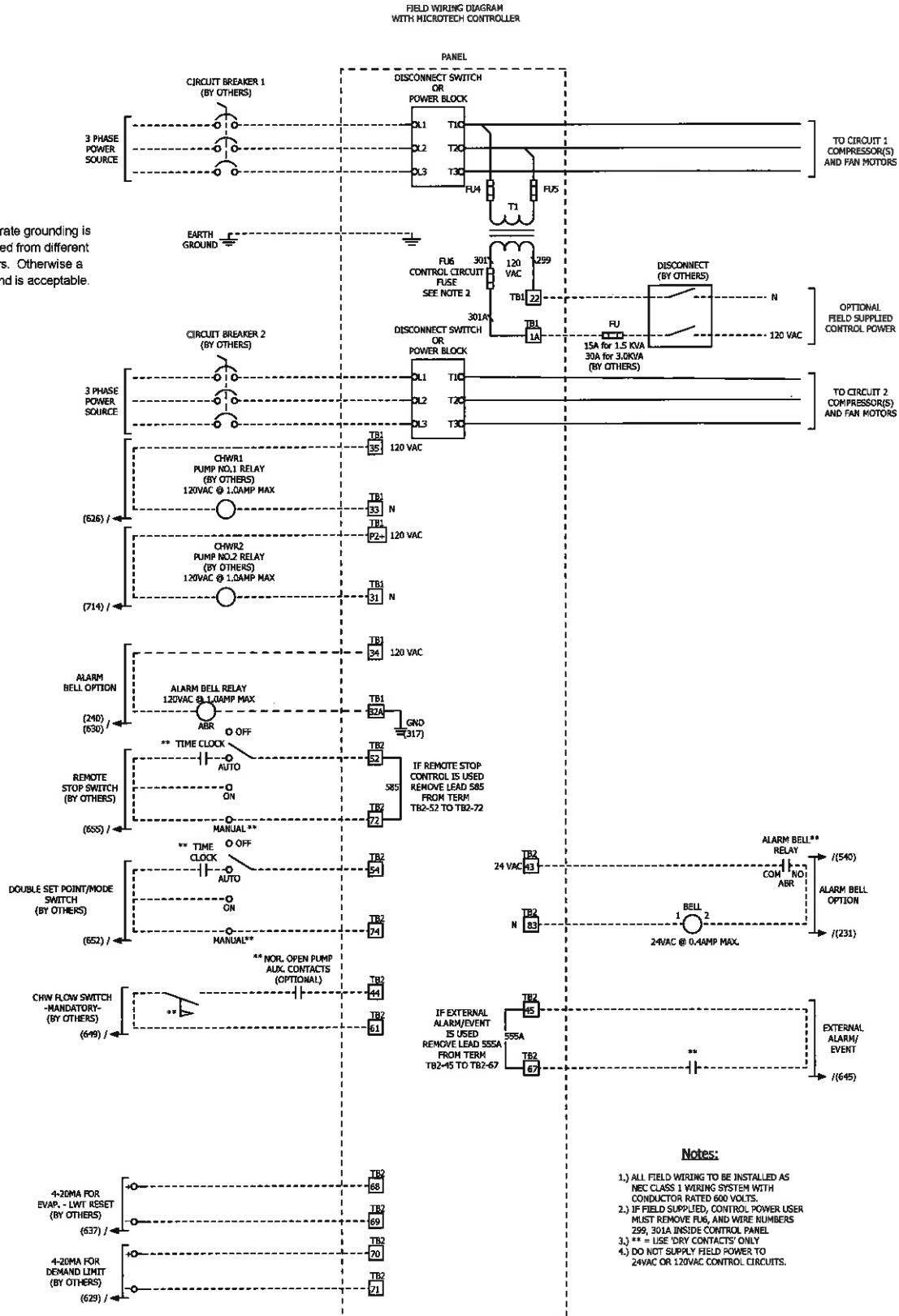


Table 14: Electrical Data - Single Point (60/50 Hz)

Model Size	Voltage / Freq.	Single Point Field Data				
		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch
030E	208V/60	149	175	175	(1) 2-600MCM	(1) 6-350MCM
	230V/60	149	175	175	(1) 2-600MCM	(1) 6-350MCM
	380V/60	87	100	100	(1) 2-600MCM	(1) 12-1/0
	460V/60	74	80	80	(1) 14-2/0	(1) 12-1/0
	575V/60	64	70	70	(1) 14-2/0	(1) 12-1/0
	400V/50	77	90	90	(1) 14-2/0	(1) 12-1/0
035E	208V/60	163	175	175	(1) 2-600MCM	(1) 6-350MCM
	230V/60	163	175	175	(1) 2-600MCM	(1) 6-350MCM
	380V/60	96	110	110	(1) 2-600MCM	(1) 4-300MCM
	460V/60	77	90	90	(1) 14-2/0	(1) 12-1/0
	575V/60	64	70	70	(1) 14-2/0	(1) 12-1/0
	400V/50	80	90	90	(1) 14-2/0	(1) 12-1/0
040E	208V/60	168	200	200	(1) 2-600MCM	(1) 6-350MCM
	230V/60	168	200	200	(1) 2-600MCM	(1) 6-350MCM
	380V/60	107	125	125	(1) 2-600MCM	(1) 4-300MCM
	460V/60	80	90	90	(1) 14-2/0	(1) 12-1/0
	575V/60	67	80	80	(1) 14-2/0	(1) 12-1/0
	400V/50	83	100	100	(1) 14-2/0	(1) 12-1/0
045E	208V/60	228	250	250	(1) 2-600MCM	(1) 6-350MCM
	230V/60	228	250	250	(1) 2-600MCM	(1) 6-350MCM
	380V/60	117	125	125	(1) 2-600MCM	(1) 4-300MCM
	460V/60	90	100	100	(1) 2-600MCM	(1) 12-1/0
	575V/60	75	90	90	(1) 14-2/0	(1) 12-1/0
	400V/50	94	110	110	(1) 2-600MCM	(1) 4-300MCM
050E	208V/60	241	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	241	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	131	150	150	(1) 2-600MCM	(1) 4-300MCM
	460V/60	109	125	125	(1) 2-600MCM	(1) 4-300MCM
	575V/60	97	110	110	(1) 2-600MCM	(1) 4-300MCM
	400V/50	107	125	125	(1) 2-600MCM	(1) 4-300MCM
055E	208V/60	251	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	251	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	147	175	175	(1) 2-600MCM	(1) 6-350MCM
	460V/60	118	125	125	(1) 2-600MCM	(1) 4-300MCM
	575V/60	105	125	125	(1) 2-600MCM	(1) 4-300MCM
	400V/50	119	125	125	(1) 2-600MCM	(1) 4-300MCM
060E	208V/60	260	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	260	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	161	175	175	(1) 2-600MCM	(1) 6-350MCM
	460V/60	126	150	150	(1) 2-600MCM	(1) 4-300MCM
	575V/60	113	125	125	(1) 2-600MCM	(1) 4-300MCM
	400V/50	129	150	150	(1) 2-600MCM	(1) 4-300MCM

Table 15: Electrical Data - Single Point (60/50 Hz)

Model Size	Voltage / Freq.	Single Point Field Data				
		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch
065E	208V/60	268	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	268	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	161	175	175	(1) 2-600MCM	(1) 6-350MCM
	460V/60	129	150	150	(1) 2-600MCM	(1) 4-300MCM
	575V/60	113	125	125	(1) 2-600MCM	(1) 4-300MCM
	400V/50	129	150	150	(1) 2-600MCM	(1) 4-300MCM
070E	208V/60	306	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	306	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	164	200	200	(1) 2-600MCM	(1) 6-350MCM
	460V/60	138	150	150	(1) 2-600MCM	(1) 4-300MCM
	575V/60	117	125	125	(1) 2-600MCM	(1) 4-300MCM
	400V/50	138	150	150	(1) 2-600MCM	(1) 4-300MCM
075E	208V/60	338	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	338	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	173	200	200	(1) 14-2/0	(1) 6-350MCM
	460V/60	149	175	175	(1) 14-2/0	(1) 6-350MCM
	575V/60	125	150	150	(1) 14-2/0	(1) 4-300MCM
	400V/50	149	175	175	(1) 14-2/0	(1) 6-350MCM
080E	208V/60	355	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	355	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	187	225	225	(1) 2-600MCM	(1) 6-350MCM
	460V/60	153	175	175	(1) 14-2/0	(1) 6-350MCM
	575V/60	126	150	150	(1) 14-2/0	(1) 4-300MCM
	400V/50	153	175	175	(1) 14-2/0	(1) 6-350MCM
090E	208V/60	384	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	384	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	218	250	250	(1) 2-600MCM	(1) 6-350MCM
	460V/60	168	200	200	(1) 14-2/0	(1) 6-350MCM
	575V/60	147	175	175	(1) 14-2/0	(1) 6-350MCM
	400V/50	168	200	200	(1) 14-2/0	(1) 6-350MCM
100E	208V/60	442	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	230V/60	442	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	380V/60	268	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	203	250	250	(1) 2-600MCM	(1) 6-350MCM
	575V/60	184	225	225	(1) 2-600MCM	(1) 6-350MCM
	400V/50	203	250	250	(1) 2-600MCM	(1) 6-350MCM
110E	208V/60	490	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	230V/60	490	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	380V/60	294	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	227	250	250	(1) 2-600MCM	(1) 6-350MCM
	575V/60	204	250	250	(1) 2-600MCM	(1) 6-350MCM
	400V/50	227	250	250	(1) 2-600MCM	(1) 6-350MCM

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
 For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

Table 16: Electrical Data - Single Point (60/50 Hz)

Model Size	Voltage / Freq.	Single Point Field Data				
		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch
120E	208V/60	534	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	230V/60	534	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	380V/60	330	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	261	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	234	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	261	300	300	(1) 2-600MCM	(2) 3/0-500MCM
130E	208V/60	569	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	569	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	358	400	450	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	284	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	239	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	284	350	350	(1) 2-600MCM	(2) 3/0-500MCM
140E	208V/60	612	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	612	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	388	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	309	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	248	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	309	350	350	(1) 2-600MCM	(2) 3/0-500MCM
150E	208V/60	640	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	640	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	410	500	500	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	328	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	252	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	328	400	400	(1) 2-600MCM	(2) 3/0-500MCM
161E	208V/60	668	800	800	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	668	800	800	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	432	500	500	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	346	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	255	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	346	400	400	(1) 2-600MCM	(2) 3/0-500MCM
170E	208V/60	734	800	800	(2) 6-500MCM	(4) 4/0-500MCM
	230V/60	734	800	800	(2) 6-500MCM	(4) 4/0-500MCM
	380V/60	442	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	460V/60	355	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	309	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	355	400	400	(1) 2-600MCM	(2) 3/0-500MCM
180E	208V/60	875	1000	1000	--	(4) 4/0-500MCM
	230V/60	875	1000	1000	--	(4) 4/0-500MCM
	380V/60	479	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	460V/60	394	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	339	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	394	450	450	(1) 2-600MCM	(2) 3/0-500MCM

Table 17: Electrical Data - Single Point (60/50 Hz)

Model Size	Voltage / Freq.	Single Point Field Data				
		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch
190E	208V/60	848	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	230V/60	848	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	380V/60	508	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	460V/60	424	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	575V/60	348	400	400	(2) 6-500MCM	(2) 3/0-500MCM
	400V/50	424	500	500	(1) 2-600MCM	(2) 3/0-500MCM
210E	208V/60	890	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	230V/60	890	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	380V/60	525	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	460V/60	443	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	575V/60	351	400	400	(2) 6-500MCM	(2) 3/0-500MCM
	400V/50	443	500	500	(1) 2-600MCM	(2) 3/0-500MCM
225E	208V/60	943	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	230V/60	943	1000	1000	(4) 2-600MCM	(4) 4/0-500MCM
	380V/60	551	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	460V/60	469	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	575V/60	359	400	400	(2) 6-500MCM	(2) 3/0-500MCM
	400V/50	469	500	500	(1) 2-600MCM	(2) 3/0-500MCM
240E	208V/60	1071	1200	1200	(4) 2-600MCM	(4) 4/0-500MCM
	230V/60	1071	1200	1200	(4) 2-600MCM	(4) 4/0-500MCM
	380V/60	602	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	460V/60	525	600	600	(2) 6-500MCM	(2) 3/0-500MCM
	575V/60	367	400	400	(2) 6-500MCM	(2) 3/0-500MCM
	400V/50	525	600	600	(1) 2-600MCM	(2) 3/0-500MCM

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
 For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

Table 18: Electrical Data - Multiple Point (60/50 Hz)

Model Size	Voltage / Frequency	Multiple Point Field Data - Circuit #1					Multiple Point Field Data - Circuit #2				
		Ratings			Lug Range		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch	MCA	RFS	MFS	Power Block	Disconnect Switch
030E	208V/60	78	100	100	(1) 14-2/0	(1) 12-1/0	78	100	100	(1) 14-2/0	(1) 4-300MCM
	230V/60	78	100	100	(1) 14-2/0	(1) 12-1/0	78	100	100	(1) 14-2/0	(1) 4-300MCM
	380V/60	46	60	60	(1) 14-2/0	(1) 12-1/0	46	60	60	(1) 14-2/0	(1) 12-1/0
	460V/60	39	50	50	(1) 14-2/0	(1) 12-1/0	39	50	50	(1) 14-2/0	(1) 12-1/0
	575V/60	34	40	45	(1) 14-2/0	(1) 12-1/0	34	40	45	(1) 14-2/0	(1) 12-1/0
	400V/50	40	50	50	(1) 14-2/0	(1) 12-1/0	40	50	50	(1) 14-2/0	(1) 12-1/0
035E	208V/60	82	100	110	(1) 14-2/0	(1) 4-300MCM	88	110	110	(1) 14-2/0	(1) 4-300MCM
	230V/60	82	100	110	(1) 14-2/0	(1) 4-300MCM	88	110	110	(1) 14-2/0	(1) 4-300MCM
	380V/60	44	60	60	(1) 14-2/0	(1) 12-1/0	56	70	70	(1) 14-2/0	(1) 12-1/0
	460V/60	39	50	50	(1) 14-2/0	(1) 12-1/0	42	50	50	(1) 14-2/0	(1) 12-1/0
	575V/60	32	40	40	(1) 14-2/0	(1) 12-1/0	35	45	45	(1) 14-2/0	(1) 12-1/0
	400V/50	40	50	50	(1) 14-2/0	(1) 12-1/0	44	60	60	(1) 14-2/0	(1) 12-1/0
040E	208V/60	88	110	110	(1) 14-2/0	(1) 4-300MCM	88	110	110	(1) 14-2/0	(1) 4-300MCM
	230V/60	88	110	110	(1) 14-2/0	(1) 4-300MCM	88	110	110	(1) 14-2/0	(1) 4-300MCM
	380V/60	56	70	70	(1) 14-2/0	(1) 12-1/0	56	70	70	(1) 14-2/0	(1) 12-1/0
	460V/60	42	50	50	(1) 14-2/0	(1) 12-1/0	42	50	50	(1) 14-2/0	(1) 12-1/0
	575V/60	35	45	45	(1) 14-2/0	(1) 12-1/0	35	45	45	(1) 14-2/0	(1) 12-1/0
	400V/50	44	60	60	(1) 14-2/0	(1) 12-1/0	44	60	60	(1) 14-2/0	(1) 12-1/0
045E	208V/60	120	150	150	(1) 14-2/0	(1) 4-300MCM	120	150	150	(1) 14-2/0	(1) 6-350MCM
	230V/60	120	150	150	(1) 14-2/0	(1) 4-300MCM	120	150	150	(1) 14-2/0	(1) 6-350MCM
	380V/60	62	80	80	(1) 14-2/0	(1) 12-1/0	62	80	80	(1) 14-2/0	(1) 12-1/0
	460V/60	48	60	60	(1) 14-2/0	(1) 12-1/0	48	60	60	(1) 14-2/0	(1) 12-1/0
	575V/60	39	50	50	(1) 14-2/0	(1) 12-1/0	39	50	50	(1) 14-2/0	(1) 12-1/0
	400V/50	49	60	60	(1) 14-2/0	(1) 12-1/0	49	60	60	(1) 14-2/0	(1) 12-1/0
050E	208V/60	127	150	175	(1) 14-2/0	(1) 6-350MCM	127	150	175	(1) 14-2/0	(1) 6-350MCM
	230V/60	127	150	175	(1) 14-2/0	(1) 6-350MCM	127	150	175	(1) 14-2/0	(1) 6-350MCM
	380V/60	69	90	90	(1) 14-2/0	(1) 12-1/0	69	90	90	(1) 14-2/0	(1) 12-1/0
	460V/60	58	70	80	(1) 14-2/0	(1) 12-1/0	58	70	80	(1) 14-2/0	(1) 12-1/0
	575V/60	51	60	70	(1) 14-2/0	(1) 12-1/0	51	60	70	(1) 14-2/0	(1) 12-1/0
	400V/50	56	70	70	(1) 14-2/0	(1) 12-1/0	56	70	70	(1) 14-2/0	(1) 12-1/0
055E	208V/60	127	150	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
	230V/60	127	150	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
	380V/60	69	90	90	(1) 14-2/0	(1) 12-1/0	85	110	110	(1) 14-2/0	(1) 4-300MCM
	460V/60	58	70	80	(1) 14-2/0	(1) 12-1/0	66	80	90	(1) 14-2/0	(1) 12-1/0
	575V/60	51	60	70	(1) 14-2/0	(1) 12-1/0	59	70	80	(1) 14-2/0	(1) 12-1/0
	400V/50	56	70	70	(1) 14-2/0	(1) 12-1/0	68	80	90	(1) 14-2/0	(1) 12-1/0
060E	208V/60	137	175	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
	230V/60	137	175	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
	380V/60	85	110	110	(1) 14-2/0	(1) 4-300MCM	85	110	110	(1) 14-2/0	(1) 4-300MCM
	460V/60	66	80	90	(1) 14-2/0	(1) 12-1/0	66	80	90	(1) 14-2/0	(1) 12-1/0
	575V/60	59	70	80	(1) 14-2/0	(1) 12-1/0	59	70	80	(1) 14-2/0	(1) 12-1/0
	400V/50	68	80	90	(1) 14-2/0	(1) 12-1/0	68	80	90	(1) 14-2/0	(1) 12-1/0

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
 For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

Table 19: Electrical Data - Multiple Point (60/50 Hz)

Model Size	Voltage / Frequency	Multiple Point Field Data - Circuit #1					Multiple Point Field Data - Circuit #2				
		Ratings			Lug Range		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch	MCA	RFS	MFS	Power Block	Disconnect Switch
065E	208V/60	141	175	175	(1) 14-2/0	(1) 6-350MCM	141	175	175	(1) 14-2/0	(1) 6-350MCM
	230V/60	141	175	175	(1) 14-2/0	(1) 6-350MCM	141	175	175	(1) 14-2/0	(1) 6-350MCM
	380V/60	85	110	110	(1) 14-2/0	(1) 4-300MCM	85	110	110	(1) 14-2/0	(1) 4-300MCM
	460V/60	68	80	90	(1) 14-2/0	(1) 12-1/0	68	80	90	(1) 14-2/0	(1) 12-1/0
	575V/60	59	70	80	(1) 14-2/0	(1) 12-1/0	59	70	80	(1) 14-2/0	(1) 12-1/0
	400V/50	68	80	90	(1) 14-2/0	(1) 12-1/0	68	80	90	(1) 14-2/0	(1) 12-1/0
070E	208V/60	162	200	225	(1) 2-600MCM	(1) 6-350MCM	162	200	225	(1) 2-600MCM	(1) 6-350MCM
	230V/60	162	200	225	(1) 2-600MCM	(1) 6-350MCM	162	200	225	(1) 2-600MCM	(1) 6-350MCM
	380V/60	86	110	110	(1) 14-2/0	(1) 4-300MCM	86	110	110	(1) 14-2/0	(1) 4-300MCM
	460V/60	73	90	100	(1) 14-2/0	(1) 12-1/0	73	90	100	(1) 14-2/0	(1) 4-300MCM
	575V/60	62	80	80	(1) 14-2/0	(1) 12-1/0	62	80	80	(1) 14-2/0	(1) 12-1/0
	400V/50	73	90	100	(1) 14-2/0	(1) 12-1/0	73	90	100	(1) 14-2/0	(1) 4-300MCM
075E	208V/60	186	225	250	(1) 2-600MCM	(1) 6-350MCM	170	225	225	(1) 14-2/0	(1) 6-350MCM
	230V/60	186	225	250	(1) 2-600MCM	(1) 6-350MCM	170	225	225	(1) 14-2/0	(1) 6-350MCM
	380V/60	92	110	125	(1) 14-2/0	(1) 4-300MCM	91	110	125	(1) 14-2/0	(1) 4-300MCM
	460V/60	80	100	110	(1) 14-2/0	(1) 4-300MCM	76	100	100	(1) 14-2/0	(1) 4-300MCM
	575V/60	66	80	90	(1) 14-2/0	(1) 12-1/0	65	80	90	(1) 14-2/0	(1) 12-1/0
	400V/50	80	100	110	(1) 14-2/0	(1) 4-300MCM	76	100	100	(1) 14-2/0	(1) 4-300MCM
080E	208V/60	186	225	250	(1) 2-600MCM	(1) 6-350MCM	186	225	250	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	186	225	250	(1) 2-600MCM	(1) 6-350MCM	186	225	250	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	98	125	125	(1) 14-2/0	(1) 4-300MCM	98	125	125	(1) 14-2/0	(1) 6-350MCM
	460V/60	80	100	110	(1) 14-2/0	(1) 4-300MCM	80	100	110	(1) 14-2/0	(1) 4-300MCM
	575V/60	66	80	90	(1) 14-2/0	(1) 12-1/0	66	80	90	(1) 14-2/0	(1) 4-300MCM
	400V/50	80	100	110	(1) 14-2/0	(1) 4-300MCM	80	100	110	(1) 14-2/0	(1) 4-300MCM
090E	208V/60	203	250	250	(1) 2-600MCM	(1) 6-350MCM	203	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	203	250	250	(1) 2-600MCM	(1) 6-350MCM	203	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	115	150	150	(1) 14-2/0	(1) 4-300MCM	115	150	150	(1) 14-2/0	(1) 6-350MCM
	460V/60	89	110	125	(1) 14-2/0	(1) 4-300MCM	89	110	125	(1) 14-2/0	(1) 4-300MCM
	575V/60	78	100	110	(1) 14-2/0	(1) 4-300MCM	78	100	110	(1) 14-2/0	(1) 4-300MCM
	400V/50	89	110	125	(1) 14-2/0	(1) 4-300MCM	89	110	125	(1) 14-2/0	(1) 4-300MCM
100E	208V/60	215	300	300	(1) 2-600MCM	(2) 3/0-500MCM	248	300	350	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	215	300	300	(1) 2-600MCM	(2) 3/0-500MCM	248	300	350	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	129	175	175	(1) 14-2/0	(1) 6-350MCM	152	200	200	(1) 14-2/0	(2) 3/0-500MCM
	460V/60	96	125	125	(1) 14-2/0	(1) 4-300MCM	117	150	150	(1) 14-2/0	(1) 6-350MCM
	575V/60	87	110	110	(1) 14-2/0	(1) 4-300MCM	105	150	150	(1) 14-2/0	(1) 6-350MCM
	400V/50	96	125	125	(1) 14-2/0	(1) 4-300MCM	117	150	150	(1) 14-2/0	(1) 6-350MCM
110E	208V/60	259	350	350	(1) 2-600MCM	(2) 3/0-500MCM	259	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	259	350	350	(1) 2-600MCM	(2) 3/0-500MCM	259	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	156	200	225	(1) 14-2/0	(1) 6-350MCM	156	200	225	(1) 14-2/0	(2) 3/0-500MCM
	460V/60	120	150	175	(1) 14-2/0	(1) 6-350MCM	120	150	175	(1) 14-2/0	(1) 6-350MCM
	575V/60	108	150	150	(1) 14-2/0	(1) 4-300MCM	108	150	150	(1) 14-2/0	(1) 6-350MCM
	400V/50	120	150	175	(1) 14-2/0	(1) 6-350MCM	120	150	175	(1) 14-2/0	(1) 6-350MCM

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
 For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

Table 20: Electrical Data - Multiple Point (60/50 Hz)

Model Size	Voltage / Frequency	Multiple Point Field Data - Circuit #1					Multiple Point Field Data - Circuit #2				
		Ratings			Lug Range		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch	MCA	RFS	MFS	Power Block	Disconnect Switch
120E	208V/60	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	174	225	225	(1) 14-2/0	(1) 6-350MCM	174	225	225	(1) 14-2/0	(2) 3/0-500MCM
	460V/60	137	175	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
	575V/60	123	150	150	(1) 14-2/0	(1) 4-300MCM	123	150	150	(1) 14-2/0	(1) 6-350MCM
	400V/50	137	175	175	(1) 14-2/0	(1) 6-350MCM	137	175	175	(1) 14-2/0	(1) 6-350MCM
130E	208V/60	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM	316	400	450	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	281	350	350	(1) 2-600MCM	(2) 3/0-500MCM	316	400	450	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	174	225	225	(1) 14-2/0	(1) 6-350MCM	201	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	137	175	175	(1) 14-2/0	(1) 6-350MCM	160	200	225	(1) 14-2/0	(2) 3/0-500MCM
	575V/60	123	150	150	(1) 14-2/0	(1) 4-300MCM	128	175	175	(1) 14-2/0	(1) 6-350MCM
	400V/50	137	175	175	(1) 14-2/0	(1) 6-350MCM	160	200	225	(1) 14-2/0	(2) 3/0-500MCM
140E	208V/60	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	206	250	250	(1) 2-600MCM	(1) 6-350MCM	206	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	164	200	225	(1) 14-2/0	(1) 6-350MCM	164	200	225	(1) 14-2/0	(2) 3/0-500MCM
	575V/60	131	175	175	(1) 14-2/0	(1) 6-350MCM	131	175	175	(1) 14-2/0	(1) 6-350MCM
	400V/50	164	200	225	(1) 14-2/0	(1) 6-350MCM	164	200	225	(1) 14-2/0	(2) 3/0-500MCM
150E	208V/60	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM	351	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	324	400	450	(1) 2-600MCM	(2) 3/0-500MCM	351	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	206	250	250	(1) 2-600MCM	(1) 6-350MCM	228	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	164	200	225	(1) 14-2/0	(1) 6-350MCM	182	225	250	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	131	175	175	(1) 14-2/0	(1) 6-350MCM	134	175	175	(1) 14-2/0	(1) 6-350MCM
	400V/50	164	200	225	(1) 14-2/0	(1) 6-350MCM	182	225	250	(1) 2-600MCM	(2) 3/0-500MCM
161E	208V/60	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	212	250	250	(1) 2-600MCM	(1) 6-350MCM	212	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	165	200	200	(1) 14-2/0	(1) 6-350MCM	165	200	200	(1) 14-2/0	(2) 3/0-500MCM
	575V/60	146	175	175	(1) 14-2/0	(1) 6-350MCM	146	175	175	(1) 14-2/0	(1) 6-350MCM
	400V/50	165	200	200	(1) 14-2/0	(1) 6-350MCM	165	200	200	(1) 14-2/0	(2) 3/0-500MCM
170E	208V/60	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM	405	500	500	(1) 2-600MCM	(2) 3/0-500MCM
	230V/60	358	450	450	(1) 2-600MCM	(2) 3/0-500MCM	405	500	500	(1) 2-600MCM	(2) 3/0-500MCM
	380V/60	212	250	250	(1) 2-600MCM	(1) 6-350MCM	248	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	165	200	200	(1) 14-2/0	(1) 6-350MCM	204	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	146	175	175	(1) 14-2/0	(1) 6-350MCM	176	200	225	(1) 2-600MCM	(1) 6-350MCM
	400V/50	165	200	200	(1) 14-2/0	(1) 6-350MCM	204	250	250	(1) 2-600MCM	(2) 3/0-500MCM
180E	208V/60	453	500	500	(2) 6-500MCM	(2) 3/0-500MCM	453	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	230V/60	453	500	500	(2) 6-500MCM	(2) 3/0-500MCM	453	500	500	(2) 6-500MCM	(2) 3/0-500MCM
	380V/60	248	300	300	(1) 2-600MCM	(2) 3/0-500MCM	248	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	204	250	250	(1) 2-600MCM	(1) 6-350MCM	204	250	250	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	176	200	225	(1) 2-600MCM	(1) 6-350MCM	176	200	225	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	204	250	250	(1) 2-600MCM	(1) 6-350MCM	204	250	250	(1) 2-600MCM	(2) 3/0-500MCM

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
 For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

Table 21: Electrical Data - Multiple Point (60/50 Hz)

Model Size	Voltage / Frequency	Multiple Point Field Data - Circuit #1					Multiple Point Field Data - Circuit #2				
		Ratings			Lug Range		Ratings			Lug Range	
		MCA	RFS	MFS	Power Block	Disconnect Switch	MCA	RFS	MFS	Power Block	Disconnect Switch
190E	208V/60	413	500	500	(1) 2-600MCM	(2) 3/0-500MCM	464	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	413	500	500	(1) 2-600MCM	(2) 3/0-500MCM	464	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	252	300	300	(1) 2-600MCM	(2) 3/0-500MCM	274	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	208	250	250	(1) 2-600MCM	(1) 6-350MCM	231	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	179	225	225	(1) 2-600MCM	(1) 6-350MCM	182	225	225	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	208	250	250	(1) 2-600MCM	(1) 6-350MCM	231	300	300	(1) 2-600MCM	(2) 3/0-500MCM
210E	208V/60	464	600	600	(2) 6-500MCM	(2) 3/0-500MCM	464	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	464	600	600	(2) 6-500MCM	(2) 3/0-500MCM	464	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	274	350	350	(1) 2-600MCM	(2) 3/0-500MCM	274	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	231	300	300	(1) 2-600MCM	(2) 3/0-500MCM	231	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	182	225	225	(1) 2-600MCM	(2) 3/0-500MCM	182	225	225	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	231	300	300	(1) 2-600MCM	(1) 6-350MCM	231	300	300	(1) 2-600MCM	(2) 3/0-500MCM
225E	208V/60	483	600	600	(2) 6-500MCM	(2) 3/0-500MCM	494	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	483	600	600	(2) 6-500MCM	(2) 3/0-500MCM	494	600	600	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	278	350	350	(1) 2-600MCM	(2) 3/0-500MCM	295	350	350	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	235	300	300	(1) 2-600MCM	(2) 3/0-500MCM	253	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	185	225	225	(1) 2-600MCM	(2) 3/0-500MCM	187	225	225	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	235	300	300	(1) 2-600MCM	(1) 6-350MCM	253	300	300	(1) 2-600MCM	(2) 3/0-500MCM
240E	208V/60	555	700	700	(2) 6-500MCM	(3) 2/0-400MCM	555	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	230V/60	555	700	700	(2) 6-500MCM	(3) 2/0-400MCM	555	700	700	(2) 6-500MCM	(3) 2/0-400MCM
	380V/60	312	400	400	(1) 2-600MCM	(2) 3/0-500MCM	312	400	400	(1) 2-600MCM	(2) 3/0-500MCM
	460V/60	272	300	300	(1) 2-600MCM	(2) 3/0-500MCM	272	300	300	(1) 2-600MCM	(2) 3/0-500MCM
	575V/60	190	225	225	(1) 2-600MCM	(2) 3/0-500MCM	190	225	225	(1) 2-600MCM	(2) 3/0-500MCM
	400V/50	272	300	300	(1) 2-600MCM	(1) 6-350MCM	272	300	300	(1) 2-600MCM	(2) 3/0-500MCM

NOTE: MCA = Minimum Current Ampacity, RFS = Recommended Fuse Size, MFS = Maximum Fuse Size.
 For RFS, use the given values for intended standard ambient operation. If the operating ambient is intended to be above 105°F, MFS must be used.

General Description

The MicroTech® III controller's design not only permits the chiller to run more efficiently, but also can simplify troubleshooting if a system failure occurs. Every MicroTech® III controller is programmed and tested prior to shipment to facilitate start-up.

The controller menu structure is separated into three distinct categories that provide the operator or service technician with a full description of:

1. current unit status
2. control parameters
3. alarms

Security protection prevents unauthorized changing of the setpoints and control parameters.

MicroTech® III control continuously performs self-diagnostic checks, monitoring system temperatures, pressures and protection devices, and will automatically shut down a compressor or the entire unit should a fault occur. The cause of the shutdown will be retained in memory and can be easily displayed in plain English for operator review. The MicroTech® III chiller controller will also retain and display the date/time the fault occurred. In addition to displaying alarm diagnostics, the MicroTech® III chiller controller also provides the operator with a warning of limit (pre-alarm) conditions.

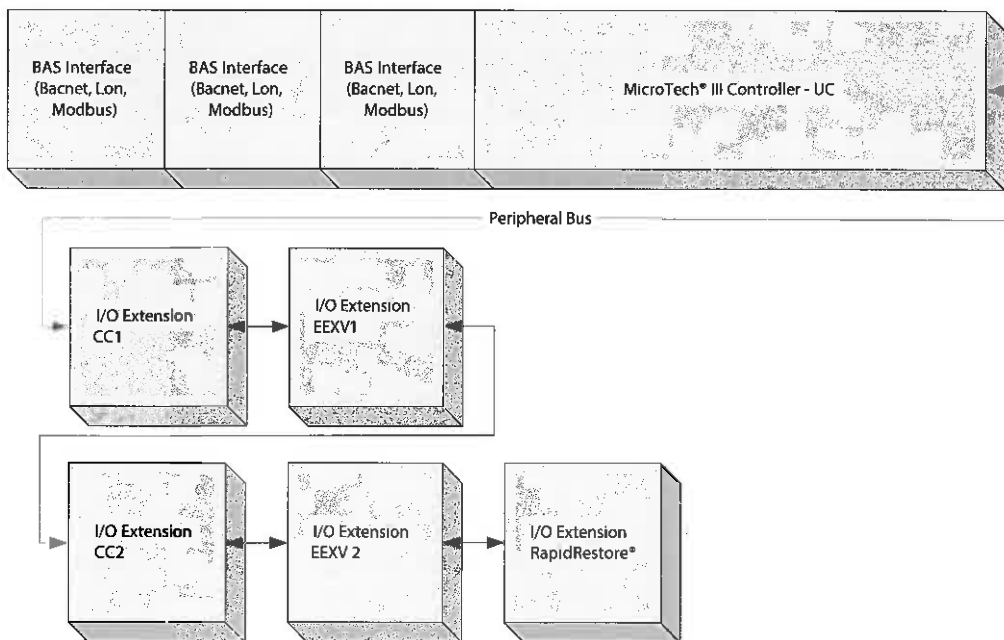
System Architecture

The overall controls architecture uses the following:

- One MicroTech® III unit controller
- I/O extension modules as needed depending on the configuration of the unit
- Communications interface(s) as needed based on installed options

Communication interface modules will connect directly to the left side of the unit controller. I/O extensions will connect via peripheral bus using the connection on the right side of the controller. All of the I/O extension modules can connect directly or using a wiring harness.

Figure 46: System Architecture



Controller Inputs and Outputs

Main Controller

Table 22: Analog Inputs

#	Description	Signal Type	Expected Range
AI1	Evaporator EWT	NTC 10k	340 to 300k Ω
AI2	Evaporator LWT	NTC 10k	340 to 300k Ω
AI3	Ambient Temp	NTC 10k	340 to 300k Ω
X1	Demand Limit	4-20 mA	1 to 23 mA
X4	LWT Reset	4-20 mA	1 to 23 mA

Table 23: Analog Outputs

#	Description	Signal Type	Range
X2	Circuit 1 Fan VFD Speed2	Voltage	0 to 10 volts
X3	Circuit 2 Fan VFD Speed2	Voltage	0 to 10 volts
X5	Circuit 1 Fan VFD Speed1	Voltage	0 to 10 volts
X6	Circuit 2 Fan VFD Speed1	Voltage	0 to 10 volts

Table 24: Digital Inputs

	Description	Signal Off	Signal On
DI1	External Alarm/Event	Ext. Fault	No Ext. Fault
DI2	Evaporator Flow Switch	No Flow	Flow
DI3	Double Set Point/ Mode Switch	See sections on Unit Mode Selection and LWT Target	
DI4	Remote Switch	Remote Disable	Remote Enable
DI5	Unit Switch	Unit Disable	Unit Enable

Table 25: Digital Outputs

	Description	Output Off	Output On
DO1	Evaporator Water Pump 1	Pump Off	Pump On
DO2	Alarm Indicator	Alarm Not Active	Alarm Active
DO3	Circuit 1 Fan Output 1	Fan(s) Off	Fan(s) On
DO4	Circuit 1 Fan Output 2	Fan(s) Off	Fan(s) On
DO5	Circuit 1 Fan Output 3	Fan(s) Off	Fan(s) On
DO6	Circuit 1 Fan Output 4	Fan(s) Off	Fan(s) On
DO7	Circuit 2 Fan Output 1	Fan(s) Off	Fan(s) On
DO8	Circuit 2 Fan Output 2	Fan(s) Off	Fan(s) On
DO9	Circuit 2 Fan Output 3	Fan(s) Off	Fan(s) On
DO10	Circuit 2 Fan Output 4	Fan(s) Off	Fan(s) On
X7	Circuit 1 Condenser SV 1	Solenoid Closed	Solenoid Open
X8	Circuit 2 Condenser SV 1	Solenoid Closed	Solenoid Open

Compressor Module 1

Table 26: Analog Inputs

	Description	Signal Type	Expected Range
X1	Circuit 1 Suction Temp	NTC 10k	340 to 300k Ω
X2	Circuit 1 Evaporator Press	Voltage	0.4 to 4.6 volts
X4	Circuit 1 Condenser Press	Voltage	0.4 to 4.6 volts

Table 27: Digital Inputs

	Description	Signal Off	Signal On
X6	Circuit 1 Switch	Circuit Disable	Circuit Enable
X7	Circuit 1 MHP Switch	Fault	No fault
X8	Circuit 1 Motor Protection	Fault	No fault
DI1	Circuit 1 (or Unit) PVM/ GFP	Fault	No fault

NOTE: The Motor Protection and MHP input signal are wired in series. If Motor Protection input is open, MHP Switch input will also be open.

Table 28: Digital Outputs

	Description	Output Off	Output On
DO1	Compressor #1	Compressor Off	Compressor On
DO2	Compressor #3	Compressor Off	Compressor On
DO3	Compressor #5	Compressor Off	Compressor On
DO4	Evaporator Water Pump 2	Pump Off	Pump On
DO5	Circuit 1 Hot Gas Bypass SV	Solenoid Closed	Solenoid Open
DO6	Circuit 1 Liquid Line SV	Solenoid Closed	Solenoid Open

Compressor Module 2

Table 29: Analog Inputs

	Description	Signal Type	Expected Range
X1	Circuit 2 Suction Temp	NTC 10k	340 to 300k Ω
X2	Circuit 2 Evaporator Press	Voltage	0.4 to 4.6 volts
X4	Circuit 2 Condenser Press	Voltage	0.4 to 4.6 volts

Table 30: Digital Inputs

	Description	Signal Off	Signal On
X6	Circuit 2 Switch	Circuit Disable	Circuit Enable
X7	Circuit 2 MHP Switch	Fault	No fault
X8	Circuit 2 Motor Protection	Fault	No fault
DI1	Circuit 2 PVM/GFP	Fault	No fault

NOTE: The Motor Protection and MHP input signal are wired in series. If Motor Protection input is open, MHP Switch input will also be open (not applicable to 030 and 045E models).

Table 31: Digital Outputs

	Description	Output Off	Output On
DO1	Compressor #2	Compressor Off	Compressor On
DO2	Compressor #4	Compressor Off	Compressor On
DO3	Compressor #6	Compressor Off	Compressor On
DO5	Circuit 2 Hot Gas Bypass SV	Solenoid Closed	Solenoid Open
DO6	Circuit 2 Liquid Line SV	Solenoid Closed	Solenoid Open

EXV Module 1 and 2

These modules will be used only when the expansion valve type is electronic.

Table 32: Digital Outputs

	Description	Output Off	Output On
DO1	Circuit 1 or 2 Fan Output 5	Fan(s) Off	Fan(s) On

Table 33: Stepper Motor Output

	Description
M1+, M1-	EXV Stepper Coil 1
M2+, M2-	EXV Stepper Coil 2

Condenser Fan Output Labels

All condenser fan output labels, both the digital outputs and analog speed signals, will be labeled according to which fans are connected to each one. The following tables show the fans connected to each output for each configuration.

Table 34: AGZ-E Models without VFDs

	Output Descr.	Physical Output	Number of Fans					
			4	6	8	10	12	14
Circuit 1	Speed 1	UC X5						
	Speed 2	UC X2						
	Fan Output 1	UC DO3	Fan 11	Fan 11	Fan 11	Fan 11	Fan 11	Fan 11/13
	Fan Output 2	UC DO4	Fan 12	Fan 12	Fan 12	Fan 12	Fan 12	Fan 12
	Fan Output 3	UC DO5		Fan 13	Fan 13	Fan 13	Fan 13	Fan 14/16
	Fan Output 4	UC DO6			Fan 14	Fan 14	Fan 14/16	Fan 15
Fan Output 5	EEXV1 DO1				Fan 15	Fan 15	Fan 17	
Circuit 2	Speed 1	UC X6						
	Speed 2	UC X3						
	Fan Output 1	UC DO7	Fan 21	Fan 21	Fan 21	Fan 21	Fan 21	Fan 21/23
	Fan Output 2	UC DO8	Fan 22	Fan 22	Fan 22	Fan 22	Fan 22	Fan 22
	Fan Output 3	UC DO9		Fan 23	Fan 23	Fan 23	Fan 23	Fan 24/26
	Fan Output 4	UC DO10			Fan 24	Fan 24	Fan 24/26	Fan 25
Fan Output 5	EEXV2 DO1				Fan 25	Fan 25	Fan 27	

Table 35: AGZ-E Models with 1 VFD per Circuit

	Output Descr.	Physical Output	Number of Fans					
			4	6	8	10	12	14
Circuit 1	Speed 1	UC X5	Fan 11	Fan 11	Fan 11/13	Fan 11/13	Fan 11/13	Fan 11/13
	Speed 2	UC X2						
	Fan Output 1	UC DO3					Fan 12	Fan 12
	Fan Output 2	UC DO4	Fan 12	Fan 12	Fan 12	Fan 12	Fan 14	Fan 14
	Fan Output 3	UC DO5		Fan 13			Fan 15	Fan 15
	Fan Output 4	UC DO6			Fan 14	Fan 14	Fan 16	Fan 16
Fan Output 5	EEXV1 DO1				Fan 15		Fan 17	
Circuit 2	Speed 1	UC X6	Fan 21	Fan 21	Fan 21/23	Fan 21/23	Fan 21/23	Fan 21/23
	Speed 2	UC X3						
	Fan Output 1	UC DO7					Fan 22	Fan 22
	Fan Output 2	UC DO8	Fan 22	Fan 22	Fan 22	Fan 22	Fan 24	Fan 24
	Fan Output 3	UC DO9		Fan 23			Fan 25	Fan 25
	Fan Output 4	UC DO10			Fan 24	Fan 24	Fan 26	Fan 26
Fan Output 5	EEXV2 DO1				Fan 25		Fan 27	

Table 36: AGZ-E Models with 2 VFDs per Circuit

	Output Descr.	Physical Output	Number of Fans				
			6	8	10	12	14
Circuit 1	Speed 1	UC X5	Fan 11	Fan 11/13	Fan 11/13	Fan 11/13	Fan 11/13
	Speed 2	UC X2	Fan 12/13	Fan 12/14	Fan 12/14	Fan 12/14/15/16	Fan 12/14/15/16
	Fan Output 1	UC DO3					
	Fan Output 2	UC DO4					
	Fan Output 3	UC DO5					
	Fan Output 4	UC DO6					
	Fan Output 5	EEXV1 DO1			Fan 15		Fan 17
Circuit 2	Speed 1	UC X6	Fan 21	Fan 21/23	Fan 21/23	Fan 21/23	Fan 21/23
	Speed 2	UC X3	Fan 22/23	Fan 22/24	Fan 22/24	Fan 22/24/25/26	Fan 22/24/25/26
	Fan Output 1	UC DO7					
	Fan Output 2	UC DO8					
	Fan Output 3	UC DO9					
	Fan Output 4	UC DO10					
	Fan Output 5	EEXV2 DO1			Fan 25		Fan 27

RapidRestore®

This module will be used only when the unit is equipped with the RapidRestore® option.

Table 37: Digital Inputs

	Description	Signal Off	Signal On
DI1	RapidRestore Enable	Disable RapidRestore	Allow RapidRestore Enabling
DI2	Backup Chiller Designation	Not Backup Chiller	Backup Chiller

Sensor Information

Pressure

Pressure inputs will be read using 0 to 5 volt ratiometric sensors. Nominal voltage range will be 0.5 to 4.5 volts.

Set Points

Set points are initially set to the values in the Default column, and can be adjusted to any value in the Range column. Set points are stored in permanent memory. If an option is not available on a specific model size, the respective set point will

not be needed and therefore not be visible.

Basic unit configuration set points will require the unit to be off in order to make a change and then require rebooting the controller in order to apply a change.

Table 38: Unit Level Set Point Defaults and Ranges

Description	Default	Range
Basic Unit Configuration		
Unit Model	AGZ000???	Based on Unit Model Configuration
Condenser Type	Not Set	Not Set Tube and Fin, Microchannel
Expansion Valve Type	Not Set	Not Set., Thermal, Electronic
Condenser Fan VFD Configuration	None	None, 1/cir, 2/cir
Power Connection Configuration	Single Point	Single Point, Multi Point
Mode/Enabling		
Unit Enable	Enable	Disable, Enable
Control source	Local	Local, Network
Available Modes	Cool	Cool, Cool w/Glycol, Cool/Ice w/Glycol, Ice, Test
Staging and Capacity Control		
Cool LWT 1	7°C (44.6°F)	See Dynamic Set Point Ranges
Cool LWT 2	7°C (44.6°F)	See Dynamic Set Point Ranges
Ice LWT	4.4°C (39.9°F)	-9.5 to 4.4 °C (14.9 to 39.9 °F)
Startup Delta T	5.6°C (10.1°F)	0.6 to 8.3 °C (1.1 to 14.9 °F)
Shut Down Delta T	0.3°C (0.5°F)	0.3 to 1.7 °C (0.5 to 3.1 °F)
Stage Up Delay	240 sec	120 to 480 sec
Stage Down Delay	30 sec	20 to 60 sec
Stage Delay Clear	No	No, Yes
Max Pulldown Rate	0.6°C/min (1.1°F/min)	0.1 to 2.7°C/min (0.2 to 4.9°F/min)
Full Capacity Evap Delta T	8.9 °C (16°F)	3.3 to 8.9 °C (5.9 to 16 °F)
Variable Evaporator Flow	No	No, Yes
Ice TimCycle Delay	12	1-23 hours
Clear Ice Timer	No	No, Yes
RapidRestore	Disable	Disable, Enable
Rapid Restore Max Power Off	15 seconds	15 to 180 seconds
Evaporator Pump Control		
Evap Pump Control Configuration	#1 Only	#1 Only, #2 Only, Auto, #1 Primary, #2 Primary
Evap Recirc Timer	90	15 to 300 seconds
Evap Pump 1 Run Hours	0	0 to 999999 hours
Evap Pump 2 Run Hours	0	0 to 999999 hours
Power Conservation and Limits		
LWT Reset Enable	Disable	Disable, Enable
Demand Limit Enable	Disable	Disable, Enable
High IPLV Mode	Disable	Disable, Enable
IPLV Condensing Target	23.89°C (75°F)	21.11 to 32.22°C (70 to 90°F)
Sound Reduction Mode		
Sound Reduction Enable	Disable	Disable, Enable
Sound Reduction Priority	Capacity	Sound, Capacity
Sound Reduction Fan Speed Limit	50%	50%, 60%, 70%, 80%, 90%
Monday Start Time	22:00	00:00 to 23:00
Monday Duration	12 hrs	0 to 24 hrs
Tuesday Start Time	22:00	00:00 to 23:00
Tuesday Duration	12 hrs	0 to 24 hrs
Wednesday Start Time	22:00	00:00 to 23:00
Wednesday Duration	12 hrs	0 to 24 hrs
Thursday Start Time	22:00	00:00 to 23:00
Thursday Duration	12 hrs	0 to 24 hrs
Friday Start Time	22:00	00:00 to 23:00
Friday Duration	12 hrs	0 to 24 hrs
Saturday Start Time	22:00	00:00 to 23:00

Table 39: Unit Level Set Point Defaults and Ranges (continued)

Saturday Duration	12 hrs	0 to 24 hrs
Sunday Start Time	22:00	00:00 to 23:00
Sunday Duration	12 hrs	0 to 24 hrs
Unit Sensor Offsets		
Evap LWT Sensor Offset	0°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
Evap EWT Sensor Offset	0°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
OAT Sensor Offset	0°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
Circuit Configuration Timers (applies to both circuits)		
Compressor Start to Start Time Delay	15 min	10-60 minutes
Compressor Stop to Start Time Delay	5 min	3-20 minutes
Clear Cycle Timers	No	No, yes
Alarm and Limit Settings - Units		
Evaporator Water Freeze	2.2°C (36°F)	See Dynamic Set Point Ranges
Evaporator Flow Proof	5 sec	5 to 15 sec
Evaporator Recirculate Timeout	3 min	1 to 10 min
External Fault Configuration	Event	Event, Alarm
Low Ambient Lockout	1.7°C (35.1°F)	See Dynamic Set Point Ranges
Low Ambient Lockout BAS Alert	Off	Off, On
Alarm and Limit Settings - Circuits		
Low Evap Pressure Unload	689.5 KPA (100 PSI)	See Dynamic Set Point Ranges
Low Evap Pressure Hold	696.4 KPA (101 PSI)	See Dynamic Set Point Ranges
High Condenser Pressure	4240 KPA (615 PSI)	3310 to 4275 KPA (480 to 620 PSI)
High Condenser Pressure Unload	4137 KPA (600 PSI)	3241 to 4137 KPA (470 to 600 PSI)
Low OAT Start Time	165 sec	150 to 240 sec
BAS Control Inputs		
Network Unit Enable	Disable	Disable, Enable
Network Mode Command	Cool	Cool, Ice
Network Cool Set Point	7°C (44.6°F)	See Dynamic Set Point Ranges
Network Ice Set Point	4.4°C (39.9°F)	-9.5 to 4.4 °C (14.9 to 39.9 °F)
Network Capacity Limit	100%	0 to 100%
Network Alarm Clear Command	Normal	Normal, Clear Alarm

Dynamic Set Point Ranges

The following settings have different ranges of adjustment based on other settings.

Table 40: Cool LWT 1 and Cool LWT2 Set Point Ranges

Available Mode Selection	Unit Vintage	Range
Without Glycol	E vintage	4.4 to 18.34°C (39.9 to 65°F)
With Glycol	E vintage	-9.5 to 18.34°C (14.9 to 65°F)

Table 41: Evaporator Water Freeze

Available Mode Selection	Range
Without Glycol	2.2 to 5.6°C (36 to 42.1°F)
With Glycol	-10.8 to 5.6°C (12.6 to 42.1°F)

Table 42: Low Ambient Lockout

Fan VFD	Range
Disable	0 to 15.6°C (32 to 60.1°F)
Enable	-23.3 to 15.6°C (-9.9 to 60.1°F)

Table 43: Low Evaporator Pressure

Available Mode Selection	Range
Hold - Without Glycol	669 to 793 KPA (97 to 115 PSI)
Hold - With Glycol	317 to 793 KPA (46 to 115 PSI)
Unhold - Without Glycol	669 to 793 KPA (97 to 115 PSI)
Unhold - With Glycol	317 to 793 KPA (46 to 115 PSI)

Table 44: Design Conditions

Description	Default	Range
Design Evaporator EWT	0°C (32°F)	-9.5°C to 28.34°C (14.9°F to 83°F)
Design Evaporator LWT	0°C (32°F)	-9.5°C to 18.34°C (14.9°F to 65°F)
Design Evaporator Water Flow	0 lph (0 gpm)	0 to 908399 lph (0 to 4000 gpm)
Design Evaporator Approach Circuit 1/2	0°C (0°F)	0°C to 10°C (0°F to 18°F)
Design Ambient Temperature	0°C (32°F)	-28.89°C to 51.67°C (-20°F to 125°F)
Design Condenser Approach Circuit 1/2	0°C (0°F)	0°C to 40°C (0°F to 72°F)
Design Full Load Efficiency	0%	0 to 100%
Design IPLV	0	0 to 100
Design Rated Capacity	0 tons	0 to 1000 tons

Table 45: Administration and Service Support

Description	Default	Range
Unit G.O. Number	"Enter Data"	Alphanumeric string of up to 16 characters
Unit Serial Number	"Enter Data"	Alphanumeric string of up to 20 characters
Next Maintenance Month	January	January through December
Next Maintenance Year	2009	2009 - 2100
Service Support Reference	999-999-9999	Any 10 digit phone number
Controller Time	From Controller Timeclock	00:00:00 to 23:59:59
Controller Date	From Controller Timeclock	1/1/2000 to 12/31/2050
UTC Difference	-60 minutes	-3276 to 32767 minutes
Daylight Savings Time Enable	Yes	No, Yes
Daylight Savings Time Start Month	March	January through December
Daylight Savings Time Start Week	2nd Week	1st through 5th Week
Daylight Savings Time End Month	November	January through December
Daylight Savings Time End Week	1st Week	1st through 5th Week
Operator Password Disable	Off	Off, On
Apply Changes	No	No, Yes
Active Alarm Clear	Off	Off, On
Alarm Log Clear	No	No, Yes
Power Restore Event Log - Day Selection	Current	Current, 2nd Day, 3rd Day, 4th Day, 5th Day, 6th Day, 7th Day
Display Units	English	English, Metric

Table 46: Unit Test Mode Set Points

Description	Default	Range
Test Unit Alarm Output	Off	Off, On
Test Evaporator Pump Output 1	Off	Off, On
Test Evaporator Pump Output 2	Off	Off, On

NOTE: Unit test mode set points can be changed only when the unit mode is in Test. When the unit mode is no longer Test, all unit test mode set points will be changed back to the 'off' values.

Table 47: Commnication Configuration

Description	Default	Range
Controller IP DHCP	On	Off, On
Controller IP Network Address	192.168.001.042	000.000.000.000 to 255.255.255.255
Controller IP Network Mask	255.255.255.000	000.000.000.000 to 255.255.255.255
Controller IP Network Gateway	192.168.001.001	000.000.000.000 to 255.255.255.255
Lon Module Maximum Send Time	0 seconds	0 to 6553.4 seconds
Lon Module Minimum Send Time	0 seconds	0 to 6553.4 seconds
Lon Module Receive Heartbeat	0 seconds	0 to 6553.4 seconds
BACnet Module Name		Alphanumeric string up to 15 characters long
BACnet Module Dev Instance	0	0 to 4194302
BACnet Module Unit Support	English	Metric, English
BACnet Module NC Dev 1	0	0 to 42949672
BACnet Module NC Dev 2	0	0 to 42949672
BACnet Module Reset Out of Service	Done	Done, False, True
BACnet IP Module UDP Port	0	0 to 65535
BACnet IP Module DHCP	Off	Off, On
BACnet IP Module Network Address		000.000.000.000 to 999.999.999.999
BACnet IP Module Network Mask		000.000.000.000 to 999.999.999.999
BACnet IP Module Network Gateway		000.000.000.000 to 999.999.999.999
BACnet MSTP Module Address	0	0 to 127
BACnet MSTP Module Baud Rate	38400	9600, 19200, 38400, 76800
BACnet MSTP Module Max Master	0	0 to 127
BACnet MSTP Module Max Info Frm	0	0 to 255
Modbus Module Address	1	1 to 247
Modbus Module Baud Rate	19200	4800, 9600, 19200, 38400
Modbus Module Parity	Even	Even, Odd, None
Modbus Module Two Stop Bits	No	No, Yes
Modbus Module Response Delay	0 milliseconds	0 to 30000 milliseconds
Modbus Module Comm LED Time Out	0 seconds	0 to 3600 seconds
AWM DHCP	Off	Off, On
AWM Network Address		000.000.000.000 to 999.999.999.999
AWM Network Mask		000.000.000.000 to 999.999.999.999
AWM Network Gateway		000.000.000.000 to 999.999.999.999

Circuit Level Set Points

The settings in this section all exist for each individual circuit.

Table 48: Set Points for Individual Circuits

Description	Default	Range
Mode/Enabling		
Circuit mode	Enable	Disable, Enable, Test
Compressor 1 Enable	Auto	Auto, Off
Compressor 2 Enable	Auto	Auto, Off
Compressor 3 Enable	Auto	Auto, Off
EXV Settings		
EXV control	Auto	Auto, manual
EXV position	See Special Setpoints	0% to 100%
Suction SH Target @50% (3)	4.44°C (8°F)	4.44 to 6.12 °C (8 to 11 °F)
Suction SH Target @100% (3)	5.56°C (10°F)	4.44 to 6.67 °C (8 to 12 °F)
Suction SH Target @33% (4)	See Special Setpoints	4.44 to 6.12 °C (8 to 11 °F)
Suction SH Target @66/100% (4)	5.56°C (10°F)	4.44 to 6.67 °C (8 to 12 °F)
Max Evap Pressure	1075.6 KPA(156 PSI)	979 to 1172 KPA (142 to 170 PSI)
Condenser Control		
Condenser Target 100%	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 67% (2)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 50% (1)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 50%, Unit 75% (1)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 50%, Unit 50% (1)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 50%, Unit 25% (1)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Condenser Target 33% (2)	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
VFD Max Speed	100%	90 to 110%
VFD Min Speed	25%	25 to 60%
Fan Stage Up Deadband 1	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Up Deadband 2	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Up Deadband 3	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Up Deadband 4	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Down Deadband 1	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Down Deadband 2	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Down Deadband 3	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Fan Stage Down Deadband 4	See Dynamic Set Point Ranges	See Dynamic Set Point Ranges
Sensor Offsets		
Evap Pressure Offset	0 KPA (0 PSI)	-100 to 100 KPA (-14.5 to 14.5 PSI)
Cond Pressure Offset	0 KPA (0 PSI)	-100 to 100 KPA (-14.5 to 14.5 PSI)
Suction Temp Offset	0°C (0°F)	-5.0 to 5.0 °C (-9.0 to 9.0 °F)
BAS Control Inputs		
Network Compressor 1 Enable	Enable	Enable, Disable
Network Compressor 2 Enable	Enable	Enable, Disable
Network Compressor 3 Enable	Enable	Enable, Disable

- NOTE:**
1. Condenser Target 50% will be available only when the unit has 4 compressors.
 2. Condenser Targets 33% and 67% will be available only when the unit has 6 compressors.
 3. Suction SH Targets 50% and 100% will be available only when the unit has 4 compressors.
 4. Suction SH Targets 33% and 66/100% will be available only when the unit has 6 compressors.

Dynamic Set Point Ranges and Defaults

Some settings have different ranges of adjustment based on other parameters and unit configuration. The condenser settings that follow are applicable to four configuration groups:

- 1 - Models 30 to 70
- 2 - Models 75 to 240 with no fan VFDs or one VFD per circuit
- 3 - Models from 75 to 161 with 2 fan VFDs per circuit
- 4 - Models 170 to 240 with 2 fan VFDs per circuit

Table 49: Configuration Group 1

Description	Default	Range
Condenser Target - 100% Circuit Capacity	37.78°C (100°F)	37.78 to 46.11°C (100 to 115°F)
Condenser Target - 67% Circuit Capacity	32.22°C (90°F)	32.22 to 46.11°C (90 to 115°F)
Condenser Target - 50% Circuit Capacity	32.22°C (90°F)	32.22 to 46.11°C (90 to 115°F)
Condenser Target - 33% Circuit Capacity	32.22°C (90°F)	32.22 to 40.56°C (90 to 105°F)
Fan Stage Up Deadband 1	11.11°C (20°F)	11.11 to 13.89°C (20 to 25°F)
Fan Stage Up Deadband 2	8.33°C (15°F)	8.33 to 11.11°C (15 to 20°F)
Fan Stage Up Deadband 3	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)
Fan Stage Up Deadband 4	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)
Fan Stage Down Deadband 4	5.56°C (10°F)	3.33 to 5.56°C (6 to 10°F)
Fan Stage Down Deadband 3	5.56°C (10°F)	3.33 to 5.56°C (6 to 10°F)
Fan Stage Down Deadband 2	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)
Fan Stage Down Deadband 1	11.11°C (20°F)	8.33 to 11.11°C (15 to 20°F)

Table 50: Configuration Group 2

Description	Default	Range
Condenser Target - 100% Circuit Capacity	37.78°C (100°F)	37.78 to 46.11°C (100 to 115°F)
Condenser Target - 67% Circuit Capacity	32.22°C (90°F)	32.22 to 43.33°C (90 to 110°F)
Condenser Target - 50% Circuit Capacity	29.44°C (85°F)	29.44 to 32.22°C (85 to 90°F)
Condenser Target - 33% Circuit Capacity	29.44°C (85°F)	29.44 to 40.56°C (85 to 105°F)
Fan Stage Up Deadband 1	11.11°C (20°F)	11.11 to 13.89°C (20 to 25°F)
Fan Stage Up Deadband 2	8.33°C (15°F)	8.33 to 11.11°C (15 to 20°F)
Fan Stage Up Deadband 3	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)
Fan Stage Up Deadband 4	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)
Fan Stage Down Deadband 4	5.56°C (10°F)	3.33 to 5.56°C (6 to 10°F)
Fan Stage Down Deadband 3	5.56°C (10°F)	3.33 to 5.56°C (6 to 10°F)
Fan Stage Down Deadband 2	8.33°C (15°F)	8.33 to 11.11°C (15 to 20°F)
Fan Stage Down Deadband 1	8.33°C (15°F)	8.33 to 11.11°C (15 to 20°F)

Table 51: Configuration Group 3

Description	Default	Range
Condenser Target - 100% Circuit Capacity	40.56°C (105°F)	40.56 to 46.11°C (105 to 115°F)
Condenser Target - 50% Circuit Capacity, 75% Unit Capacity	40.56°C (105°F)	37.78 to 43.33°C (100 to 110°F)
Condenser Target - 50% Circuit Capacity, 50% Unit Capacity	32.22°C (90°F)	31.11 to 36.67°C (88 to 98°F)
Condenser Target - 50% Circuit Capacity, 25% Unit Capacity	26.67°C (80°F)	23.89 to 29.44°C (75 to 85°F)
Fan Stage Up Deadband 1	5.56°C (10°F)	2.78 to 8.33°C (5 to 15°F)
Fan Stage Up Deadband 2	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 3	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 2	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 1	5.56°C (10°F)	5.56 to 8.33°C (10 to 15°F)

Table 52: Configuration Group 4

Description	Default	Range
Condenser Target - 100% Circuit Capacity	37.78°C(100 °F)	35 to 46.11°C (95 to 115°F)
Condenser Target - 67% Circuit Capacity	37.78°C(100 °F)	35 to 40.56°C (95 to 105°F)
Condenser Target - 33% Circuit Capacity	26.67°C (80°F)	23.89 to 29.44°C (75 to 85°F)
Fan Stage Up Deadband 1	5.56°C (10°F)	2.78 to 8.33°C (5 to 15°F)
Fan Stage Up Deadband 2	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Up Deadband 3	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 4	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 3	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 2	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)
Fan Stage Down Deadband 1	2.78°C (5°F)	2.78 to 5.56°C (5 to 10°F)

Special Set Point Operation

EXV settings are only visible if the unit is configured with electronic expansion valves. The EXV position set point is not changeable unless the unit switch is off.

EXV Position set point on each circuit follows the actual EXV position while EXV Control = Auto. When EXV Control = Manual, the position set point will be changeable.

Table 53: Suction Superheat Target 33%

Unit Model	Default
Models 75 to 180	4.44°C (8°F)
Models 190 to 240	5.56°C (10°F)

Security

All set points are protected using passwords. A four-digit password provides operator access to changeable parameters. Service level passwords are reserved for authorized service personnel. See Passwords on page 84 for various levels of access.

Entering Passwords

Passwords are entered on the first screen on the unit controller.

If the wrong password is entered, a message will temporarily appear stating this. If no valid password is active the active password level displays "none."

Editing Setpoints

After a valid password has been entered at the unit controller, set points may be changed. If the operator attempts to edit a set point for which the necessary password level is not active, no action will be taken.

Once a password has been entered, it remains valid for 10 minutes after the last key-press on the unit controller.

Figure 47: Unit Sequence of Operation - Cool Mode

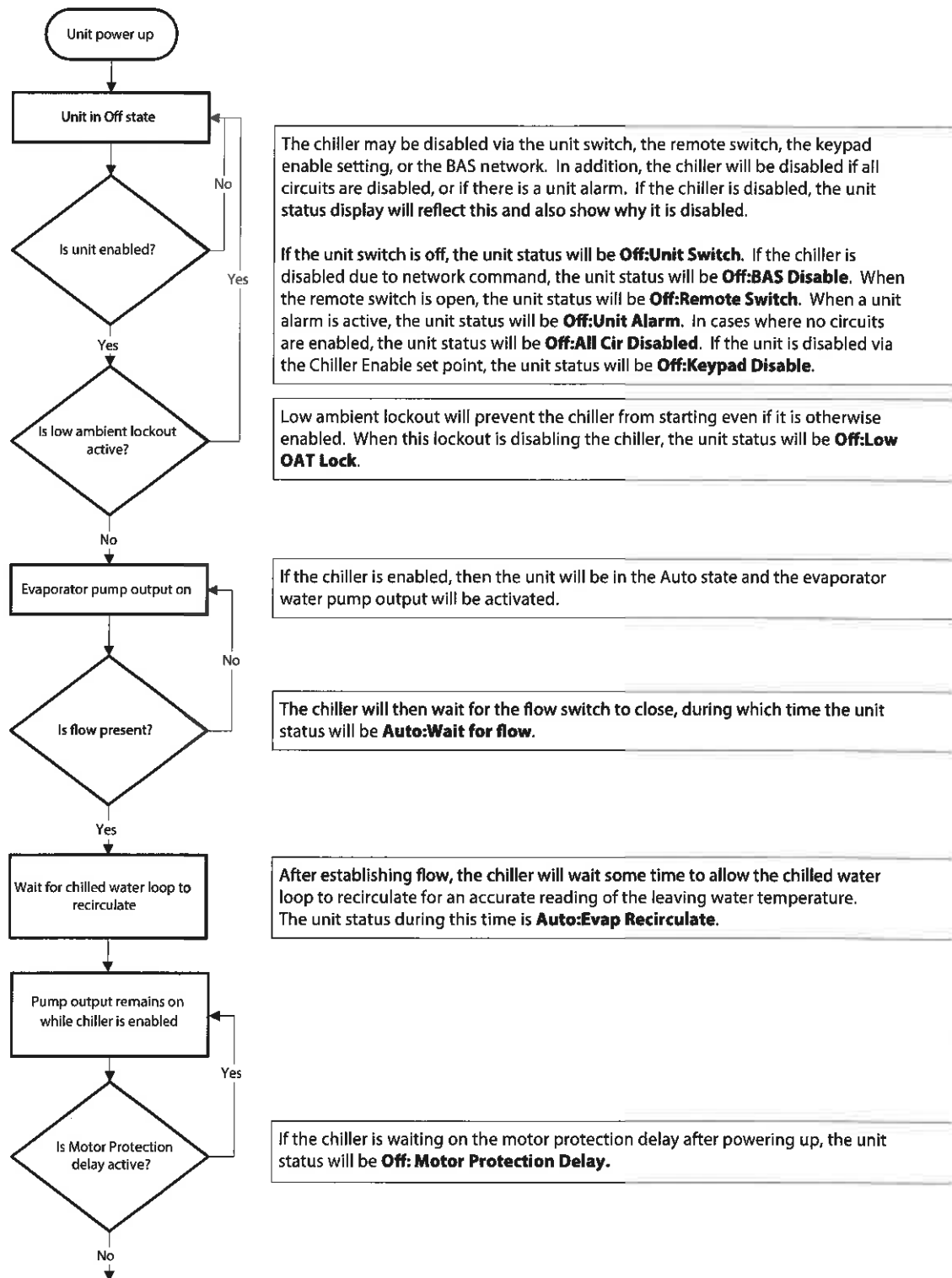


Figure 48: Unit Sequence of Operation - Cool Mode (continue)

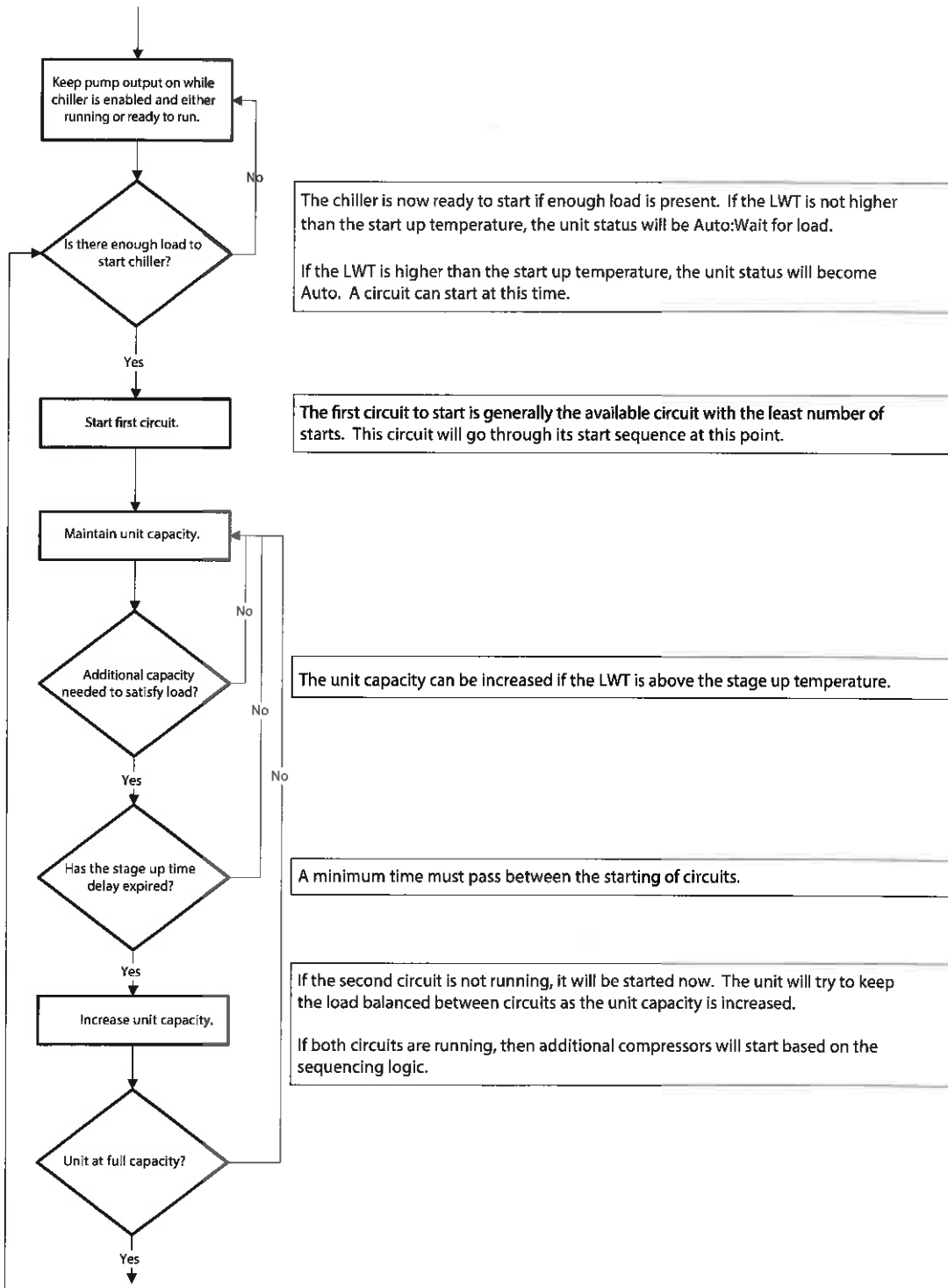


Figure 49: Unit Sequence of Operation - Cool Mode (continued)

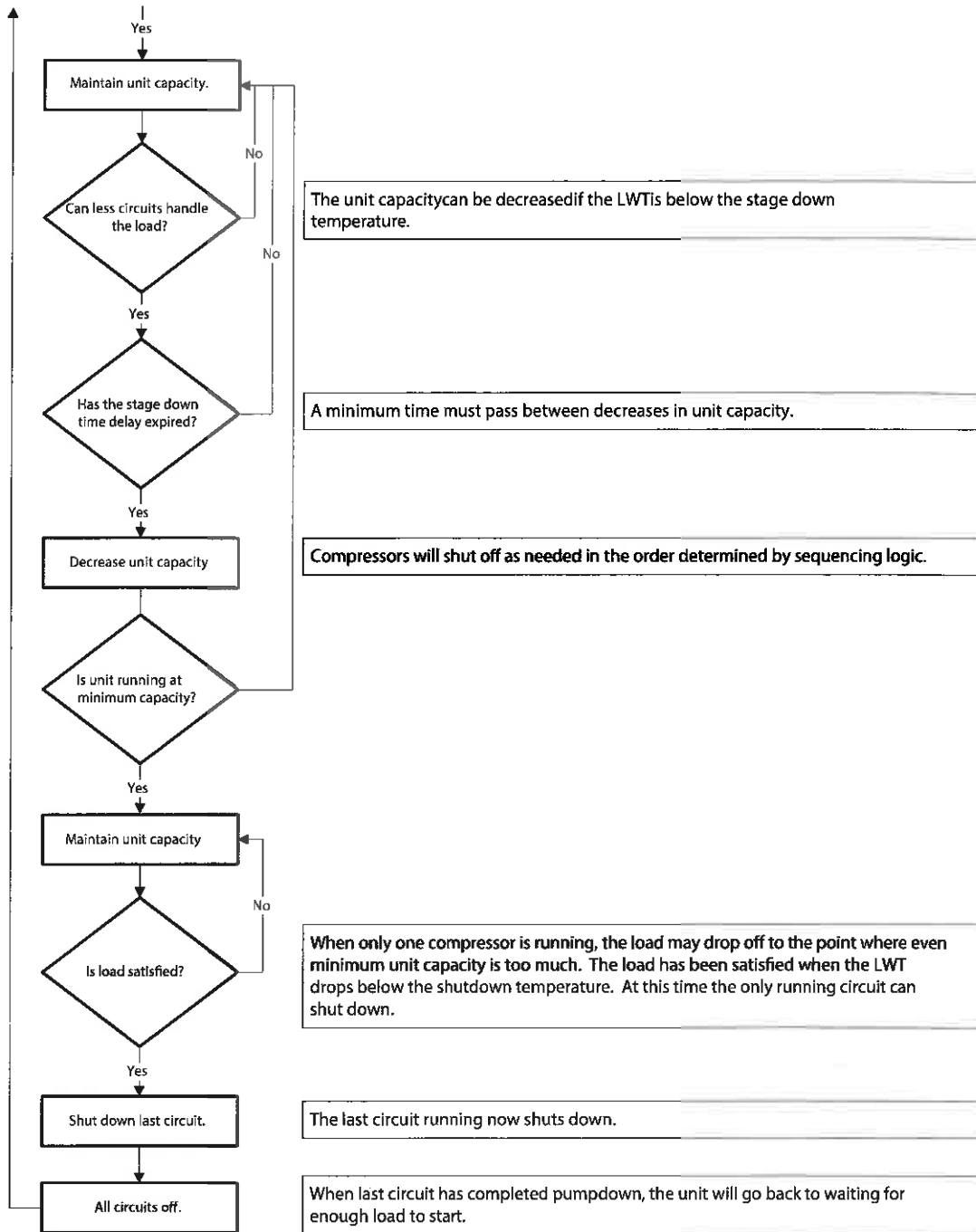


Figure 50: Unit Sequence of Operation - Ice Mode

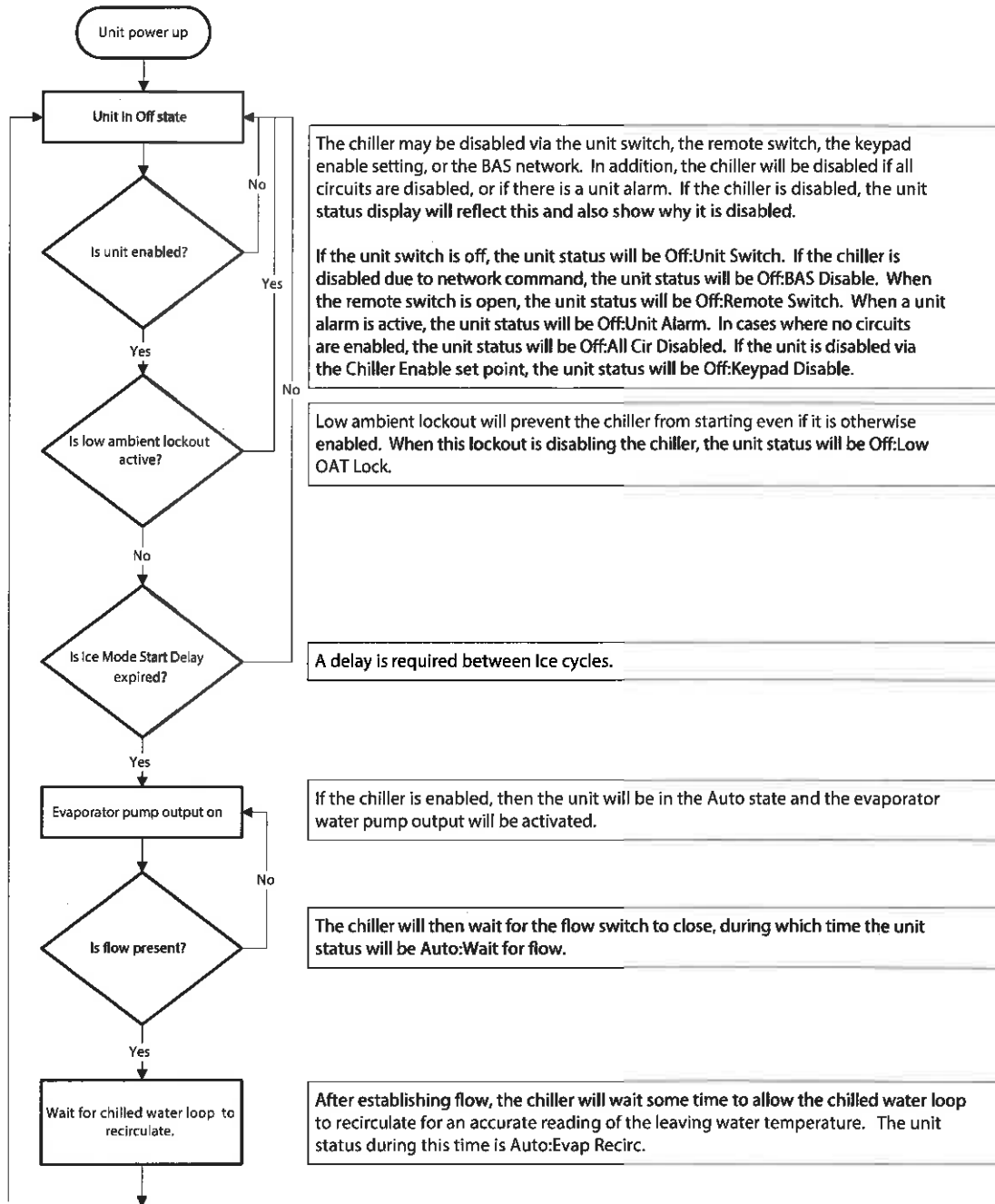


Figure 51: Unit Sequence of Operation - Ice Mode (continued)

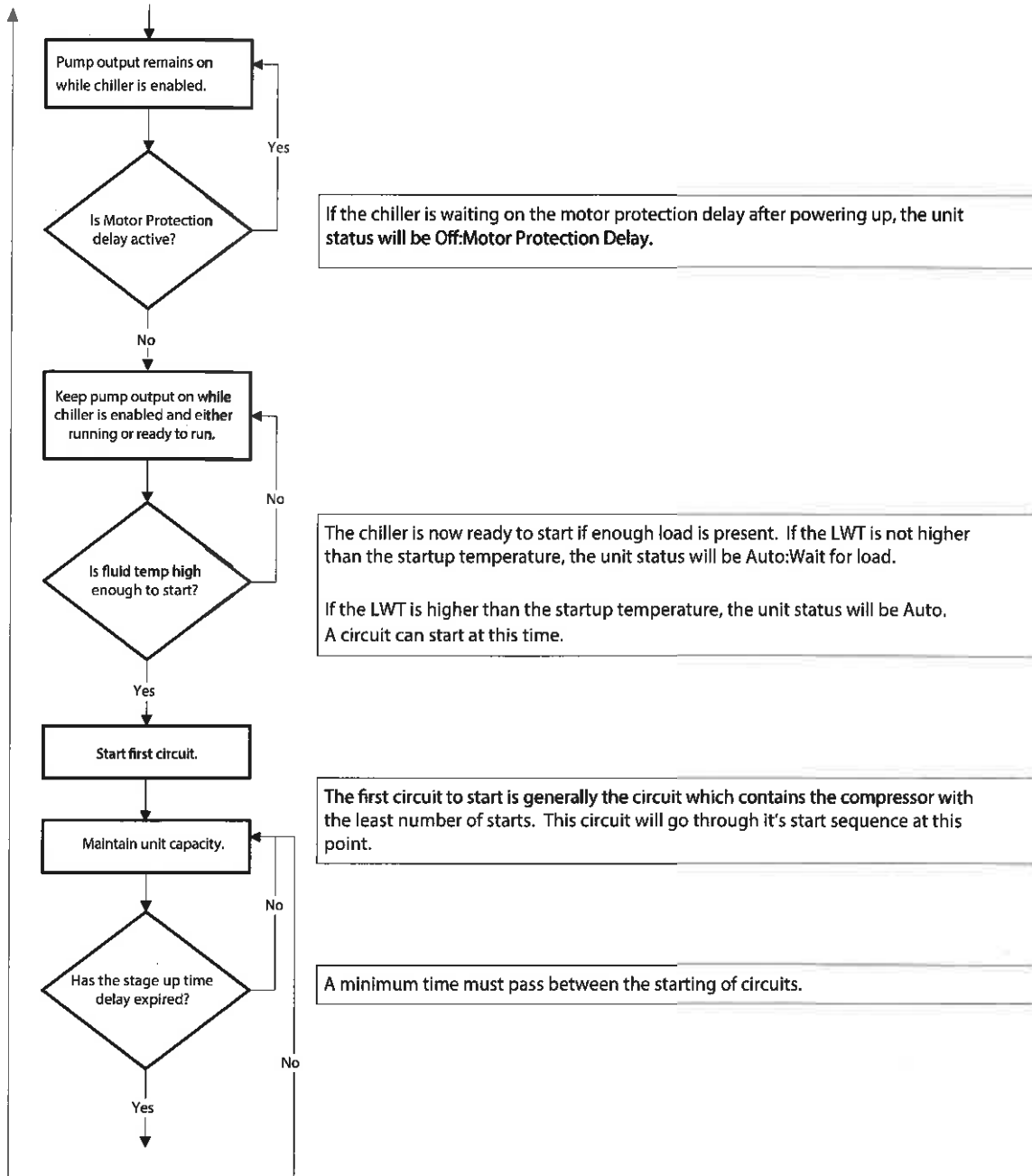


Figure 52: Unit Sequence of Operation - Ice Mode (continued)

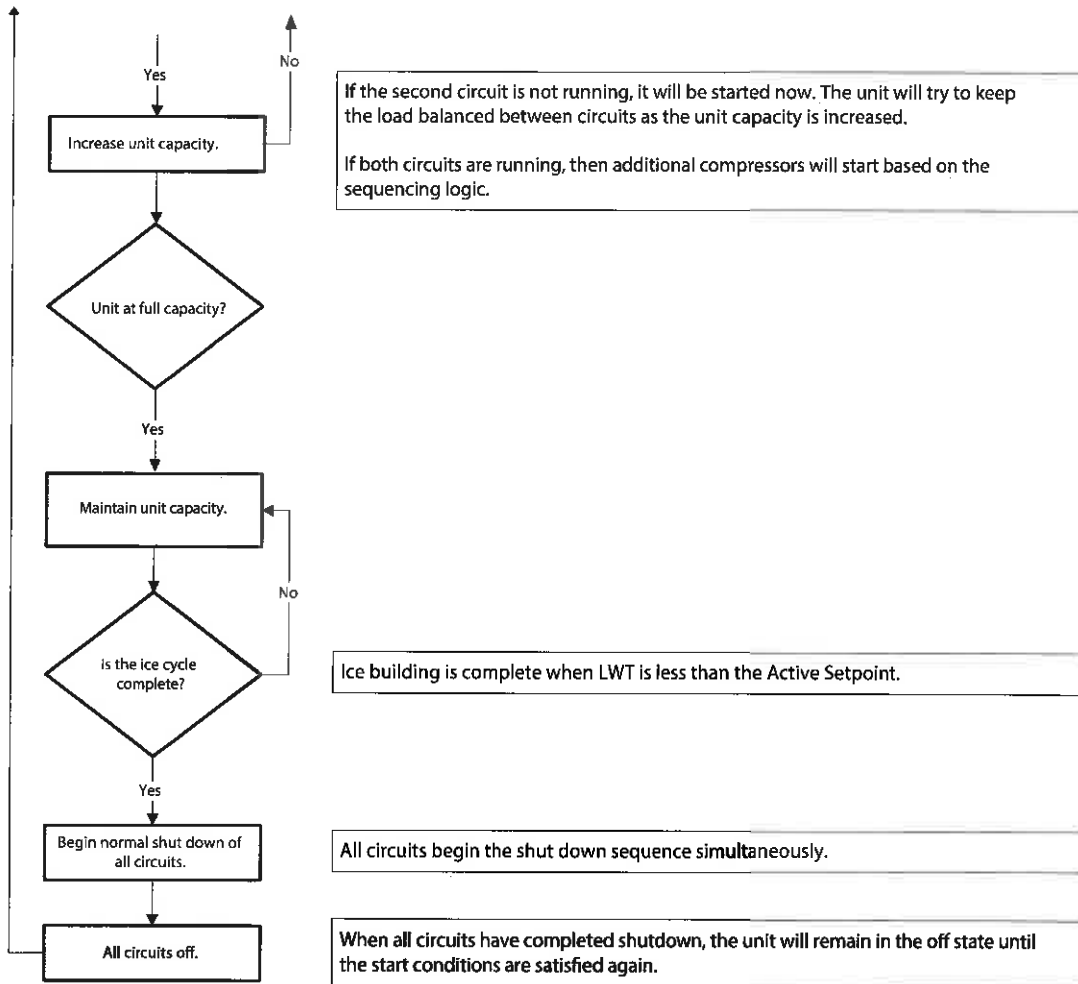
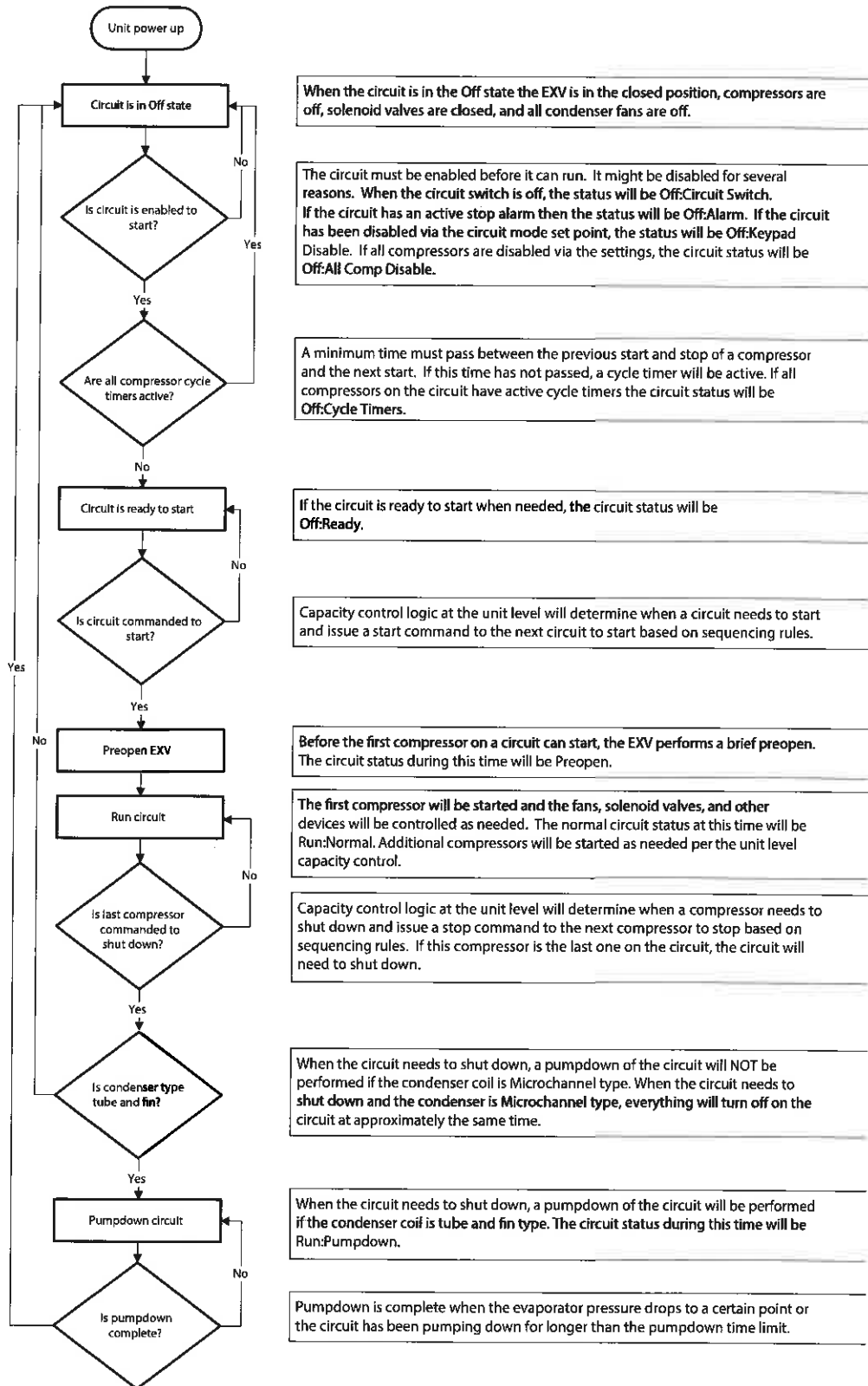


Figure 53: Circuit Sequence of Operation



The calculations in this section are used in unit level control logic or in control logic across all circuits.

Evaporator Delta T

The evaporator water delta T is calculated as entering water temperature minus leaving water temperature.

LWT Slope

LWT slope is calculated such that the slope represents the estimated change in LWT over a time frame of one minute.

Pulldown Rate

The slope value calculated above will be a negative value as the water temperature is dropping. A pulldown rate is calculated by inverting the slope value and limiting to a minimum value of 0°C/min.

LWT Error

LWT error is calculated as LWT – LWT target.

Unit Capacity

For applying unit capacity limits, an estimate of total unit capacity is needed. Unit capacity will be based on the estimated circuit capacities.

The unit capacity is the number of compressors running (on circuits that are not pumping down) divided by the number of compressors on the unit.

Control Band

The Control Band defines the band in which unit capacity will not be increased or decreased.

Constant Evaporator Flow

If Variable Evaporator Flow set point is set to No, the control band is calculated as follows:

- Four compressor units: Control Band = Full Capacity Evap Delta T Set Point * 0.35
- Six compressor units: Control Band = Full Capacity Evap Delta T Set Point * 0.25

Variable Evaporator Flow

When the unit set point for Variable Evaporator Flow is set to Yes, the control band increases as capacity decreases to account for the decrease in flow. It is assumed that the flow will vary to maintain the full capacity evaporator temperature delta at part load conditions. The control band is limited at each capacity step to a maximum value that corresponds to the minimum flow for that capacity step.

Since evaporator flow is represented by the set point Full Capacity Evaporator Delta T, the calculations of the control band for variable flow applications are explained in terms of delta T also. The term 'Effective Full Capacity Delta T' means the approximate temperature delta that would be observed with the unit running at full capacity for the given flow. 'Nominal flow'

means the flow that is needed for a 5.56°C (10°F) delta T at full unit capacity.

Table 54: Minimum Flows and Corresponding Maximum Effective Full Capacity Delta T with Variable Flow

Number of Compressors	Unit Capacity	Minimum Flow (nominal %)	Max Effective Full Capacity DT
4	100%	62.5%	8.9 °C (16 °F)
	75%	55%	10.1 °C (18.2 °F)
	50%	47.5%	11.7 °C (21.1 °F)
	25%	40%	13.9 °C (25 °F)
6	100%	62.5%	8.9 °C (16 °F)
	83.3%	58%	9.59 °C (17.3 °F)
	66.7%	53.5%	10.39 °C (18.7 °F)
	50%	49%	11.35 °C (20.4 °F)
	33.3%	44.5%	12.49 °C (22.5 °F)
	16.7%	40%	13.9 °C (25 °F)

For variable evaporator flow, the Control Band is calculated as follows:

1. Effective Full Capacity Delta T = (Full Capacity Evap Delta T * 100) / Unit Capacity
2. If above value is more than the Max Effective Full Capacity dT listed in the table above for the corresponding unit capacity, it is set equal to the value in the table.
3. Effective Full Capacity Delta T with the limit applied is then multiplied by 0.35 for units with four compressors and by 0.25 for units with six compressors. This gives the total control band for the unit configuration and actual unit capacity.

Staging Temperatures

If the unit is configured for use without glycol:

When the LWT target is more than half the Control Band above 3.9°C (39.0°F)

- Stage Up Temperature = LWT target + (Control Band/2)
- Stage Down Temperature = LWT target – (Control Band/2)

If the LWT target is less than half the Control Band above 3.9°C (39.0°F)

- Stage Down Temperature = LWT target – (LWT target - 3.9°C)
- Stage Up temperature = LWT target + Control Band – (LWT target – 3.9°C)

If the unit is configured for use with glycol, the compressor staging temperatures are calculated as shown below:

- Stage Up Temperature = LWT target + (Control Band/2)
- Stage Down Temperature = LWT target – (Control Band/2)

The Start up and Shutdown temperatures are referenced from

the Control Band:

- Start Up Temperature = Stage Up Temperature + Start Up Delta set point
- Shutdown Temperature = Stage Down Temperature – Shutdown Delta set point

Unit Enable

Enabling and disabling the chiller is accomplished using set points and inputs to the chiller. The unit switch, remote switch input, and Unit Enable Set Point all are required to be 'on' for the unit to be enabled when the control source is set to 'local.' The same is true if the control source is set to 'network,' with the additional requirement that the building automation system (BAS) Enable set point must be 'on'. The BAS should enable the chiller only when there is a demand for cooling.

Unit is enabled according to the following table:

Unit Switch	Control Source Set Point	Remote Switch Input	Unit Enable Set Point	BAS Enable Set Point	Unit Enable
Off	Local	On	On	On	Off
Off	Local	Off	Off	On	Off
Off	Local	Off	On	Off	Off
On	Local	On	On	On	On
On	Local	On	On	Off	Off
On	Local	Off	On	On	Off
On	Network	On	On	On	On

Unit Mode Selection

The operating mode of the unit is determined by setpoints and inputs to the chiller. The Available Modes Set Point determines what modes of operation can be used. This set point also determines whether the unit is configured for glycol use. The Control Source Set Point determines where a command to change modes will come from. A digital input switches between cool mode and ice mode if they are available and the control source is set to 'local.' The BAS mode request switches between cool mode and ice mode if they are both available and the control source is set to 'network.'

The Available Modes Set Point should only be changeable when the unit switch is off. This is to avoid changing modes of operation inadvertently while the chiller is running.

Table 55: Unit Mode Settings

Control Source Set Point	Mode Input	BAS Request	Available Modes Set Point	Unit Mode
Local	Off	Off	Cool	Cool
Local	Off	Off	Cool w/ Glycol	Cool
Local	Off	Off	Cool/Ice w/ Glycol	Cool
Local	On	Off	Cool/Ice w/ Glycol	Ice
Network	Off	Cool	Cool/Ice w/ Glycol	Cool
Network	Off	Ice	Cool/Ice w/ Glycol	Ice
Network	Off	Off	Ice w/Glycol	Ice
Network	Off	Off	Test	Test

Glycol Configuration

If the Available Modes Set Point is set to an option 'w/Glycol,' then glycol operation should be enabled for the unit. Glycol operation should only be disabled when the Available Modes Set Point is set to 'Cool.'

Unit States

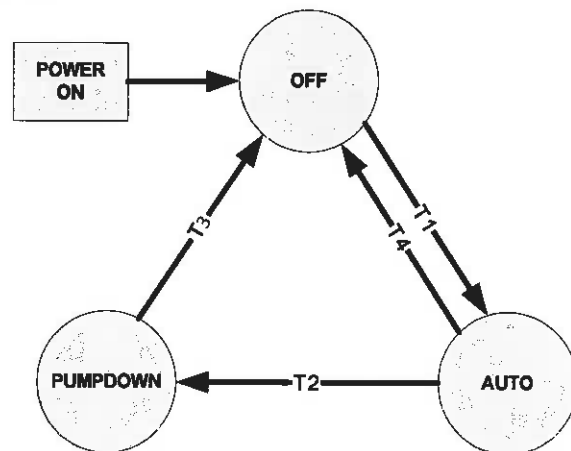
The unit will always be in one of three states:

Off – Unit is not enabled to run

Auto – Unit is enabled to run

Pumpdown – Unit is doing a normal shutdown (tube and fin condenser coils only). If a unit has microchannel coils, the individual refrigerant circuits will never do a pumpdown. So if the conditions for the Auto to Pumpdown transition occur, the unit state will transition from Auto to Pumpdown and then immediately to Off.

Transitions between these states are shown in the following diagram.



T1 - Off to Auto

All of the following are required:

- Unit Enable = On
- No Unit Alarm active
- A circuit is enabled to start
- If Unit Mode = Ice then Ice Delay not active
- Low Ambient Lockout is not active
- Unit configuration settings are valid

T2 - Auto to Pumpdown

Any of the following are required:

- Unit Enable = Off and Unit Switch is closed
- Unit Mode = Ice AND LWT target is reached
- Unit Pumpdown Alarm active
- Low Ambient Lockout is active

T3 - Pumpdown to Off

Any of the following are required:

- Unit rapid stop alarm active
- All circuits complete pumpdown
- Unit Switch open

T4 - Auto to Off

Any of the following are required:

- Unit rapid stop alarm active
- No circuit enabled and no compressors running
- Unit Switch open

Motor Protection Module Power Up Start Delay

After powering up the unit, the motor protection modules may not be engaged for a period of time. Therefore, after the control is powered up, no compressor can start for 150 seconds. In addition, the motor protect inputs are ignored during this time so as to avoid tripping a false alarm.

Ice Mode Start Delay

An adjustable start to start ice delay timer will limit the frequency with which the chiller may start in Ice mode. The timer starts when the first compressor starts while the unit is in ice mode. While this timer is active, the chiller cannot restart in Ice mode. The time delay is adjustable via the Ice Time Delay set point.

The ice delay timer may be manually cleared to force a restart in ice mode. A set point specifically for clearing the ice mode delay is available.

Low Ambient Lockout

The operation of the chiller in response to OAT dropping below

the Low OAT Lockout set point is configurable if the chiller has condenser fan VFD's. In that case, there are three options:

- Lockout and Stop – chiller will shut down and lockout
- Lockout only – chiller does not shut down running circuits, will lock out circuits that are off
- Disabled – chiller does not shut down or lock out

For chillers without condenser fan VFD's, there is no configuration and the chiller will always operate according to the first option shown above. Descriptions of the operation for each option are in the following sections.

Lockout and Stop Operation

When the chiller is configured for lockout and stop, it will operate as described in this section.

If the OAT drops below the low ambient lockout set point and the OAT sensor fault is not active, low ambient lockout is triggered. The unit should go into the pumpdown state if any circuits are running. If no circuits are running the unit should go into the off state. This condition should clear when OAT rises to the lockout set point plus 2.5°C (4.5°F).

Lockout Only Operation

When the chiller is configured for lockout only, it will operate as described in this section.

If OAT drops below the low ambient lockout set point and any circuits are running, then those circuits will be allowed to remain running and the unit will not enter the low ambient lockout condition. Circuits that are not running will enter a circuit level lockout condition when OAT drops below the lockout set point. This condition will clear at the circuit level when OAT rises to the lockout set point plus 2.5°C (4.5°F).

If the OAT is below the low ambient lockout set point, the OAT sensor fault is not active, and neither circuit is running, low ambient lockout is triggered. The unit will go directly into the off state and will remain in the off state until the lockout has cleared. This condition will clear when OAT rises to the lockout set point plus 2.5°C (4.5°F).

Disabled Operation

When the chiller is configured to disable low ambient lockout, it will operate as described in this section.

Regardless of the OAT, the unit will not enter the low ambient lockout condition or shut down any running circuits.

BAS Annunciation

Low Ambient Lockout is not an alarm, but it can be annunciated to the BAS as if it is one. When the Low OAT Lockout BAS Alert set point is set to On and the low ambient lockout is active, the following will occur:

- Chiller alarm status parameter will show alarm state
- Active Problem Alarm Code will be set to 16642 (assuming no higher code is active)
- Active Problem Alarm Index will be set to 65 (assuming no higher index is active)

Unit Status

The displayed unit status should be determined by the conditions in the following table:

#	Status	Conditions
1	Auto	Unit State = Auto
2	Auto: Sound Reduction	Unit State = Auto and Sound Reduction is active
3	Off: Motor Prot Delay	Unit State = Auto and MP start up delay is active
4	Off: Ice Mode Timer	Unit State = Off, Unit Mode = Ice, and Ice Delay = Active
5	Off: Low OAT Lockout	Unit State = Off and Low OAT Lockout is active
6	Off: All Cir Disabled	Unit State = Off and both circuits unavailable
7	Off: Unit Alarm	Unit State = Off and Unit Alarm active
8	Off: Keypad Disable	Unit State = Off and Unit Enable Set Point = Disable
9	Off: Remote Switch	Unit State = Off and Remote Switch is open
10	Off: BAS Disable	Unit State = Off, Control Source = Network, and BAS Enable = false
11	Off: Unit Switch	Unit State = Off and Unit Switch = Disable
12	Off: Test Mode	Unit State = Off and Unit Mode = Test
13	Auto: Wait for load	Unit State = Auto, no circuits running, and LWT is less than the active set point + startup delta
14	Auto: Evap Recirculate	Unit State = Auto and Evaporator State = Start
15	Auto: Wait for flow	Unit State = Auto, Evaporator State = Start, and Flow Switch is open
16	Auto: Pumpdown	Unit State = Pumpdown
17	Auto: Max Pulldown Rate	Unit State = Auto, max pulldown rate has been met or exceeded
18	Auto: Unit Cap Limit	Unit State = Auto, unit capacity limit has been met or exceeded
19	Auto: High Amb Limit	Unit State = Auto and high ambient capacity limit is active
20	Auto:Rapid Restore	Unit State = Auto and unit is performing Rapid Restore operation
21	Off:Cond Type Not Set	Condenser type setting is set to 'Not Set'
22	Off:ExVlv Type Not Set	Expansion valve type setting is set to 'Not Set'
23	Off:Invalid Config	Unit model selected not valid
24	Cfg Chg, Rst Ctr	A configuration change requiring a reboot occurred but controller has not been rebooted yet.

Evaporator Pump Control

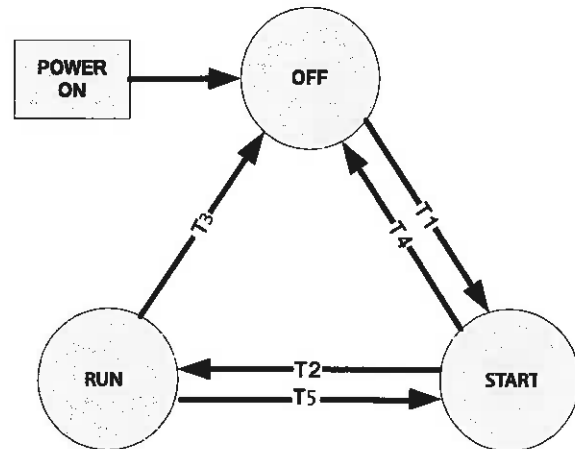
For control of the evaporator pumps, three evaporator pump control states should be used:

Off - No pump on.

Start - Pump is on, water loop is being recirculated.

Run - Pump is on, water loop has been recirculated and circuits can start if needed.

Transitions between these states are shown in the following diagram.



T1 - Off to Start

Requires any of the following

- Unit state = Auto
- Freeze protection started

T2 - Start to Run

Requires the following

- Flow ok for time longer than evaporator recirculate time set point

T3 - Run to Off

Requires all of the following

- Unit state is Off
- Freeze protection not active

T4 - Start to Off

Requires all of the following

- Unit state is Off
- Freeze protection not active

T5 - Run to Start

Flow switch input is low for longer than the flow proof set point.

Freeze Protection

To protect the evaporator from freezing, the evaporator pump will start if all of the following are true:

- LWT equal to or less than the Evap Freeze set point for at least three seconds
- LWT sensor fault isn't active
- manual reset flow loss alarm is not active

Freeze protection will end when any of the following are true:

- [LWT is at least 1.11°C (2°F) above the Evap Freeze set point OR LWT sensor fault is active] and pump has been in run state for at least 15 minutes
- manual reset flow loss alarm is active

Pump Selection

The pump output used will be determined by the Evap Pump Control set point. This setting allows the following configurations:

- #1 only – Pump 1 will always be used
- #2 only – Pump 2 will always be used
- Auto – The primary pump is the one with the least run hours, the other is used as a backup
- #1 Primary – Pump 1 is used normally, with pump 2 as a backup
- #2 Primary – Pump 2 is used normally, with pump 1 as a backup

Primary/Standby Pump Staging

The pump designated as primary will start first. If the evaporator state is start for a time greater than the recirculate timeout set point and there is no flow, then the primary pump will shut off and the standby pump will start. When the evaporator is in the run state, if flow is lost for more than half of the flow proof set point value, the primary pump will shut off and the standby pump will start. Once the standby pump is started, the flow loss alarm logic will apply if flow cannot be established in the evaporator start state, or if flow is lost in the evaporator run state.

Auto Control

If auto pump control is selected, the primary/standby logic above is still used. When the evaporator is not in the run state, the run hours of the pumps will be compared. The pump with the least hours will be designated as the primary at this time.

LWT Target

The LWT Target varies based on settings and inputs.

The base LWT Target is selected as follows:

Control Source Set Point	Mode Input	BAS Request	Available Modes Set Point	Base LWT Target
Local	OFF	-	COOL	Cool Set Point 1
Local	ON	-	COOL	Cool Set Point 2
Network	-	-	COOL	BAS Cool Set Point
Local	OFF	-	COOL w/ Glycol	Cool Set Point 1
Local	ON	-	COOL w/ Glycol	Cool Set Point 2
Network	-	-	COOL w/ Glycol	BAS Cool Set Point
Local	OFF	-	COOL/ICE w/Glycol	Cool Set Point 1
Local	ON	-	COOL/ICE w/Glycol	Ice Set Point
Network	-	COOL	COOL/ICE w/Glycol	BAS Cool Set Point
Network	-	ICE	COOL/ICE w/Glycol	BAS Ice Set Point
Local	-	-	ICE w/ Glycol	Ice Set Point
Network	-	-	ICE w/ Glycol	BAS Ice Set Point

Leaving Water Temperature (LWT) Reset

The base LWT target may be reset if the unit is in Cool mode and LWT reset is enabled via the set point.

The reset amount is adjusted based on the 4 to 20 mA reset input. Reset is 0° if the reset signal is less than or equal to 4 mA. Reset is 5.56°C (10.0°F) if the reset signal equals or exceeds 20 mA. The amount of reset will vary linearly between these extremes if the reset signal is between 4 mA and 20 mA.

When the reset amount increases, the Active LWT Target is changed at a rate of 0.1°C every 10 seconds. When the active reset decreases, the Active LWT Target is changed all at once.

After the reset is applied, the LWT target can never exceed a value of 18.33°C (65°F).

Unit Capacity Control

Unit capacity control will be performed as described in this section. All unit capacity limits described in following sections must be applied as described.

Compressor Staging in Cool Mode

The first compressor on the unit should be started when evaporator LWT is higher than the Startup Temperature.

Additional compressors can be started when Evaporator LWT is higher than the Stage Up Temperature and the Stage Up Delay is not active.

When multiple compressors are running, one should shut down if evaporator LWT is lower than the Stage Down Temperature and the Stage Down Delay is not active.

All running compressors should shut down when the evaporator LWT is lower than the Shut Down Temperature.

Stage Up Delay

A minimum amount of time, defined by the Stage Up Delay set point, should pass between increases in the capacity stage. This delay should only apply when at least one compressor is running. If the first compressor starts and quickly shuts off for some reason, another compressor may start without this minimum time passing.

Stage Down Delay

A minimum amount of time, defined by the Stage Down Delay set point, should pass between decreases in the capacity stage. This delay should not apply when the LWT drops below the Shut Down Temperature (unit should immediately shut down).

Compressor Staging in Ice Mode

The first compressor on the unit should be started when evaporator LWT is higher than the Startup Temperature.

All compressors should be operating except during startup or shut down. Additional compressors should be started as quickly as possible with respect to the Stage Up Delay.

The unit should shut down when evaporator LWT is less than the LWT target.

Stage Up Delay

A fixed stage up delay of one minute between compressor starts should be used in this mode.

Staging Sequence

This section defines which compressor is the next one to start or stop. In general, compressors with fewer starts will normally start first, and compressors with more run hours will normally stop first.

If possible circuits will be balanced in stage. If a circuit is unavailable for any reason, the other circuit shall be allowed to stage all compressors on. When staging down, one

compressor on each circuit shall be left on until each circuit has only one compressor running.

Next To Start

If both circuits have an equal number of compressors running or a circuit has no compressors available to start:

- the available compressor with the least starts will be next to start
- if starts are equal, the one with the least run hours will be next to start
- if run hours are equal, the lowest numbered one will be next to start

If the circuits have an unequal number of compressors running, the next compressor to start will be on the circuit with the least compressors running if it has at least one compressor available to start. Within that circuit:

- the available compressor with the least starts will be next to start
- if starts are equal, the one with the least run hours will be next to start
- if run hours are equal, the lowest numbered one will be next to start

Next to Stop

If both circuits have an equal number of compressors running:

- the running compressor with the most run hours will be next to stop
- if run hours are equal, the one with the least starts will be next to stop
- if starts are equal, the lowest numbered one will be next to stop

If the circuits have an unequal number of compressors running, the next compressor to stop will be on the circuit with the most compressors running. Within that circuit:

- the running compressor with the most run hours will be next to stop
- if run hours are equal, the one with the least starts will be next to stop
- if starts are equal, the lowest numbered one will be next to stop

Unit Capacity Overrides

Unit capacity limits can be used to limit total unit capacity in Cool or Cool with Glycol modes only. Multiple limits may be active at any time, and the lowest limit is always used in the unit capacity control.

Demand Limit

The maximum unit capacity can be limited by a 4 to 20 mA signal on the Demand Limit analog input. This function is only enabled if the Demand Limit set point is set to ON. The maximum unit capacity stage is determined as shown in the following tables:

Table 56: Stage Limits - Four Compressors

Demand Limit Signal (%)	Demand Limit Range (mA)	Stage
Limit ≥ 75%	Limit ≥ 16 mA	1
75% > Limit ≥ 50%	16 mA > Limit ≥ 12 mA	2
50% > Limit ≥ 25%	12 mA > Limit ≥ 8 mA	3
25% > Limit	8 mA > Limit	4

Table 57: Stage Limits - Six Compressors

Demand Limit Signal (%)	Demand Limit Range (mA)	Stage
Limit ≥ 83.3%	Limit ≥ 17.3 mA	1
83.3% > Limit ≥ 66.7%	17.3 mA > Limit ≥ 14.7 mA	2
66.7% > Limit ≥ 50%	14.7 mA > Limit ≥ 12 mA	3
50% > Limit ≥ 33.3%	12 mA > Limit ≥ 9.3 mA	4
33.3% > Limit ≥ 16.7%	9.3 mA > Limit ≥ 6.7 mA	5
16.7% > Limit	6.7 mA > Limit	6

Network Limit

The maximum unit capacity can be limited by a network signal. This function is only enabled if the control source is set to network. The maximum unit capacity stage is based on the network limit value received from the BAS and is determined as shown in the following tables:

Table 58: Stage Limits - Four Compressors

Network Limit	Stage
Limit ≥ 100%	4
100% > Limit ≥ 75%	3
75% > Limit ≥ 50%	2
50% > Limit	1

Table 59: Stage Limits - Six Compressors

Network Limit	Stage
Limit ≥ 100%	6
100% > Limit ≥ 83.3%	5
83.3% > Limit ≥ 66.7%	4
66.7% > Limit ≥ 50%	3
50% > Limit ≥ 33.3%	2
33.3% > Limit	1

Maximum LWT Pulldown Rate

The maximum drop rate for the leaving water temperature shall be limited by the Maximum Pulldown Rate set point only when the unit mode is Cool or Cool with Glycol.

If the rate exceeds the set point, no more compressors can be started until the pulldown rate is less than the set point. Running compressors will not be stopped as a result of exceeding the maximum pulldown rate.

High Ambient Limit

On units configured with single point power connections, the maximum load amps could be exceeded at high ambient temperatures. If the power connection is single point, and the outdoor air temperature OAT is greater than 46.6°C (115.9°F), the high ambient limit becomes active. This limit will be removed when the OAT drops back down to 45.56°C (114°F). The max operating ambient temperature is 51.6°C (125°F).

When the limit is active, the unit is allowed to run all but one compressor. So it will inhibit the unit from loading if all but one compressor is on, and it will shut down a compressor if all compressors are running.

RapidRestore® Option

RapidRestore® is an option that can be added to Trailblazer™ chillers. The general purpose of the option is to allow the capability to restart more quickly and to load faster than normal operation.

Enabling

The RapidRestore® option shall be enabled via the RapidRestore® set point and requires the optional module. Doing so will require the following to be true:

- RapidRestore® module is present at address 22
- DI1 on the RapidRestore® module has a signal

If the DI1 input loses the signal or the RapidRestore® module is no longer communicating, then the option will be disabled in the chiller.

Operation Following Power Cycle

The chiller will enter RapidRestore® upon powering up when the following conditions are met:

- RapidRestore® is enabled
- Power failure lasts less than the value of the Max Power Failure Time set point
- Power failure lasts at least one second (shorter power loss may result in unpredictable operation)
- Unit is enabled

When RapidRestore® is triggered, the time value used for the evaporator recirculation time will be limited to 110 seconds or less. The evaporator recirculation time set point will not be changed. Only the value used in the evaporator state logic will be limited, and only if the set point exceeds the 110 second limit.

This action will ensure that the chiller is ready to start after the motor protection module delay has expired.

Time to Start

The compressor manufacturer requires a minimum two minute delay after power on until a compressor should be started, which is to ensure proper operation of the motor protection modules. Unit controller boot time is about 10 seconds, so a delay of 110 seconds will start upon completing boot up. After this delay, the two minute manufacturer requirement will be satisfied.

After the 110 second delay, the first circuit to start will enter the preopen state, which takes five seconds. The end result is that the first compressor should start approximately 125 seconds after power is restored to the chiller.

Current software has a delay of 150 seconds after bootup is complete before the first circuit can start. The software will be changed to use the 110 second delay discussed above only when the chiller is performing the RapidRestore operation.

Fast Loading

Fast loading will be performed when the following conditions are met after the unit power up:

- Chiller enters RapidRestore® operation
- Current LWT > Start Up Temperature

For reference, Start Up Temperature is Stage Up Temperature + Start Up Delta T. Stage Up Temperature is calculated based on the Full Capacity Evaporator Delta T set point and the number of compressors on the chiller.

Fast loading should end if any of the following conditions occur:

- LWT < Stage Up Temperature
- Unit capacity = 100%
- All circuits become disabled for any reason
- Unit becomes disabled for any reason
- 10 minutes have passed since unit powered up

When fast loading ends, the RapidRestore® operation is considered complete.

Capacity Changes

Normally the delay between compressors staging on is determined by the Stage Up Delay setting. That setting defaults to 240 seconds and has a range of 120 to 480 seconds. During fast loading, a delay of 60 seconds between compressor starts within a circuit should be used. In addition, a delay of 30 seconds between compressor starts on different circuits should be used.

This change during RapidRestore® operation will allow for a faster time to full capacity while maintaining stable operation within each circuit. Assuming both circuits are able to run, the effective unit stage up delay will be 30 to 35 seconds, so it will load about four times faster during RapidRestore® than the fastest it possibly can during normal operation.

Max Pulldown Rate

Max pulldown rate will be ignored during fast loading so the chiller can reach full capacity as soon as possible.

Backup Chiller Operation

If DI2 on the RapidRestore® module has a signal and the unit has RapidRestore® enabled, then the chiller is considered a 'backup chiller'. When a 'backup chiller' is enabled, it will use an evaporator recirculation time of 13 seconds regardless of what the evaporator recirculation time set point is. Then, fast loading will be used as outlined previously in the fast loading section.

This backup chiller sequence is safe for the unit if it has had power applied for the minimum time stated in the operation manual. Since this sequence does not have to wait on the compressor motor protection module delay, the unit can achieve full capacity even faster than during a power loss scenario.

Compressor Starts Per Hour

Since the compressor cycle timers are not maintained through power cycling, a limitation on the number of starts per hour will be added. Each compressor will be allowed six starts in an hour.

If a compressor start is being delayed due to this limitation, it can be cleared by using the existing Clear Cycle Timers setting.

The following table shows the approximate best case scenario for start time and loading time with the RapidRestore® operation.

Table 60: RapidRestore® Mode Response Times

# of compressors		Maximum Restart Time	Time to Fully Loaded
Power lost and restored	4	125 sec.	220 sec.
	6		280 sec.
Backup chiller with constant power	4	20 sec.	115 sec.
	6		175 sec.

Sound Reduction

A special mode of operation is available for E vintage models with two fan VFD's per circuit, which reduces sound levels by limiting condenser fan speeds. This mode can be enabled and disabled via the Sound Reduction Enable setting.

Scheduling

When enabled, sound reduction will become active based on a daily schedule. This schedule is configurable and allows a start time and duration to be selected for each day of the week. Start times can be set in one hour increments and duration can be set in hour increments.

Sound reduction will be active if the controller time is within the time block determined by the settings for the current day.

Operation When Active

When sound reduction is active, the condenser fans will be limited to the speed selected by the fan speed limit set point.

If the Sound Reduction priority is set to 'sound', the fan speed limit is applied at all times regardless of operating conditions. If conditions are such that condenser pressure is elevated a high pressure stage down may occur, which would effectively lower the pressure into a safe zone but capacity of the chiller would be limited.

If priority is set to 'capacity', the fan speed is allowed to exceed the limit as needed to avoid high condenser pressure stage downs, which allows the chiller to maintain a higher operating capacity.

Calculations

Refrigerant Saturated Temperature

Refrigerant saturated temperature shall be calculated from the pressure sensor readings for each circuit.

Evaporator Approach

The evaporator approach shall be calculated for each circuit. The equation is as follows:

$$\text{Evaporator Approach} = \text{LWT} - \text{Evaporator Saturated Temperature}$$

Condenser Approach

The condenser approach shall be calculated for each circuit. The equation is as follows:

$$\text{Condenser Approach} = \text{Condenser Saturated Temperature} - \text{OAT}$$

Suction Superheat

Suction superheat shall be calculated for each circuit using the following equation:

$$\text{Suction superheat} = \text{Suction Temperature} - \text{Evaporator Saturated Temperature}$$

Pumpdown Pressure

The pressure to which a circuit will pumpdown is based on the Low Evaporator Pressure Unload set point. The equation is as follows:

$$\text{Pumpdown pressure} = \text{Low Evap Pressure Unload set point} - 103\text{KPA (15 PSI)}$$

Circuit Control Logic

Circuit Enabling

A circuit should be enabled to start if the following conditions are true:

- Circuit switch is closed
- No circuit alarms are active
- Circuit Mode set point is set to Enable
- At least one compressor is enabled to start (according to enable setpoints)

Compressor Availability

A compressor is considered available to start if all the following are true:

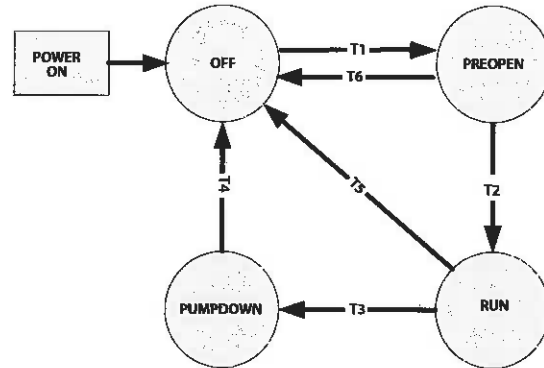
- The corresponding circuit is enabled
- The corresponding circuit is not in pumpdown
- No cycle timers are active for the compressor
- No limit events are active for the corresponding circuit
- The compressor is enabled via the enable setpoints
- The compressor is not already running

Circuit States

The circuit will always be in one of four states:

- Off – Circuit is not running
- Preopen – Circuit is preparing to start
- Run – Circuit is running
- Pumpdown – Circuit is doing a normal shutdown

Transitions between these states are shown in the following diagram.



T1 – Off to Preopen

- No compressors are running and any compressor on circuit is commanded to start (see unit capacity control)

T2 – Preopen to Run

- 5 seconds in Preopen state has passed

T3 – Run to Pumpdown

Any of the following are required:

- Last compressor on circuit is commanded to stop
- Unit State = Pumpdown
- Circuit switch is open
- Circuit mode is disable
- Circuit Pumpdown alarm is active

T4 – Pumpdown to Off

Any of the following are required:

- Evaporator Pressure < Pumpdown Pressure Value
- Unit State = Off
- Circuit Rapid Stop alarm is active

T5 – Run to Off

Any of the following are required:

- Unit State = Off
- Circuit Rapid Stop alarm is active
- A low ambient start attempt failed

T6 – Preopen to Off

Any of the following are required:

- Unit State = Off
- Unit State = Pumpdown
- Circuit switch is open
- Circuit mode is disable
- Circuit Rapid Stop alarm is active
- Circuit Pumpdown alarm is active

Pumpdown Procedure

Pumpdown is performed as follows:

- If multiple compressors are running, shut off the appropriate compressors based on sequencing logic and leave only one running
- Turn off hot gas output and liquid line output
- Keep running until evaporator pressure reaches the pumpdown pressure, then stop compressor
- If evaporator pressure does not reach pumpdown pressure within two minutes, stop compressor

Low Ambient Starts

A low OAT start is initiated if the condenser refrigerant saturated temperature is less than 29.5°C (85.1° F) when the first compressor starts. Once the compressor starts the circuit is in a low OAT start state for a time equal to the Low OAT Start Time set point. During Low OAT Starts, the freeze stat logic for the low evaporator pressure alarm as well as the low evaporator pressure hold and unload alarms are disabled. The absolute limit for low evaporator pressure is enforced and the low evaporator pressure alarm should trigger if the evaporator pressure drops below that limit. In addition if the evaporator pressure is less than the Low Evap Pressure Unload set point during the low POAT start, no additional compressors can start on that circuit even though the hold and unload events are disabled at this time.

When the Low OAT Start Timer has expired, if the evaporator pressure is greater than or equal to the Low Evaporator Pressure Unload set point, the start is considered successful and normal alarm and event logic is reinstated. If the evaporator pressure is less than the Low Evaporator Pressure Unload set point when the Low OAT Start Timer expires, the start is unsuccessful and the compressor will shutdown.

Multiple Low Ambient Start attempts are allowed. On the third failed Low Ambient Start attempt, the Restart Alarm is triggered and the circuit will not attempt to restart until the Restart alarm has been cleared.

The restart counter should be reset when either a startup is successful, the Low OAT Restart alarm is triggered, or the unit time clock shows that a new day has started.

Circuit Status

The displayed circuit status should be determined by the conditions in the following table: If more than one status is enabled at the same time, the highest numbered status overrides the others and is displayed.

#	Status	Conditions
1	Off:Ready	Circuit is ready to start when needed.
2	Off:Cycle Timers	Circuit is off and cannot start due to active cycle timer on all compressors.
3	Off:All Comp Disable	Circuit is off and cannot start due to all compressors being disabled.
4	Off:Keypad Disable	Circuit is off and cannot start due to circuit enable set point.
5	Off:Circuit Switch	Circuit is off and circuit switch is off.
6	Off:Alarm	Circuit is off and cannot start due to active circuit alarm.
7	Off:Test Mode	Circuit is in test mode.
8	Preopen	Circuit is in preopen state.
9	Run:Pumpdown	Circuit is in pumpdown state.
10	Run:Normal	Circuit is in run state and running normally.
11	Run:Evap Press Low	Circuit is running and cannot load due to low evaporator pressure.
12	Run:Cond Press High	Circuit is running and cannot load due to high condenser pressure.

Compressor Control

Compressors should run only when the circuit is in a run or pumpdown state. They should not be running when the circuit is in any other state.

Starting a Compressor

A compressor should start if it receives a start command from the unit capacity control logic.

Stopping a Compressor

A compressor should be turned off if any of the following occur:

- Unit capacity control logic commands it off
- An unload alarm occurs and the sequencing requires this compressor to be next off
- Circuit state is pumpdown and sequencing requires this compressor to be next off

Cycle Timers

A minimum time between starts of the compressor and a minimum time between shutdown and start of the compressor shall be enforced. The time values are determined by the Start-start Timer and Stop-start Timer setpoints.

These cycle timers should not be enforced through cycling of power to the chiller. This means that if power is cycled, the cycle timers should not be active.

These timers may be cleared via a setting on the controller.

Condenser Fan Control

Condenser fan control should stage fans as needed any time compressors are running on the circuit. All fans and solenoid valves will be off when the circuit is in the off and preopen states. Condenser fan digital outputs will be turned on or off immediately for condenser stage changes. Condenser solenoid valve outputs will turn on immediately when a stage up requires the output to turn on, but will have a delay for turning off during a stage down. This delay is 20 seconds. If the circuit shuts off then the condenser solenoid valve outputs will turn off without a delay.

Condenser Staging

Condenser staging will use up to 5 digital outputs for control of condenser fans and a digital output for control of a condenser solenoid valve. When equipped with condenser fan VFDs, the speed signal(s) also starts and stops the fan that is connected to the VFD. The total number of fans on shall be adjusted with changes of one fan at a time. The tables below show the outputs energized for each stage.

Figure 54: 2 Fans per Circuit - Unit Numbering Schematic

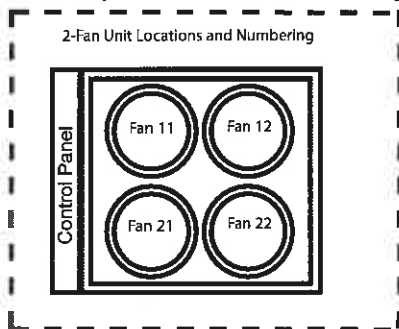


Table 61: 2 Fans per Circuit - Without Fan VFD

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11	On	On	--	--	--	--
Fan Output 2	UC DO4	Fan 12		On	--	--	--	--
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21	On	On	--	--	--	--
Fan Output 2	UC DO8	Fan 22		On	--	--	--	--

Table 62: 2 Fans per Circuit - With 1 Fan VFD per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11	On	On	--	--	--	--
Fan Output 2	UC DO4	Fan 12		On	--	--	--	--
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21	On	On	--	--	--	--
Fan Output 2	UC DO8	Fan 22		On	--	--	--	--

Figure 55: 3 Fans per Circuit - Unit Numbering Schematic

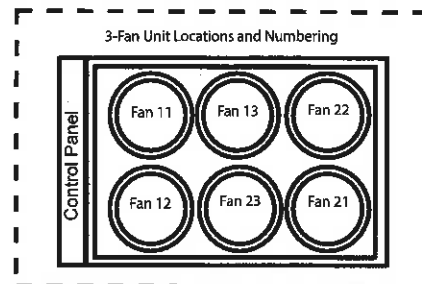


Table 63: 3 Fans per Circuit - Without Fan VFD

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11	On	On	On	--	--	--
Fan Output 2	UC DO4	Fan 12		On	On	--	--	--
Fan Output 3	UC DO5	Fan 13			On			
Condenser SV	UC X7	SV 11			On			
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21	On	On	On	--	--	--
Fan Output 2	UC DO8	Fan 22		On	On	--	--	--
Fan Output 3	UC DO9	Fan 23			On	--	--	--
Condenser SV	UC X8	SV 21			On	--	--	--

Table 64: 3 Fans per Circuit - With 1 Fan VFD per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11	On	On	On	--	--	--
Fan Output 2	UC DO4	Fan 12		On	On	--	--	--
Fan Output 3	UC DO5	Fan 13			On			
Condenser SV	UC X7	SV 11			On			

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21	On	On	On	--	--	--
Fan Output 2	UC DO8	Fan 22		On	On	--	--	--
Fan Output 3	UC DO9	Fan 23			On	--	--	--
Condenser SV	UC X8	SV 21			On	--	--	--

Table 65: 3 Fans per Circuit - With 2 Fan VFDs per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11	On		On	--	--	--
Speed Signal 2	UC X2	Fan 12/13		On	On	--	--	--
Condenser SV	UC X7	SV 11		On	On			

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21	On		On	--	--	--
Speed Signal 2	UC X3	Fan 22/23		On	On	--	--	--
Condenser SV	UC X8	SV 21		On	On			

Figure 56: 4 Fans per Circuit - Unit Numbering Schematic

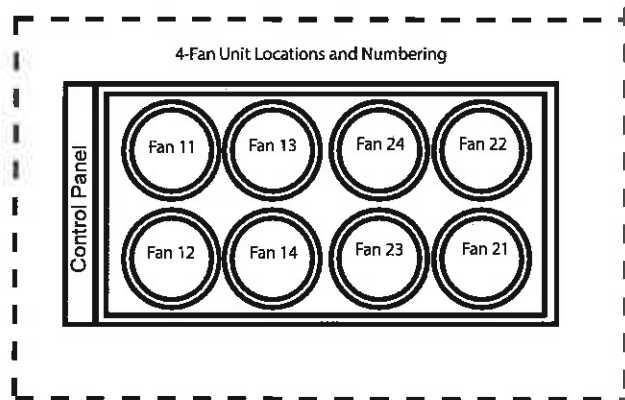


Table 66: 4 Fans per Circuit - Without Fan VFD

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11	On	On	On	On	--	--
Fan Output 2	UC DO4	Fan 12			On	On	--	--
Fan Output 3	UC DO5	Fan 13		On	On	On	--	--
Fan Output 4	UC DO6	Fan 14				On	--	--
Condenser SV	UC X7	SV 11		On	On	On	--	--

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21	On	On	On	On	--	--
Fan Output 2	UC DO8	Fan 22			On	On	--	--
Fan Output 3	UC DO9	Fan 23		On	On	On	--	--
Fan Output 4	UC DO10	Fan 24				On	--	--
Condenser SV	UC X8	SV 21		On	On	On	--	--

Table 67: 4 Fans per Circuit - With 1 Fan VFD per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	On	--	--
Fan Output 2	UC DO4	Fan 12			On	On	--	--
Fan Output 4	UC DO6	Fan 14				On	--	--
Condenser SV	UC X7	SV 11		On	On	On	--	--

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	On	--	--
Fan Output 2	UC DO8	Fan 22			On	On	--	--
Fan Output 4	UC DO10	Fan 24				On	--	--
Condenser SV	UC X8	SV 21		On	On	On	--	--

Table 68: 4 Fans per Circuit - With 2 Fan VFDs per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	--	--	--
Speed Signal 2	UC X2	Fan 12/14			On	--	--	--
Condenser SV	UC X7	SV 11		On	On			

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	--	--	--
Speed Signal 2	UC X3	Fan 22/24			On	--	--	--
Condenser SV	UC X8	SV 21		On	On			

Figure 57: 5 Fans per Circuit - Unit Numbering Schematic

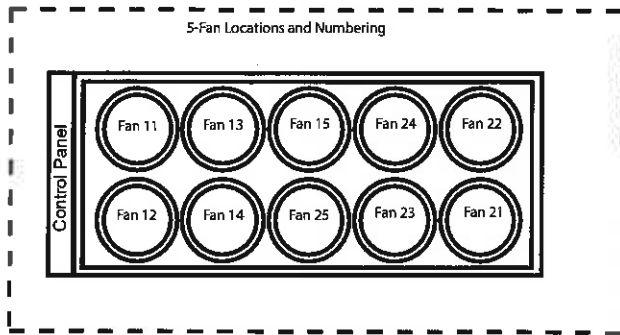


Table 69: 5 Fans per Circuit - Without Fan VFD

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11	On	On	On	On	On	--
Fan Output 2	UC DO4	Fan 12			On	On	On	--
Fan Output 3	UC DO5	Fan 13		On	On	On	On	--
Fan Output 4	UC DO6	Fan 14				On	On	--
Fan Output 5	EEXV1 DO1	Fan 15					On	--
Condenser SV	UC X7	SV 11					On	--
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21	On	On	On	On	On	--
Fan Output 2	UC DO8	Fan 22			On	On	On	--
Fan Output 3	UC DO9	Fan 23		On	On	On	On	--
Fan Output 4	UC DO10	Fan 24				On	On	--
Fan Output 5	EEXV2 DO1	Fan 25					On	--
Condenser SV	UC X8	SV 21					On	--

Table 70: 5 Fans per Circuit - With 1 Fan VFD per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	On	--	--
Fan Output 2	UC DO4	Fan 12		On	On	On	--	--
Fan Output 4	UC DO6	Fan 14			On	On	--	--
Fan Output 5	EEXV1 DO1	Fan 15				On	--	--
Condenser SV	UC X7	SV 11				On	--	--
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	On	--	--
Fan Output 2	UC DO8	Fan 22		On	On	On	--	--
Fan Output 4	UC DO10	Fan 24			On	On	--	--
Fan Output 5	EEXV2 DO1	Fan 25				On	--	--
Condenser SV	UC X8	SV 21				On	--	--

Table 71: 5 Fans per Circuit - With 2 Fan VFDs per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	--	--	--
Speed Signal 2	UC X2	Fan 12/14		On	On	--	--	--
Fan Output 5	EEXV1 DO1	Fan 15			On			
Condenser SV	UC X7	SV 11			On			
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	--	--	--
Speed Signal 2	UC X3	Fan 22/24		On	On	--	--	--
Fan Output 5	EEXV2 DO1	Fan 25			On	--	--	--
Condenser SV	UC X8	SV 21			On			--

Figure 58: 6 Fans per Circuit - Unit Numbering Schematic

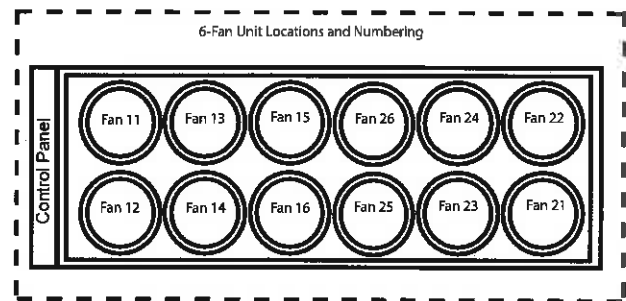


Table 72: 6 Fans per Circuit - Without Fan VFD

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11	On	On	On	On	On	On
Fan Output 2	UC DO4	Fan 12				On		On
Fan Output 3	UC DO5	Fan 13		On	On	On	On	On
Fan Output 4	UC DO6	Fan 14/16					On	On
Fan Output 5	EEXV1 DO1	Fan 15			On	On	On	On
Condenser SV	UC X7	SV 11				On	On	On
Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21	On	On	On	On	On	On
Fan Output 2	UC DO8	Fan 22				On		On
Fan Output 3	UC DO9	Fan 23		On	On	On	On	On
Fan Output 4	UC DO10	Fan 24/26					On	On
Fan Output 5	EEXV2 DO1	Fan 25				On	On	On
Condenser SV	UC X8	SV 21				On	On	On

Table 73: 6 Fans per Circuit - With 1 Fan VFD per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	On	On	--
Fan Output 1	UC DO3	Fan 12			On	On	On	--
Fan Output 2	UC DO4	Fan 14				On	On	--
Fan Output 3	UC DO5	Fan 15		On	On	On	On	--
Fan Output 4	UC DO6	Fan 16					On	--
Condenser SV	UC X7	SV 11		On	On	On	On	--

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	On	On	--
Fan Output 1	UC DO7	Fan 22			On	On	On	--
Fan Output 2	UC DO8	Fan 24				On	On	--
Fan Output 3	UC DO9	Fan 25		On	On	On	On	--
Fan Output 4	UC DO10	Fan 26					On	--
Condenser SV	UC X8	SV 21		On	On	On	On	--

Table 74: 6 Fans per Circuit - With 2 Fan VFDs per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On		On	--	--	--
Speed Signal 2	UC X2	Fan 12/14/15/16		On	On	--	--	--
Condenser SV	UC X7	SV 11		On	On			

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On		On	--	--	--
Speed Signal 2	UC X3	Fan 22/24/25/26		On	On	--	--	--
Condenser SV	UC X8	SV 21		On	On			--

Figure 59: 7 Fans per Circuit - Unit Numbering Schematic

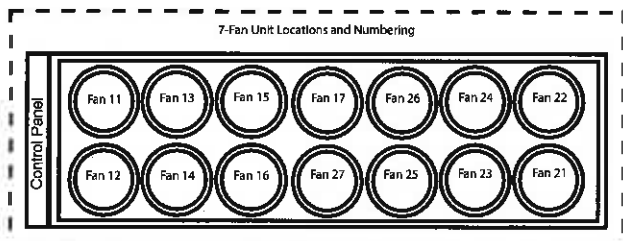


Table 75: 7 Fans per Circuit - Without Fan VFD

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO3	Fan 11/13	On	On	On	On	On	On
Fan Output 2	UC DO4	Fan 12			On		On	On
Fan Output 3	UC DO5	Fan 14/16				On	On	On
Fan Output 4	UC DO6	Fan 15		On	On	On	On	On
Fan Output 5	EEXV1 DO1	Fan 17						On
Condenser SV	UC X7	SV 11						On

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Fan Output 1	UC DO7	Fan 21/23	On	On	On	On	On	On
Fan Output 2	UC DO8	Fan 22			On		On	On
Fan Output 3	UC DO9	Fan 24/26				On	On	On
Fan Output 4	UC DO10	Fan 25		On	On	On	On	On
Fan Output 5	EEXV2 DO1	Fan 27						On
Condenser SV	UC X8	SV 21						On

Table 76: 7 Fans per Circuit - With 1 Fan VFD per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On	On	On	On	On	On
Fan Output 1	UC DO3	Fan 12			On	On	On	On
Fan Output 2	UC DO4	Fan 14				On	On	On
Fan Output 3	UC DO5	Fan 15		On	On	On	On	On
Fan Output 4	UC DO6	Fan 16					On	On
Fan Output 5	EEXV1 DO1	Fan 17						On
Condenser SV	UC X7	SV 11						On

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On	On	On	On	On	On
Fan Output 1	UC DO7	Fan 22			On	On	On	On
Fan Output 2	UC DO8	Fan 24				On	On	On
Fan Output 3	UC DO9	Fan 25		On	On	On	On	On
Fan Output 4	UC DO10	Fan 26					On	On
Fan Output 5	EEXV2 DO1	Fan 27						On
Condenser SV	UC X8	SV 21						On

Table 77: 7 Fans per Circuit - With 2 Fan VFDs per Circuit

Circuit 1								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X5	Fan 11/13	On		On	On	--	--
Speed Signal 2	UC X2	Fan 12/14/15/16		On	On	On	--	--
Fan Output 5	EEXV1 DO1	Fan 17					On	
Condenser SV	UC X7	SV 11					On	

Circuit 2								
Description	Output	Fans	Stage					
			1	2	3	4	5	6
Speed Signal 1	UC X6	Fan 21/23	On		On	On	--	--
Speed Signal 2	UC X3	Fan 22/24/25/26		On	On	On	--	--
Fan Output 5	EEXV2 DO1	Fan 27					On	
Condenser SV	UC X8	SV 21					On	--

Condenser Target

The condenser target is selected based on circuit capacity using the condenser target set points. There are set points that establish the condenser target for 33%, 50%, 67%, and 100% capacity. If the circuit has two compressors the set points for 50% and 100% will be used. If the circuit has three compressors then the set points for 33%, 67%, and 100% will be used.

A minimum condenser target should be enforced. This minimum will be calculated based on the evaporator LWT. As the LWT varies from 7.2°C (45°F) to 32.2°C (90°F), the minimum condenser target will vary from 23.9°C (75°F) to 48.9°C (120°F).

Staging Up

The first fan will not start until the evaporator pressure drop or condenser pressure rise requirement for the No Pressure Change After Start alarm is satisfied. Once that requirement is met, if there is no fan VFD then the first condenser stage should start when the saturated condenser temperature exceeds the condenser target. If there is a fan VFD, then the first stage should start when the saturated condenser temperature exceeds the condenser target less 5.56°C (10°F).

After this, the four stage up dead band settings will be used:

- Stage Up Deadband 1 – used when active condenser stage is 1
- Stage Up Deadband 2 – used when active condenser stage is 2
- Stage Up Deadband 3 – used when active condenser stage is 3
- Stage Up Deadband 4 – used when active condenser stage is 4, 5, or 6

When the saturated condenser temperature is above the target plus the active deadband, stage up error is accumulated.

$$\text{Stage Up Error Step} = \text{Saturated Condenser Temperature} - (\text{Target} + \text{Stage Up dead band})$$

The Stage Up Error Step is added to Stage Up Accumulator once every 5 seconds, only if the Saturated Condenser Refrigerant Temperature is not falling. When Stage Up Error Accumulator is greater than 11°C (19.8°F) another stage is added.

When a stage up occurs or the saturated condenser temperature falls back within the stage up dead band the Stage Up Accumulator is reset to zero.

Staging Down

Four stage down dead bands shall be used.

- Stage Down Deadband 1 – used when active condenser stage is 1
- Stage Down Deadband 2 – used when active condenser stage is 2
- Stage Down Deadband 3 – used when active condenser stage is 3
- Stage Down Deadband 4 – used when active condenser stage is 4, 5, or 6

When the saturated condenser refrigerant temperature is

below the target – the active deadband, a stage down error is accumulated.

$$\text{Stage Down Error Step} = (\text{Target} - \text{Stage Down dead band}) - \text{Saturated Condenser Temperature}$$

The Stage Down Error Step is added to Stage Down Accumulator once every 5 seconds. When the Stage Down Error Accumulator is greater than 2.8°C (5°F) another stage of condenser fans is removed.

When a stage down occurs or the saturated temperature rises back above the target minus the Stage Down dead band, the Stage Down Error Accumulator is reset to zero.

VFD Control

Configurations can include a VFD on the first fan on the circuit, or two VFD's on the circuit with either all fans connected to those VFD's or all except one (leaving one fixed speed fan). The VFD's will vary fan speed to drive the saturated condenser temperature to a target value. The target value is normally the same as the saturated condenser temperature target.

Note that when there are two VFD's per circuit, there are two separate speed signals on each circuit. Staging logic will determine when each speed signal output should be something other than 0vdc (meaning the connected fans should run), but any time both VFD's are to be running the speed signals will be the same (there is no independent speed control on the two VFD's within a circuit).

The speed will normally be controlled between the minimum and maximum speed set points using a PID loop.

VFD State

The VFD speed signals should always be 0 when the fan stage is 0.

When the condenser fan staging requires the fans connected to a VFD to run, the VFD speed signal should be enabled and control the speed as needed.

Stage Up Compensation

In order to create a smoother transition when another fan is staged on, the VFD speed compensates by slowing down initially. This is accomplished by adding the new fan stage up deadband to the VFD target. The higher target causes the VFD logic to decrease fan speed. Then, every 2 seconds, 0.1°C (0.18°F) is subtracted from the VFD target until it is equal to the saturated condenser temperature target set point.

Sound Reduction Operation

When Sound Reduction is active, the maximum speed of the VFD's will be limited to the Sound Reduction fan speed limit set point value. When Sound Reduction priority is set to 'sound', the fan speed limit is applied at all times regardless of operating conditions.

When priority is set to 'capacity', the fan speed limit is in effect unless saturated condenser temperature rises to a certain value. That value is the high condenser pressure unload set point converted to saturated temperature, less 5.56° (10°F).

Once the condenser saturated temperature starts to exceed that value, the fans will speed up beyond the speed limit as needed to control the saturated temperature to that value.

High IPLV Mode

When the High IPLV Mode setting is 'On' and one compressor is running on the unit, the condenser target setting for the running circuit may be overridden. In this case, rather than use the condenser target setting for 33% or 50% (depending on number of compressors), the condenser target will be forced to the value of the IPLV Condenser Target set point.

In addition, when high IPLV mode is active the calculation for the minimum allowed condenser target (based on LWT) will be changed. The minimum value will be changed from 23.9°C (75°F) to the value of the IPLV Condenser Target set point. No other changes to the operation are made when High IPLV mode is on.

Additional Conditions For Microchannel Coils

For units configured with microchannel condenser coils, the fan staging is the same as for a tube and fin coil except there are additional conditions which may cause the fan stage to increase:

- If circuit has two compressors, the second compressor on a circuit starts, the circuit is not already at the maximum condenser stage, and the condenser saturated temperature is higher than 37.78°C (100°F), then a condenser stage will be added immediately.
- If the condenser stage is not already at the maximum, the saturated condenser temperature exceeds 56.67°C (134°F), it has been at least 5 seconds since adding a condenser stage, and the saturated condenser temperature is not dropping, then a condenser stage will be added immediately.

In addition, if the circuit has 4 fans, or it has 6 fans and no fan VFD's, then the first condenser stage may be skipped at startup. This happens if the OAT is at least 21.11°C (70°F) when the first condenser stage would normally be started, in which case it will go directly to the second stage.

If the circuit has two fan VFDs and OAT is at least 10°C (50°F) when the first condenser stage would normally be started.

Both of these additions are in place to deal with spikes in condenser pressure resulting from the lower volume of the microchannel coils.

Limiting Last Stage

For E vintage models with either 5 or 7 fans per circuit and two fan VFD's per circuit, the last fan stage on those configurations is a fixed speed fan. The last fan stage will be turned off and will not be allowed to activate when noise reduction is active.

The last fan stage will also be turned off if OAT is less than 23.89°C (75°F) and it will not be allowed to activate if OAT is less than 25.56°C (78°F).

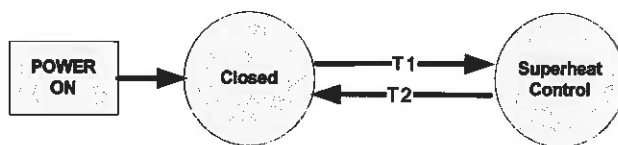
EXV Control

Control States

EXV control will always be in one of two states: Closed or Superheat Control.

Transitions between these states are shown in Figure 59.

Figure 60: EXV Control Transitions



T1 – Closed to Superheat Control

- Circuit state is preopen

T2 – Superheat Control to Closed

- Circuit state is off or pumpdown

Closed State Operation

When the EXV is in the Closed state the position command will be 0 and the EXV control state display will show 'Closed'.

Superheat Control State Operation

While in superheat control, the EXV controls suction superheat. A PID loop will be used to control the suction superheat to the target value. The EXV response is faster when the SSH is lower than 1.67°C (3°F) or higher than the SSH Target + 1.67°C (3°F). Normally during superheat control the EXV control state display will show 'Superheat'.

The EXV should also prevent the evaporator pressure from exceeding the Maximum Evaporator Pressure set point. This is done by using another PID function to control evaporator pressure to the maximum evaporator pressure. The EXV position should be the lesser position output from the two PID functions. If the EXV position is being limited due to exceeding the maximum evaporator pressure, then the EXV control state display will show 'MaxEvapPr'.

Superheat Target

The suction superheat target is selected per the set points depending on what capacity the circuit is running at.

- If the circuit has two compressors and one is running, the value used is the SSH Target at 50% set point. If both compressors are running the SSH Target at 100% set point is used.
- If the circuit has three compressors and one is running, the value used is the SSH Target at 33% set point. If either two or three are running the SSH Target at 66/100% set point is used.

If no compressors are running the target is set to the set point used when one compressor is running (this applies during EXV preopen).

Position Commands

In order to improve the reliability of the EXV positioning, the position commands that are issued to the stepper driver are limited in two ways:

1. Position commands are filtered so that the minimum change in position is 0.3%. Changes of less than this are ignored. This avoids unnecessary movement of the EXV and lowers the chances of losing steps as a result.
2. The position commands are issued once per program cycle with a maximum change of 0.7% each time. This allows the stepper to move the valve to the commanded position before the next position command is issued. Issuing commands in this way may also lower the chances of losing steps.

EXV Position Range

The minimum EXV position while the circuit is running will always be 8%. The maximum position will change as the number of compressors running on the circuit changes. These values are shown for each unit model in Table 78.

Table 78: Maximum Position Range

Model	# Compressors Running/Circuit		
	1	2	3
AGZ030E	50	100	n/a
AGZ035E	50	100	n/a
AGZ040E	50	100	n/a
AGZ045E	50	100	n/a
AGZ050E	50	100	n/a
AGZ055E	50	100	n/a
AGZ060E	50	100	n/a
AGZ065E	50	100	n/a
AGZ070E	50	100	n/a
AGZ075E	60	100	n/a
AGZ080E	60	100	n/a
AGZ090E	60	100	n/a
AGZ100E	60	100	n/a
AGZ110E	50	80	n/a
AGZ120E	50	80	n/a
AGZ130E	50	80	n/a
AGZ140E	70	100	n/a
AGZ150E	70	100	n/a
AGZ161E	80	100	n/a
AGZ170E	60	80	100
AGZ180E	60	80	100
AGZ190E	60	80	100
AGZ210E	60	80	100
AGZ225E	60	80	100
AGZ240E	60	80	100

Operation Considerations

For units equipped with shell and tube evaporators, when staging down a compressor the maximum position is reduced by 10% for one minute to prevent liquid refrigerant from getting to the compressors. After this initial one minute delay, the maximum valve position is allowed to return to its normal

value at a rate of 0.1% every six seconds. This offset to the maximum position should not occur if the stage down is due to a low pressure unload.

For all units - the expansion valve maximum position may be increased if both the suction superheat is higher than the target and the expansion valve has been within 1% of its current maximum position for a minute. The maximum should increase at a rate of 0.1% every six seconds up to a total of an additional 10%. This addition to the maximum position should be reset when the EXV is no longer in the Superheat Control state, or a compressor on the circuit stages.

Manual Control

The EXV position can be set manually. Manual control can only be selected when the circuit is in the run state. At any other time, the EXV control set point is forced to auto.

When EXV control is set to manual, the EXV position is equal to the manual EXV position setting. If set to manual when the circuit state transitions from run to another state, the control setting is automatically set back to auto. When in manual control, the EXV control state displayed will be 'Manual'.

Liquid Line Solenoid Valve

The liquid line solenoid output should be on when the circuit state is either Pre-open or Run. This output should be off at all other times.

Hot Gas Bypass Solenoid Valve

This output will be on when circuit state is Run for at least 30 seconds and one compressor on the unit is running. The output should be off at all other times unless the unit is a model 190-240. For these models, the hot gas bypass will also be activated for 10 minutes when a second or third compressor is started on the circuit.

Capacity Overrides – Limits of Operation

The following conditions shall override automatic capacity control as described. These overrides keep the circuit from entering a condition in which it is not designed to run.

Low Evaporator Pressure

If the Low Evaporator Pressure Hold or Low Evaporator Pressure Unload alarms are triggered, the circuit capacity may be limited or reduced. See the Circuit Events section for details on triggering, reset, and actions taken.

High Condenser Pressure

If the High Condenser Pressure Unload alarm is triggered, the circuit capacity may be limited or reduced. See the Circuit Events section for details on triggering, reset, and actions taken.

Situations may arise that require some action from the chiller or that should be logged for future reference. Alarms are classified in the following sections as Faults, Problems, or Warnings.

When any Unit Fault Alarm is active, the alarm digital output should be turned on continuously. If both circuits have a Circuit Fault Alarm active, the alarm digital output should be turned on continuously. If no Unit Fault Alarm is active and only one circuit has a Circuit Fault Alarm is active, the alarm digital output should alternate five seconds on and five seconds off continuously.

All alarms appear in the active alarm list while active. All alarms are added to the alarm log when triggered and when cleared. Entries in the log representing the occurrence of an alarm will be preceded by '+' while entries representing the clearing of an alarm will be preceded by '-'.

Unit Fault Alarms

PVM/GFP Fault

Trigger: Power Configuration = Single Point and PVM/GFP Input #1 is open for longer than one second.

Action Taken: Rapid stop all circuits

Reset: Auto reset when input is closed for at least 5 seconds or if Power Configuration = Multi Point.

Evaporator Flow Loss

Trigger:

1: Evaporator Pump State = Run AND Evaporator Flow Digital Input = No Flow for time > Flow Proof Set Point AND at least one compressor running

2: Evaporator Pump State = Start for time greater than Recirc Timeout Set Point and all pumps have been tried and Evaporator Flow Digital Input = No Flow

Action Taken: Rapid stop all circuits

Reset:

This alarm can be cleared at any time manually via the keypad or via the BAS clear alarm command.

If active via trigger condition 1:

When the alarm occurs due to this trigger, it can auto reset the first two times each day with the third occurrence being manual reset.

For the auto reset occurrences, the alarm will reset automatically when the evaporator state is Run again. This means the alarm stays active while the unit waits for flow, then it goes through the recirculation process after flow is detected. Once the recirculation is complete, the evaporator goes to the Run state which will clear the alarm. After three occurrences, the count of occurrences is reset and the cycle starts over if the manual reset flow loss alarm is cleared.

If active via trigger condition 2:

If the flow loss alarm has occurred due to this trigger, it is

always a manual reset alarm.

Evaporator Water Freeze Protect

Trigger: Evaporator LWT drops below evaporator freeze protect set point and LWT sensor fault is not active for a time longer than the evaporator recirculation time set point.

Action Taken: Rapid stop all circuits

Reset: This alarm can be cleared manually via the keypad, but only if the alarm trigger conditions no longer exist.

Evaporator LWT Sensor Fault

Trigger: Sensor shorted or open for longer than one second

Action Taken: Normal stop all circuits

Reset: This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range.

Outdoor Air Temperature Sensor Fault

Trigger: Sensor shorted or open for longer than one second

Action Taken: Normal stop of all circuits.

Reset: This alarm can be cleared manually via the keypad or via BAS command if the sensor is back in range.

External Alarm

Trigger: External Alarm/Event opens for at least 5 seconds and external fault input is configured as an alarm.

Action Taken: Rapid stop of all circuits.

Reset: Auto clear when digital input is closed.

Compressor Module 1 Comm Failure

Trigger: Communication with I/O extension module has failed.

Action Taken: Rapid stop of circuit 1.

Reset: This alarm can be cleared manually via the keypad or BAS command when communication between main controller and the extension module is working for 5 seconds.

Compressor Module 2 Comm Failure

Trigger: Communication with I/O extension module failed.

Action Taken: Rapid stop of circuit 2.

Reset: This alarm can be cleared manually via the keypad or BAS command when communication between main controller and the extension module is working for 5 seconds.

EXV Module 1 Comm Failure

Trigger: Expansion Valve Type = Electronic and communication with the I/O extension module has failed.

Action Taken: Rapid stop of circuit 1.

Reset: This alarm can be cleared manually via the keypad or BAS command when communication between main controller and the extension module is working for 5 seconds or Expansion Valve Type = Thermal.

EXV Module 2 Comm Failure

Trigger: Expansion Valve Type = Electronic and communication with the I/O extension module has failed.

Action Taken: Rapid stop of circuit 2.

Reset: This alarm can be cleared manually via the keypad or BAS command when communication between main controller and the extension module is working for 5 seconds or Expansion Valve Type = Thermal.

Unit Problem Alarms

Evaporator Pump #1 Failure

Trigger: Unit is configured with primary and backup pumps, pump #1 is running, and the pump control logic switches to pump #2.

Action Taken: Backup pump is used.

Reset: This alarm can be cleared manually via the keypad or BAS command.

Evaporator Pump #2 Failure

Trigger: Unit is configured with primary and backup pumps, pump #2 is running, and the pump control logic switches to pump #1.

Action Taken: Backup pump is used.

Reset: This alarm can be cleared manually via the keypad or BAS command.

Unit Warning Alarms

External Event

Trigger: External Alarm/Event input is open for at least 5 seconds and external fault is configured as an event.

Action Taken: None.

Reset: Auto clear when digital input is closed.

Bad Demand Limit Input

Trigger: Demand limit input out of range and demand limit is enabled. For this alarm out of range is considered to be a signal less than 3mA or more than 21mA.

Action Taken: Cannot use demand limit function.

Reset: Auto clear when demand limit disabled or demand limit input back in range for 5 seconds.

Bad LWT Reset Input

Trigger: LWT reset input out of range and LWT reset is enabled. For this alarm out of range is considered to be a signal less than 3mA or more than 21mA.

Action Taken: Cannot use LWT reset function.

Reset: Auto clear when LWT reset is disabled or LWT reset input back in range for 5 seconds.

Evaporator EWT Sensor Fault

Trigger: Sensor shorted or open for longer than one second

Action Taken: None.

Reset: Auto clear when the sensor is back in range.

Circuit Fault Alarms

PVM/GFP Fault

Trigger: Power Configuration = Multi Point and circuit PVM/GFP input is open for longer than one second

Action Taken: Rapid stop circuit.

Reset: Auto reset when input is closed for at least 5 seconds or if Power Configuration = Single Point.

Low Evaporator Pressure

Trigger:

This alarm should trigger when Freeze time is exceeded, Low Ambient Start is not active, and Circuit State = Run. It should also trigger if Evaporator Press < 137.9 KPA (20 psi) and Circuit State = Run for longer than 1 second.

Freezestat logic allows the circuit to run for varying times at low pressures. The lower the pressure, the shorter the time the compressor can run. This time is calculated as follows:

$$\text{Freeze error} = \text{Low Evaporator Pressure Unload} - \text{Evaporator Pressure}$$

Freeze time =

For units equipped with 10 or more condenser fans (shell and tube type evaporator):

$$80 - (\text{freeze error}/6.895), \text{ limited to a range of 40 to 80 seconds}$$

For all other configurations (plate to plate type evaporator):

$$60 - (\text{freeze error}/6.895), \text{ limited to a range of 20 to 60 seconds}$$

When the evaporator pressure goes below the Low Evaporator Pressure Unload set point, a timer starts. If this timer exceeds the freeze time, then a freezestat trip occurs. If the evaporator pressure rises to the unload set point or higher, and the freeze time has not been exceeded, the timer will reset.

The alarm cannot trigger if the evaporator pressure sensor fault is active.

Action Taken: Rapid stop circuit.

Reset: This alarm can be cleared manually via the keypad if the evaporator pressure is above 137.9 KPA (20 PSI).

High Condenser Pressure

Trigger: Condenser Pressure > High Condenser Pressure set point for longer than one second.

Action Taken: Rapid stop circuit.

Reset: This alarm can be cleared manually via the controller keypad.

Mechanical High Pressure Switch

Trigger: Mechanical High Pressure switch input is open and Motor Protection input is closed for longer than one second, and power up start delay is not active.

Action Taken: Rapid stop circuit.

Reset: This alarm can be cleared manually via the controller keypad if the MHP switch input is closed.

Motor Protection Fault

Trigger: Motor Protection input is open and power up start delay is not active for longer than one second.

Action Taken: Rapid stop circuit.

Reset: This alarm can be cleared manually via the controller keypad if the input is closed.

Low OAT Restart Fault

Trigger: Circuit has failed three low OAT start attempts.

Action Taken: Rapid stop circuit.

Reset: This alarm can be cleared manually via the keypad or via BAS command.

No Pressure Change After Start

Trigger: After start of compressor, at least a 7 KPA (1 PSI) drop in evaporator pressure OR 35 KPA (5.1 PSI) increase in condenser pressure has not occurred after 30 seconds. The actual alarm will not be triggered until the second occurrence. This counter should be reset every day at midnight.

Action Taken: Rapid stop circuit.

Reset: This alarm can be cleared manually via the keypad or via BAS command.

Evaporator Pressure Sensor Fault

Trigger: Triggered when sensor is shorted or open for longer than one second. However the fault should not be triggered due to the input signal reading too high unless the circuit has been running for longer than 90 seconds or the OAT is less than 40.56°C (105°F).

Action Taken: Rapid stop circuit.

Reset: This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range.

Condenser Pressure Sensor Fault

Trigger: Sensor shorted or open for longer than one second.

Action Taken: Rapid stop circuit.

Reset: This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range.

Suction Temperature Sensor Fault

Trigger: Sensor shorted or open for longer than one second and Expansion Valve Type = Electronic.

Action Taken: Normal shutdown of circuit.

Reset: This alarm can be cleared manually via the keypad or BAS command, but only if the sensor is back in range.

Circuit Warning Alarm

Failed Pumpdown

Trigger: Circuit state = pumpdown for longer than 2 minutes.

Action Taken: Rapid stop circuit.

Reset: N/A.

Alarm Logs

Press the alarm button on the controller to go to the alarm section. Three alarm sub-sections will appear. Turn the navigating wheel to highlight among them and press the wheel to select. Reference Figure 60 for controller components.

Active Alarms

When an alarm or event occurs, it appears in the active alarm list. The active alarm list holds a record of all active alarms not yet cleared and includes the date and time each occurred. When cleared, the alarm transfers to the Alarm Log that contains an alarm history with time/date stamp. A (+) before an alarm indicates that it is active, a (-) indicates a cleared alarm. The Active Alarm list is only limited by the number of alarms since any given alarm cannot appear twice.

Alarm Log

An alarm log stores the last 50 occurrences or resets that occur. When an alarm or event occurs, it is put into the first slot in the alarm log and all others are moved down one, dropping the last entry. The date and time the alarm occurred are stored in the alarm log.

Event Log

An Event Log similar to the Alarm Log stores the last 50 event occurrences. Each Event Log entry includes an event description and a time and date stamp for the event occurrence plus the count of the event occurrences on the current day and for each of the last seven days. Events do not appear in the Active Alarm list.

Clearing Alarms

Active alarms can be cleared through the keypad/display or a BAS network. Alarms are automatically cleared when controller power is cycled. Alarms are cleared only if the conditions required to initiate the alarm no longer exist. All alarms and groups of alarms can be cleared via the keypad or network via LON using `nviClearAlarms` and via BACnet using the `ClearAlarms` object.

To use the keypad, follow the Alarm links to the Alarms screen, which will show Active Alarms and Alarm Log. Select Active Alarm and press the wheel to view the Alarm List (list of current active alarms). They are in order of occurrence with the most recent on top. The second line on the screen shows Alm Cnt (number of alarms currently active) and the status of the alarm clear function. Off indicates that the Clear function is off and the alarm is not cleared. Press the wheel to go to the edit mode. The Alm Clr (alarm clear) parameter will be highlighted with OFF showing. To clear all alarms, rotate the wheel to select ON and enter it by pressing the wheel.

An active password is not necessary to clear alarms.

If the problem(s) causing the alarm have been corrected, the alarms will be cleared, disappear from the Active Alarm list and be posted in the Alarm Log. If not corrected, the On will immediately change back to OFF and the unit will remain in the alarm condition.

Events

Situations may arise that require some action from the chiller or that should be logged for future reference, but aren't severe enough to track as alarms. These events are stored in a log separate from alarms. This log shows the time and date of the latest occurrence, the count of occurrences for the current day, and the count of occurrences for each of the previous 7 days.

Unit Events

Unit Power Restore

Trigger: Unit controller is powered up.

Action Taken: None

Reset: None

Circuit Events

Low Evaporator Pressure - Hold

Trigger:

This event is triggered if all of the following are true:

- circuit state = Run
- evaporator pressure \leq Low Evaporator Pressure - Hold set point
- circuit is not currently in a low OAT start
- it has been at least 30 seconds since a compressor has started on the circuit.

Action Taken: Inhibit starting of additional compressors on the circuit.

Reset: While still running, the event will reset if evaporator

pressure $>$ Low Evaporator Pressure Hold SP + 90 KPA (13 PSI). The event is also reset if the circuit is no longer in the run state.

Low Evaporator Pressure - Unload

Trigger:

This event is triggered if all of the following are true:

- circuit state = Run
- more than one compressor is running on the circuit
- evaporator pressure \leq Low Evaporator Pressure - Unload set point for a time greater than half of the current freezestat time
- circuit is not currently in a low OAT start
- it has been at least 30 seconds since a compressor has started on the circuit.

On units equipped with 6 compressors, electronic expansion valves, and 10 or more fans, when each compressors starts, there should be a 2 minute window during which the evaporator pressure must drop an additional 27 KPA (3.9 PSI) to trigger the alarm. After this 2 minute window, the trigger point should return to normal.

Action Taken: Stage off one compressor on the circuit every 10 seconds while evaporator pressure is less than the unload set point, except the last one.

Reset: While still running, the event will be reset if evaporator pressure $>$ Low Evaporator Pressure Hold SP + 90 KPA(13 PSI). The event is also reset if the circuit is no longer in the run state.

High Condenser Pressure - Unload

Trigger:

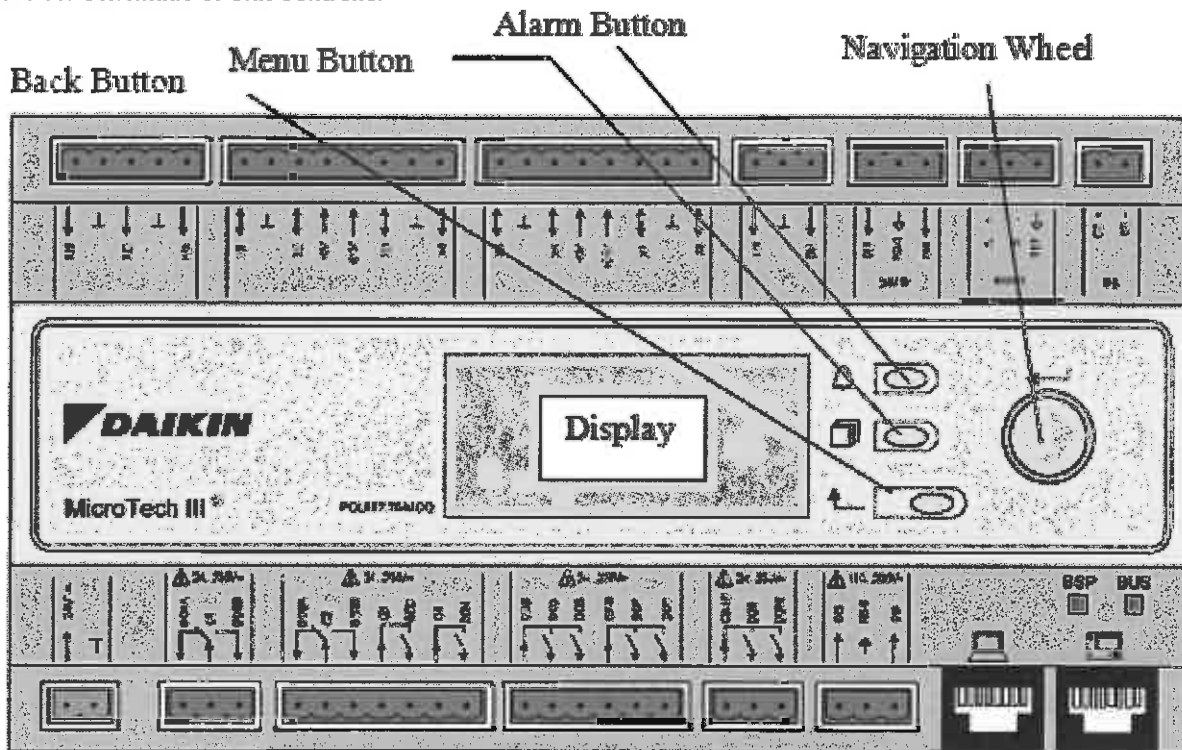
This event is triggered if all of the following are true:

- circuit state = Run
- more than one compressor is running on the circuit
- condenser pressure $>$ High Condenser Pressure - Unload set point

Action Taken: Stage off one compressor on the circuit every 10 seconds while condenser pressure is higher than the unload set point, except the last one. Inhibit staging more compressors on until the condition resets.

Reset: While still running, the event will be reset if condenser pressure \leq High Condenser Pressure Unload SP - 862 KPA(125 PSI). The event is also reset if the circuit is no longer in the run state.

Figure 61: Schematic of Unit Controller



The keypad/display consists of a 5-line by 22-character display, three buttons (keys) and a "push and roll" navigation wheel. There is an Alarm Button, Menu (Home) Button and a Back Button. The wheel is used to navigate between lines on a screen (page) and to increase and decrease changeable values when editing. Pushing the wheel acts as an Enter Button and will jump from a link to the next set of parameters.

Figure 62: Typical Screen

•6	View/Set Unit	3
Status/Settings		>
Set Up		>
Temperature	10.00F	>
Date/Time/Schedule		>

Generally, each line on the display contains a menu title, a parameter (such as a value or a setpoint), or a link (which will have an arrow in the right of the line) to a further menu.

The first line visible on each display includes the menu title and the line number to which the cursor is currently "pointing." In the above screen, Temperature is highlighted.

The left most position of the title line includes an "up" arrow ▲ to indicate there are lines (parameters) "above" the currently displayed line; and/or a "down" arrow ▼ to indicate there are lines (parameters) "below" the currently displayed items or an "up/down" arrow • to indicate there are lines "above and below" the currently displayed line. The selected line is highlighted.

Each line on a screen can contain status-only information or

include changeable data fields (setpoints).

When the cursor is on a line the highlights will look like this:

Evaporator Delta T= 10.0F

If line contains a changeable value-

Unit Status= Run

If the line contains status-only information-

Or a line in a menu may be a link to further menus. This is often referred to as a jump line, meaning pushing the navigation wheel will cause a "jump" to a new menu. An arrow (>) is displayed to the far right of the line to indicate it is a "jump" line and the entire line is highlighted when the cursor is on that line.

NOTE - Only menus and items that are applicable to the specific unit configuration are displayed.

This manual includes information relative to the operator level of parameters; data and setpoints necessary for the every day operation of the chiller. There are more extensive menus available for the use of service technicians.

Navigating

When power is applied to the control circuit, the controller screen will be active and display the Home screen, which can also be accessed by pressing the Menu Button. The navigating wheel is the only navigating device necessary, although the MENU, ALARM, and BACK buttons can provide shortcuts as explained later.

Passwords

Enter passwords from the Main Menu:

- Enter Password links to the Entry screen which is an editable screen. So pressing the wheel goes to the edit mode where the password (6363 for start-up access, 2526 for technician access, 5321 for operator access) can be entered. The first (*) will be highlighted, rotate the wheel clockwise to the first number and set it by pressing the wheel. Repeat for the remaining three numbers. The password will time out after 10 minutes and is cancelled if a new password is entered or the control powers down.
- Not entering a password allows access to a limited number of parameters as shown in Figure 65.

Figure 63: Password Menu

Main Menu	1/3
Enter Password >	
Unit Status	
Off. Unit Sw	
ACTIVE SETPT 44.6°F	

Figure 64: Password Entry Page

Enter Password	1/1
Enter PW ****	

Entering an invalid password has the same effect as not entering a password.

Once a valid password has been entered, the controller allows further changes and access without requiring the user to enter a password until either the password timer expires or a different password is entered. The default value for this password timer is 10 minutes.

Navigation Mode

When the navigation wheel is turned clockwise, the cursor moves to the next line (down) on the page. When the wheel is turned counter-clockwise the cursor moves to the previous line (up) on the page. The faster the wheel is turned the faster the cursor moves. Pushing the wheel acts as an "Enter" button.

Three types of lines exist:

- Menu title, displayed in the first line as in Figure 62.
- Link (also called Jump) having an arrow (>) in the right of the line and used to link to the next menu.
- Parameters with a value or adjustable setpoint.

For example, "Time Until Restart" jumps from level 1 to level 2 and stops there.

When the Back Button is pressed the display reverts back to the previously displayed page. If the Back button is repeatedly pressed the display continues to revert one page back along the current navigation path until the "main menu" is reached.

When the Menu (Home) Button is pressed the display reverts to the "main page."

When the Alarm Button is depressed, the Alarm Lists menu is displayed.

Edit Mode

The Editing Mode is entered by pressing the navigation wheel while the cursor is pointing to a line containing an editable field. Once in the edit mode pressing the wheel again causes the editable field to be highlighted. Turning the wheel clockwise while the editable field is highlighted causes the value to be increased. Turning the wheel counter-clockwise while the editable field is highlighted causes the value to be decreased. The faster the wheel is turned the faster the value is increased or decreased. Pressing the wheel again cause the new value to be saved and the keypad/display to leave the edit mode and return to the navigation mode.

A parameter with an "R" is read only; it is giving a value or description of a condition. An "R/W" indicates a read and/or write opportunity; a value can be read or changed (providing the proper password has been entered).

Link and parameter access is indicated for the various password levels with one column for each level. Column headings for the password levels are as follows and shown in Figure 64:

- N = No password
- O = Operator level
- T = Technician level
- D = Daikin Applied factory service technician level

Screen navigational links:

- For each link on a screen, the linked screen is indicated in the rightmost column.
- For each screen, the screen(s) from which you can navigate to it is also shown in parentheses after the screen identifier.
- For most circuit or compressor level parameters, there is a link to a screen that shows the values for all circuits/compressors which is indicated in the 'Links to screen' column as *.

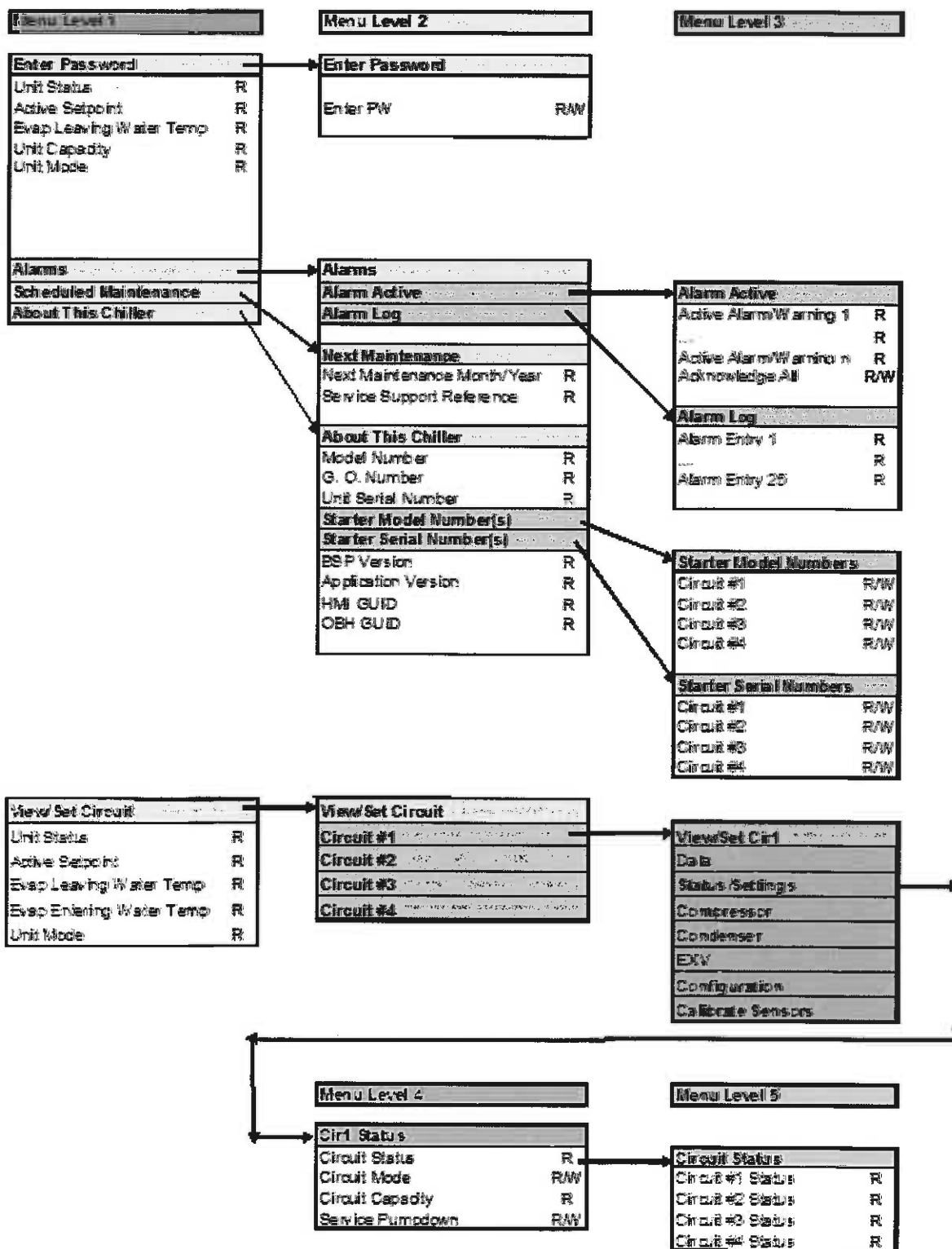
For many of the circuit level screens, only one screen will be shown in this section. The same set of screens exists for each circuit and compressor. These screens are the ones with 'Cx' and CmpX' identifiers.

Figure 65: Example of Screen Menu With Access Levels

U-1					
Main Menu	N	O	T	D	To Screen
Enter Password	R	R	R	R	U-2
Quick Menu		R	R	R	U-3
View/Set Unit		R	R	R	U-4
View/Set Circuit		R	R	R	U-5
Unit Status	R	R	R	R	
Active Setpoint	R	R	R	R	

Figure 66: Controller Keypad Sample Navigation

Visible (w/o Password)



The optional VFD fan control is used for unit operation below 32°F (0°C) down to a minimum of -10°F (-23°C). The control looks at the saturated discharge temperature and varies the fan speed to hold the temperature (pressure) at the "target" temperature.

Low ambient air temperature control is accomplished by using the Optional Low Ambient VFD to control the speed of the first fan on each circuit. This VFD control uses a proportional integral function to drive the saturated condenser temperature to a target value by changing the fan speed. The target value is normally the same as the saturated condenser temperature target setpoint.

The fan VFD always starts when the saturated condenser temperature rises higher than the target.

What is an Inverter?

The term inverter and variable-frequency drive are related and somewhat interchangeable. An electronic motor drive, for an AC motor, controls the motor's speed by varying the frequency of the power sent to the motor.

In general, an inverter is a device that converts DC power to AC power. The figure below shows how the variable-frequency drive employs an internal inverter. The drive first converts incoming AC power to DC through a rectifier bridge, creating an internal DC bus voltage. Then the inverter circuit converts the DC back to AC again to power the motor. The special inverter can vary its output frequency and voltage according to the desired motor speed.

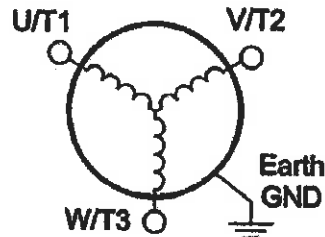
Inverter Output to the Motor

WARNING

Avoid swapping any 2 of the 3 motor lead connections which will cause reversal of the motor direction. In applications where reversed rotation could cause equipment damage or personnel injury, be sure to verify direction of rotation before attempting full-speed operation. For safety to personnel, the motor chassis ground must be connected to the ground connection at the bottom of the inverter housing.

The AC motor must be connected only to the inverter's output terminals. The output terminals are uniquely labeled (to differentiate them from the input terminals) with the designations U/T1, V/T2, and W/T3.

3-Phase AC Motor



This corresponds to typical motor lead connection designations T1, T2, and T3. The consequence of swapping any two of the three connections is the reversal of the motor direction. This must not be done. In applications where reversed rotation could cause equipment damage or personnel injury, be sure to verify direction of rotation before attempting full-speed operation. For safety to personnel, the motor chassis ground must be connected to the ground connection at the bottom of the inverter housing.

Notice the three connections to the motor do not include one marked "Neutral" or "Return." The motor represents a balanced "Y" impedance to the inverter, so there is no need for a separate return. In other words, each of the three "Hot" connections serves also as a return for the other connections because of their phase relationship.

Do not to switch off power to the inverter while the motor is running (unless it is an emergency stop) to avoid equipment damage. Also, do not install or use disconnect switches in the wiring from the inverter to the motor (except thermal disconnect).

VFD Interface

The VFD controller is located in the lower left-hand corner of the unit control panel. It is used to view data including fault and alarm information. No operator intervention on this control is required for normal unit operation.

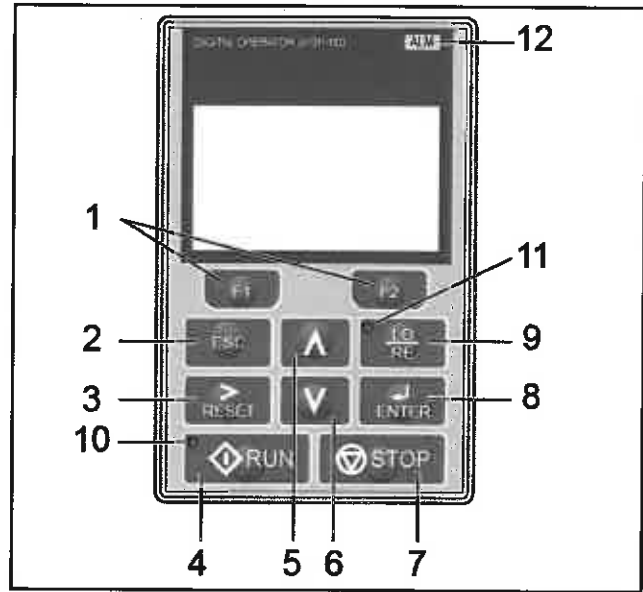


Table 79: Display Key Functions

No.	Display Name	Function
1	Function Key (F1, F2)	The functions assigned to F1 and F2 vary depending on the currently displayed menu. The name of each function appears in the lower half of the display window.
2, 3	ESC Key, RESET Key	<ul style="list-style-type: none"> • Returns to the previous display. • Moves the cursor one space to the left. • Pressing and holding this button will return to the Frequency Reference display.
3	RESET Key	<ul style="list-style-type: none"> • Moves the cursor to the right. • Resets the drive to clear a fault situation.
4	RUN Key	Starts the drive in LOCAL mode.
5	Up Arrow Key	Scrolls up to display the next item, select parameter numbers, and increment setting values.
6	Down Arrow Key.	Scrolls down to display the next item, select parameter numbers, and increment setting values.
7	STOP Key	Stops drive operation.
8	ENTER Key	<ul style="list-style-type: none"> • Enters parameter values and settings. • Selects a menu item to move between displays.
9	LO/RE Selection Key	Switches drive control between the operator (LOCAL) and an external source (REMOTE) for the Run command and frequency reference.
10	RUN Light	Lit while the drive is operating the motor.
11	LO/RE Ligh	Lit while the operator is selected to run the drive (LOCAL mode).
12	ALM LED Light	Refer to ALARM (ALM) LED Displays in Table 81.

Figure 67: LCD Display

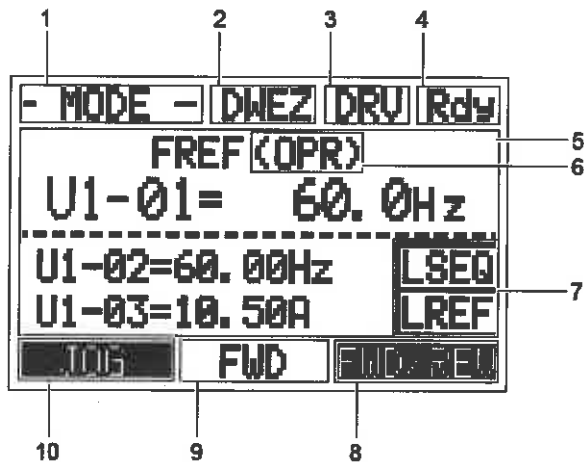


Table 80: Display Data

No	Name	Display	Content
1	Operation Mode Menu	MODE	Displayed when in Mode Selection.
		MONITR	Displayed when in Monitor Mode.
		VERIFY	Indicates the Verify Menu.
		PRMSET	Displayed when in Parameter Setting Mode.
		A.TUNE	Displayed during Auto-Tuning.
		SETUP	Displayed when in Setup Mode.
2	DriveWorksEZ Function Selection	DWEZ	Displayed when DriveWorksEZ is set to enable. (A1-07 = 1 or 2)
3	Mode Display Area	DRV	Displayed when in Drive Mode.
		PRG	Displayed when in Programming Mode.
4	Ready	Rdy	Indicates the drive is ready to run.
5	Data Display	—	Displays specific data and operation data.
6	Frequency Reference Assignment <1>	OPR	Displayed when the frequency reference is assigned to the LCD Operator Option.
		AI	Displayed when the frequency reference is assigned to the Analog Input of the drive.
		COM	Displayed when the frequency reference is assigned to the MEMOBUS/Modbus Communication Inputs of the drive.
		OP	Displayed when the frequency reference is assigned to an Option Unit of the drive.
		RP	Displayed when the frequency reference is assigned to the Pulse Train Input of the drive.
7	LO/RE Display <2>	RSEQ	Displayed when the run command is supplied from a remote source.
		LSEQ	Displayed when the run command is supplied from the operator keypad.
		RREF	Displayed when the run command is supplied from a remote source.
		LREF	Displayed when the run command is supplied from the operator keypad.
8	Function Key 1 (F1)	JOG	Pressing [F1] executes the Jog function.
		HELP	Pressing [F1] displays the Help menu.
		←	Pressing [F1] scrolls the cursor to the left.
		HOME	Pressing [F1] returns to the top menu (Frequency Reference).
		ESC	Pressing [F1] returns to the previous display.
9	FWD/REV	FWD	Indicates forward motor operation.
		REV	Indicates reverse motor operation.
10	Function Key 2 (F2)	FWD/REV	Pressing [F2] switches between forward and reverse.
		DATA	Pressing [F2] scrolls to the next display.
		→	Pressing [F2] scrolls the cursor to the right.
		RESET	Pressing [F2] resets the existing drive fault error.

Table 81: Alarm Content

State	Content
Illuminated	When the drive detects an alarm or error
Flashing	When an alarm occurs
	When an oPE is detected
	When a fault or error occurs during Auto-Tuning
Off	Normal operation (no fault or alarm)

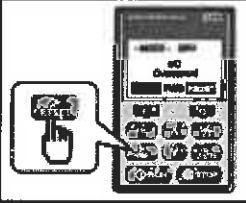
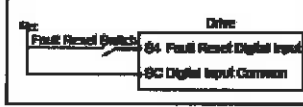
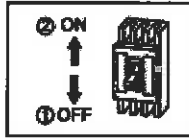
Table 82: LO/RE LED and RUN LED Indicators

LED	Lit	Flashing Slowly	Flashing Quickly	Off
LO/RE	When the operator is selected for Run command and frequency reference control (LOCAL)	--	--	When a device other than the operator is selected for Run command and frequency reference control (REMOTE)
RUN	During run	During deceleration to stop When a Run command is input and frequency reference is 0 Hz	While the drive was set to LOCAL, a Run command was entered to the input terminals then the drive was switched to REMOTE. A Run command was entered via the input terminals while the drive was not in the Drive Mode. During deceleration when a Fast Stop command was entered. The drive output is shut of by the Safe Disable function. The STOP key was pressed while drive was running in REMOTE. The drive was powered up with b1-17 = 0 (default) while the Run command was active.	During stop

Table 83: Types of Alarms, Faults, and Errors

Type	Drive Response
Faults	When the drive detects a fault:
	<ul style="list-style-type: none"> • The digital operator displays text indicating the specific fault and the ALM indicator LED remains lit until the fault is reset.
	<ul style="list-style-type: none"> • The fault interrupts drive output and the motor coasts to a stop. • Some faults allow the user to select the stopping method when the fault occurs.
	<ul style="list-style-type: none"> • Fault output terminals MA-MC will close, and MB-MC will open.
	The drive will remain inoperable until the fault is cleared.
Minor Faults and Alarms	When the drive detects an alarm or a minor fault:
	<ul style="list-style-type: none"> • The digital operator displays text indicating the specific alarm or minor fault, and the ALM indicator LED flashes.
	<ul style="list-style-type: none"> • The drive continues running the motor, although some alarms allow the user to select a stopping method when the alarm occurs.
	<ul style="list-style-type: none"> • A multi-function contact output set to be tripped by a minor fault closes. If the output is set to be tripped by an alarm, the contact will not close.
	<ul style="list-style-type: none"> • The digital operator displays text indicating a specific alarm and the ALM indicator LED flashes.
	Remove the cause of the problem to reset a minor fault or alarm.
Operation Errors	An operation error occurs when parameter settings conflict or do not match hardware settings (such as with an option card). When the drive detects an operation error:
	<ul style="list-style-type: none"> • The digital operator displays text indicating the specific error. • Multi-function contact outputs do not operate.
	The drive will not operate the motor until the error has been reset. Correct the settings that caused the operation error to clear the error.
Tuning Errors	Tuning errors occur while performing Auto-Tuning. When the drive detects a tuning error:
	<ul style="list-style-type: none"> • The digital operator displays text indicating the specific error. • Multi-function contact outputs do not operate.
	<ul style="list-style-type: none"> • Motor coasts to stop.
	Remove the cause of the error and repeat the Auto-Tuning process.
Copy Function Errors	Copy Function Errors occur when using the digital operator or the USB Copy Unit to copy, read, or verify parameter settings.
	<ul style="list-style-type: none"> • The digital operator displays text indicating the specific error.
	<ul style="list-style-type: none"> • Multi-function contact outputs do not operate.
	Pressing any key on the digital operator will clear the fault. Investigate the cause of the problem (such as model incompatibility) and try again.

Table 84: Fault Reset Methods

After the Fault Occurs	Procedure
Fix the cause of the fault, restart the drive, and reset the fault	Press RESET on the controller. 
Resetting via Fault Reset Digital Input S4	Close then open the fault signal digital input via terminal S4. S4 is set for "Fault Reset" as default (H1-04 = 14) 
Turn off the main power supply if the above methods do not reset the fault. Reapply power after the controller display has turned off.	

NOTE: When a fault occurs, the cause of the fault must be removed and the drive must be restarted. The above table list the various ways to restart the drive. Remove the Run command before attempting to clear a fault. If the Run command is present, the control will disregard any attempt to reset the fault.

Recommended Periodic Inspection

WARNING

Electrical Shock Hazard. Before servicing or inspecting the equipment, disconnect power to the unit. The internal capacitor remains charged after power is turned off. Wait at least the amount of time specified on the drive before touching any components.

Table 85: Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action
General	Inspect equipment including wiring, terminals, resistors, capacitors, diode and IGBT for discoloration from overheating or deterioration.	Replace damaged components.
	Inspect for dirt or foreign particles	Use dry air to clear away.
Relays and Contactors	Inspect contactors and relays for excessive noise.	Check for over or undervoltage
	Inspect for signs of overheating such as melted or cracked insulation	Replace damaged parts.

Optional BAS Interface

The AGZ chiller controller is configured for stand-alone operation or integration with BAS through an optional communication module.

The following installation manuals for optional BAS interface modules are shipped with the chiller. They can also be found and downloaded from www.DaikinApplied.com.

- IM 966-1, BACnet® IP Communication Module
- IM 967-1, BACnet® Communication Module (MS/TP)
- IM 968-1, LONWORKS Communication Module
- IM 969-2, Modbus® Communication Module
- ED 15120, Protocol Information for MicroTech® III chiller, BACnet and LONWORKS
- ED 15121, Protocol Information for MicroTech® III chiller, Modbus

For specific information on the installation and operation of the Intelligent Equipment® platform for Trailblazer chillers please refer to OM 1241 - Intelligent Equipment® Operation and Maintenance Manual for Trailblazer® Chillers or IM 1240 Intelligent Equipment® Installation Manual for Trailblazer® Chillers.

Pre Startup

Inspect the chiller to ensure no components became loose or damaged during shipping or installation including leak test and wiring check. Complete the pre-start checklist at the front of this manual and return to Daikin Applied prior to startup date.

Pre-Startup Water Piping Checkout

1. Check the pump operation and vent all air from the system.
2. Circulate evaporator water, checking for proper system pressure and evaporator pressure drop. Compare the pressure drop to the evaporator water pressure drop curve.
3. Flush System and clean all water strainers before placing the chiller into service.
4. Check water treatment and proper glycol percent.
5. Pre-Startup Refrigerant Piping Checkout
6. Check all exposed brazed joints for evidence of leaks. Joints may have been damaged during shipping or when the unit was installed.
7. Check that all refrigerant valves are either opened or closed as required for proper operation of the chiller.
8. A thorough leak test must be done using an approved electronic leak detector. Check all valve stem packing for leaks. Replace all refrigerant valve caps and tighten.
9. Check all refrigerant lines to insure that they will not vibrate against each other or against other chiller components and are properly supported.
10. Check all connections and all refrigerant threaded connectors.
11. Look for any signs of refrigerant leaks around the condenser coils and for damage during shipping or installation.
12. Connect refrigerant service gauges to each refrigerant circuit before starting unit.

Pre-Startup Electrical Check Out

WARNING

Electrical power must be applied to the compressor crankcase heaters 8 hours before starting unit to eliminate refrigerant from the oil.

1. Open all electrical disconnects and check all power wiring connections. Start at the power block and check all connections through all components to and including the compressor terminals. These should be checked again after 3 months of operation and at least yearly thereafter.
2. Check all control wiring by pulling on the wire at the spade connections and tighten all screw connections. Check plug-in relays for proper seating and to insure retaining clips are installed.

3. Put System Switch (S1) to the Emergency Stop position.
4. Put both circuit #1 & #2 switches to the Pumpdown and Stop position.
5. Apply power to the unit. The panel Alarm Light will stay on until S1 is closed. Ignore the Alarm Light for the check out period. If you have the optional Alarm Bell, you may wish to disconnect it.
6. Check at the power block or disconnect for the proper voltage and proper voltage between phases. Check power for proper phasing using a phase sequence meter before starting unit.
7. Check for 120 Vac at the optional control transformer and at TB-2 terminal #1 and the neutral block (NB).
8. Check between TB-2 terminal #7 and NB for 120 Vac supply for transformer #2.
9. Check between TB-2 terminal #2 and NB for 120 Vac control voltage. This supplies the compressor crank case heaters.
10. Check between TB-3 terminal #17 and #27 for 24 Vac control voltage.

Startup

Refer to the MicroTech® III Controller information on page 43 to become familiar with unit operation before starting the chiller.

There should be adequate building load (at least 50 percent of the unit full load capacity) to properly check the operation of the chiller refrigerant circuits.

Be prepared to record all operating parameters required by the "Compressorized Equipment Warranty Form". Return this information within 10 working days to Daikin Applied as instructed on the form to obtain full warranty benefits.

Startup Steps

- Verify chilled water flow.
- Verify remote start / stop or time clock (if installed) has requested the chiller to start.
- Set the chilled water setpoint to the required temperature. (The system water temperature must be greater than the total of the leaving water temperature setpoint plus one-half the control band plus the startup delta-T before the MicroTech® III controller will stage on cooling.)
- Set the Evap Delta T based on a percent of unit nominal flow indicated in page 33 and the Start Delta T as a starting point. $\Delta T = \text{Tons} \times 24 / \text{gpm}$
- Check the controller setpoints to be sure that factory defaults are appropriate.
- Put both pumpdown switches (PS1 and PS2) to the ON position.
- Put system switch (S1) to ON position.

Table 86: Pumpdown and System Switch Positions

Switch	Switch Position	
	ON	OFF
PS1, PS2, Pumpdown Switches	Circuits will operate in the normal, automatic mode	Circuit will go through the normal pumpdown cycle and shut off.
S1, System Switch	Unit will operate in the normal automatic mode	Unit will shut off immediately without pumping down (emergency stop)

Post Startup

After the chiller has been operating for a period of time and has become stable, check the following:

- Compressor oil level. (Some scroll compressors do not have oil sight glasses).
- Refrigerant sight glass for flashing.
- Rotation of condenser fans.
- Complete the "Equipment Warranty Registration Form," found at the end of this manual, within 10 days of startup in order to comply with the terms of Daikin Limited Product Warranty.

Shutdown

Temporary Shutdown

1. Put both circuit switches to the OFF position (Pumpdown and Stop).
2. After compressors have stopped, put System Switch (S1) to OFF (emergency stop).
3. Turn off chilled water pump. Chilled water pump to operate while compressors are pumping down.
4. To start the chiller after a temporary shutdown, follow the startup instructions.

Extended Shutdown

1. Front seat both condenser liquid line service valves.
2. Put both circuit switches to the OFF position (Pumpdown and Stop position).
3. After the compressors have stopped, put System Switch (S1) to the OFF position (emergency stop).
4. Front seat both refrigerant circuit discharge valves (if applicable).
5. If chilled water system is not drained, maintain power to the evaporator heater to prevent freezing. Maintain heat tracing on the chilled water lines.
6. Drain evaporator and water piping to prevent freezing.
7. If electrical power to the unit is on, the compressor crankcase heaters will keep the liquid refrigerant out of the compressor oil. This will minimize startup time when putting the unit back into service. The evaporator heater will be able to function.
8. If electrical power is off, make provisions to power the evaporator heater (if chilled water system is not drained or is filled with suitable glycol). Tag all opened electrical disconnect switches to warn against startup before the refrigerant valves are in the correct operating position.

To start the chiller after an extended shutdown, follow the prestartup and startup instructions.

Hot Gas Bypass (Optional)

This option allows the system to operate at lower loads without excessive on/off compressor cycling. The hot gas bypass option is required to be on both refrigerant circuits because of the lead / lag feature of the controller.

This option allows passage of discharge gas into the evaporator inlet (between the TX valve and the evaporator) which generates a false load to supplement the actual chilled water or air handler load.

NOTE: The hot gas bypass valve should not generate a 100% false load.

The pressure regulating valve is factory set to begin opening at 110 psig with R-410a and can be changed by adjusting the pressure setting. To raise the pressure setting, remove the cap on the bulb and turn the adjustment screw clockwise. To lower the setting, turn the screw counterclockwise. Do not force the adjustment beyond the range it is designed for as this will damage the adjustment assembly. The regulating valve opening point can be determined by slowly reducing the system load while observing the suction pressure. When the bypass valve starts to open, the refrigerant line on the evaporator side of the valve will begin to feel warm to the touch.

A solenoid valve is located ahead of the bypass valve and is controlled by the MicroTech® III controller. It is active when the first stage of cooling on a circuit is active.

 WARNING
<p>The hot gas line may become hot enough to cause injury. Be careful during valve checkout.</p>

VFD Low Ambient Control (Optional)

The optional VFD fan control is used for unit operation below 32°F (0°C) down to a minimum of -10°F (-23.3°C). The control looks at the saturated discharge temperature and varies (pressure) at the “target” temperature. This temperature is established as an input to a setpoint screen labeled “Sat Condenser Temp Target.”

Compressor Communications

The CoreSense™ compressor communication module on model sizes 070-240 provides advanced diagnostics, protection, and communications that enhance compressor performance and reliability.

Features include motor temperature protection, scroll temperature protection, missing phase protection, reverse phase protection, low control circuit voltage protection, short cycling detection and alert, operational and fault history storage, and LED status display.

Warnings and Alerts

A solid green LED indicates the module is powered and operation is normal.

A solid red LED indicates an internal problem with the module.

A flashing green LED communicates Warning codes. Warning codes do not result in a trip or lockout condition.

A flashing red LED communicates Alert codes. Alert codes will result in a trip condition and possibly a lockout condition

Warning Codes (Flashing Green LED)

Code 1 – Loss of Communication: The module will flash the green Warning LED one time indicating the module has not communicated with the master controller for longer than 5 minutes.

Code 2 – Reserved For Future Use

Code 3 – Short Cycling: The module will flash the green Warning LED three times indicating the compressor has short cycled more than 48 times in 24 hours.

Code 4 – Open/Shorted Scroll Thermistor: The module will flash the green Warning LED four times indicating an open/shorted

Alert/Lockout Codes (Flashing Red LED)

Code 1 – Motor High Temperature: The module will flash the red Alert LED one time indicating the motor is overheating . A code 1 Alert will open the M2-M1 contacts. The Alert will reset after 30 minutes. Five consecutive Code 1 Alerts will lockout the compressor. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required for the lockout to be cleared.

Code 2 – Open/Shorted Motor Thermistor: The module will flash the red Alert LED two times indicating the motor PTC thermistor circuit has an open/shorted thermistor chain (see Table 2). A Code 2 Alert will open the M2-M1 contacts. The Alert will reset after 30 minutes and the M2-M1 contacts will close if the resistance of the motor PTC circuit is back in the normal range. The module will lockout the compressor and a power cycle or Modbus reset command will be required to clear the lockout.

Code 3 – Short Cycling: The module will flash the red Alert LED three times indicating the compressor is locked out due to short cycling. Once locked out the compressor, a power cycle or Modbus reset command will be required to clear the lockout.

Code 4 – Scroll High Temperature: The module will flash the red Alert LED four times indicating the over-temperature condition. A Code 4 Alert will open the M2-M1 contacts. The Alert will reset after 30 minutes. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required to clear the lockout.

Code 5 – Reserved for Future Use

Code 6 – Missing Phase: The module will flash the red Alert LED six times indicating a missing phase. The Alert will reset

after 5 minutes and the module will lockout the compressor after 10 consecutive Code 6 Alerts. Once locked out, a power cycle or Modbus reset is required.

Code 7 – Reverse Phase: The module will flash the red Alert LED seven times indicating a reverse phase in two of the three compressor leads. The modules will lockout the compressor after one Code 7 Alert. A power cycle or Modbus reset command will be required to clear the lockout.

Code 8 – Reserved For Future Use

Code 9 – Module Low Voltage: The module will flash the red Alert LED nine times indicating low module voltage for more than 5 seconds. The Alert will reset after 5 minutes and the M2-M1 contacts will close if the T2-T1 voltage is above the reset value.

NOTE: If a compressor with CoreSense Communications fails in the field, the CoreSense module should remain with the failed compressor so the manufacturer's technicians can download the CoreSense data to assist with determining the root cause of compressor failure.

Replaceable Core Filter-Driers

For units with replaceable core filter driers, the core assembly of the replaceable core drier consists of a filter core held tightly in the shell in a manner that allows full flow without bypass.

A condenser liquid line service valve is provided for isolating the charge in the condenser, but also serves as the point from which the liquid line can be pumped out. With the line free of refrigerant, the filter-drier core(s) can be easily replaced.

Crankcase Heaters

The scroll compressors are equipped with externally mounted band heaters located at the oil sump level. The function of the heater is to keep the temperature in the crankcase high enough to prevent refrigerant from migrating to the crankcase and condensing in the oil during off-cycle.

Power must be supplied to the heaters 8 hours before starting the compressors.

Evaporator

On AGZ-E models 030 through 180, the evaporator is a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates. The evaporator is protected with an electric resistance heater and insulated with 3/4" (19mm) thick closed-cell polyurethane insulation. This combination provides freeze protection down to -20°F (-29°C) ambient air temperature. The water side working pressure of the brazed plate type of evaporator is 653 psig (4502 kPa). Evaporators are designed and constructed according to, and listed by, Underwriters Laboratories (UL).

On AGZ-E models 190 through 240, the evaporator is a direct-expansion, shell-and-tube type with water flowing in the baffled shell side, and refrigerant flowing through the tubes. The evaporator has an insertion heater and is insulated with 3/4" (19 mm) thick vinyl nitrate polymer sheet insulation, protecting against water freeze-up at ambient air temperatures to -20° F (-29° C). An water thermostat controls the heater cable. The fitted and glued-in-place insulation has a K factor of 0.28 Btu in/hr ft² °F at 75°F. The water side working pressure of the shell-and-tube type of evaporator is 152 psig (1048 kPa). Each evaporator is designed, constructed, inspected, and stamped according to the requirements of the ASME Boiler and Pressure Vessel Code. Double thickness insulation is available as an option.

Phase Voltage Monitor (Optional)

Factory settings are as follows:

- Trip Delay Time: 2 seconds.
- Voltage Setting: set at nameplate voltage.
- Restart Delay Time: 60 seconds.

General

On initial start-up and periodically during operation, it will be necessary to perform certain routine service checks. Among these are checking the liquid line sight glasses, taking condensing and suction pressure readings, and checking to see that the unit has normal superheat and subcooling readings. A recommended maintenance schedule is located at the end of this section.

Evaporator

The evaporators are brazed plate design. Other than cleaning and testing, no service work should be required on the evaporator.

Compressor Maintenance

The scroll compressors are fully hermetic and require no maintenance other than checking oil level.

Lubrication

No routine lubrication is required on AGZ units. The fan motor bearings are permanently lubricated and no further lubrication is required. Excessive fan motor bearing noise is an indication of a potential bearing failure.

POE type oil is used for compressor lubrication. Further details are listed in the Unit Service section on page 100

WARNING

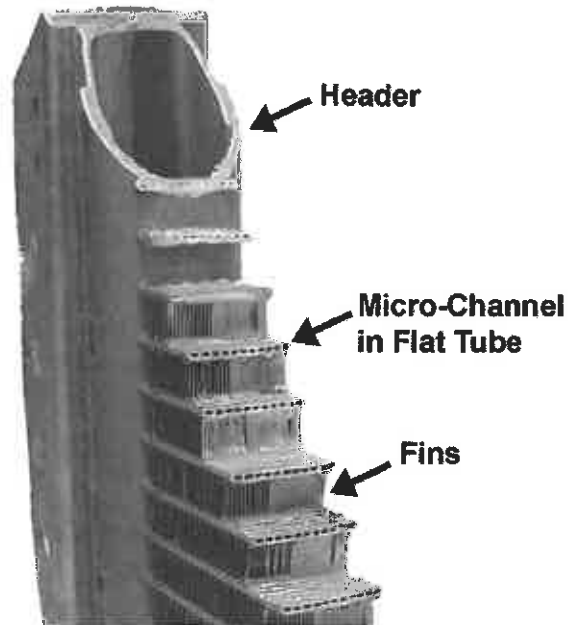
POE oil must be handled carefully using proper protective equipment (gloves, eye protection, etc.) The oil must not come in contact with certain polymers (e.g. PVC), as it may absorb moisture from this material. Also, do not use oil or refrigerant additives in the system.

All-Aluminum Condenser Coils

The condenser coils are an all-aluminum design including the connections, microchannels, fins (an oven brazing process brazes the fins to the microchannel flat tube), and headers (see "Microchannel Coil Cross Section"), which eliminates the possibility of corrosion normally found between dissimilar metals of standard coils.

During the condensing process, refrigerant in the coil passes through the microchannel flat tubes, resulting in higher efficiency heat transfer from the refrigerant to the airstream. In the unlikely occurrence of a coil leak, contact Daikin Applied to receive a replacement coil module.

Figure 68: Microchannel Coil Cross Section



Cleaning Microchannel Aluminum Coils

Maintenance consists primarily of the routine removal of dirt and debris from the outside surface of the fins.

Cleaning ElectroFin® Coated Coils

The following cleaning procedures are recommended as part of the routine maintenance activities for ElectroFin Coated Coils. Documented routine cleaning of ElectroFin Coated Coils is required to maintain warranty coverage. The cleaning procedure can be downloaded from the ElectroFin web site www.luvata.com/electrofin, click on Procedures for Cleaning.

WARNING

Prior to cleaning the unit, turn off and lock out the main power switch to the unit and open all access panels.

Remove Surface Loaded Fibers

Surface loaded fibers or dirt should be removed prior to water rinse to prevent further restriction of airflow. If unable to back wash the side of the coil opposite that of the coils entering air side, then surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft non-metallic bristle brush may be used. In either case, the tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges bent over) if the tool is applied across the fins.

NOTE: Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

Periodic Clean Water Rinse

A monthly clean water rinse is recommended for coils that are applied in coastal or industrial environments to help to remove chlorides, dirt and debris. An elevated water temperature (not to exceed 130°F) will reduce surface tension, increasing the ability to remove chlorides and dirt. Pressure washer PSI must not exceed 900 psig and the nozzle should remain at least 1 foot from the coil to avoid damaging fin edges.

Routine Quarterly Cleaning of ElectroFin Coated Coil Surfaces

Quarterly cleaning is essential to extend the life of an ElectroFin Coated Coil and is required to maintain warranty coverage. Coil cleaning shall be part of the unit's regularly scheduled maintenance procedures. Failure to clean an ElectroFin Coated Coil will void the warranty and may result in reduced efficiency and durability in the environment.

For routine quarterly cleaning, first clean the coil with an approved coil cleaner (see approved products list in Table 87). After cleaning the coils with the approved cleaning agent, use the approved chloride remover to remove soluble salts and revitalize the unit.

Recommended Coil Cleaner

The following cleaning agent, assuming it is used in accordance with the manufacturer's directions on the container for proper mixing and cleaning, has been approved for use on ElectroFin Coated Coils to remove mold, mildew, dust, soot, greasy residue, lint and other particulate:

Table 87: ElectroFin Coated Coil Recommended Cleaning Agents

Cleaning Agent	Reseller	Part Number
Enviro-Coil Concentrate	Hydro-Balance Corp P.O. Box 730 Prosper, TX 75078 800-527-5166	H-EC01
Enviro-Coil Concentrate	Home Depot	H-EC01
Chloride Remover	Chlor*Rid Int'l, Inc. P.O. Box 908 Chandler, AZ 85244 800-422-3217	Chlor*Rid DTS

CHLOR*RID DTS™ should be used to remove soluble salts from the ElectroFin Coated Coil, but the directions must be followed closely. This product is not intended for use as a degreaser. Any grease or oil film should first be removed with the approved cleaning agent.

1. Remove Barrier - Soluble salts adhere themselves to the substrate. For the effective use of this product, the product must be able to come in contact with the salts. These salts may be beneath any soils, grease or dirt; therefore, these barriers must be removed prior to

application of this product. As in all surface preparation, the best work yields the best results.

2. Apply CHLOR*RID DTS - Apply CHLOR*RID DTS directly onto the substrate. Sufficient product must be applied uniformly across the substrate to thoroughly wet out surface with no areas missed. This may be accomplished by use of a pump-up sprayer or conventional spray gun. The method does not matter, as long as the entire area to be cleaned is wetted. After the substrate has been thoroughly wetted, the salts will be soluble and is now only necessary to rinse them off.
3. Rinse - It is highly recommended that a hose be used as a pressure washer will damage the fins. The water to be used for the rinse is recommended to be of potable quality, though a lesser quality of water may be used if a small amount of CHLOR*RID DTS is added. Check with CHLOR*RID International, Inc. for recommendations on lesser quality rinse water.

Harsh Chemical and Acid Cleaners

Harsh chemicals, household bleach or acid cleaners should not be used to clean outdoor or indoor ElectroFin Coated Coils. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion and attack the ElectroFin coating. If there is dirt below the surface of the coil, use the recommended coil cleaners as described above.

High Velocity Water or Compressed Air

High velocity water from a pressure washer or compressed air should only be used at a very low pressure to prevent fin and/or coil damages. The force of the water or air jet may bend the fin edges and increase airside pressure drop. Reduced unit performance or nuisance unit shutdowns may occur.

Electrical Terminals

 **DANGER**

Electric shock hazard. Turn off all power before continuing with following service.

High Ambient Control Panel

This option consists of an exhaust fan with rain hood, two inlet screens with filters, necessary controls and wiring to allow operation to 125°F (52°C). The components can be factory or field installed as a kit.

- It must be supplied on units operating at ambient temperatures of 105°F (40.6°C) and above.
- It is automatically included on units with fan VFD (low ambient option).
- Check inlet filters periodically and clean as required. Verify that the fan is operational.

Filter-Driers

Replace the filter-drier any time excessive pressure drop is read across the filter-drier and/or when bubbles occur in the sight glass with normal subcooling. The filter-drier should also be changed if the moisture indicating liquid line sight glass indicates excess moisture in the system.

Any residual particles from the condenser tubing, compressor and miscellaneous components are swept by the refrigerant into the liquid line and are caught by the filter-drier.

Battery

The controller has a battery located behind the clear plastic bezel. It is a BR2032 with a minimum life of 2 years unpowered. The typical battery life is 10 years. .

Liquid Line Solenoid Valve

The liquid line solenoid valves that shut off refrigerant flow in the event of a power failure do not normally require any maintenance. The solenoids can, however, require replacement of the solenoid coil or of the entire valve assembly.

System Adjustment

To maintain peak performance at full load operation, the system superheat and liquid subcooling may require adjustment. Read the following subsections closely to determine if adjustment is required.

Liquid Line Sight Glass

The refrigerant sight glasses should be observed periodically. A clear glass of liquid indicates that there is subcooled refrigerant charge in the system. Bubbling refrigerant in the sight glass, during stable run conditions, may indicate that the system can be short of refrigerant charge. However, it is not unusual to see bubbles in the sight glass during changing load conditions. Refrigerant gas flashing in the sight glass could also indicate an excessive pressure drop in the liquid line, possibly due to a clogged filter-drier or a restriction elsewhere in the liquid line.

An element inside the sight glass indicates the moisture condition corresponding to a given element color. Immediately after the system has been opened for service, the element may indicate a wet condition. If the sight glass does not indicate a dry condition after about 12 hours of operation, the circuit should be pumped down and the filter-drier changed or verify moisture content by performing an acid test on the compressor oil.

Expansion Valve

The expansion valve's function is to keep the evaporator supplied with the proper amount of refrigerant to satisfy the load conditions.

Before adjusting superheat, check that unit charge is correct and liquid line sight glass is full with no bubbles and that the circuit is operating under stable, full load conditions.

The suction superheat for the suction leaving the evaporator is set at the factory to 10 degrees F.

Table 88: Planned Maintenance Schedule

Operation	Weekly	Monthly (Note 1)	Annual (Note 2)
General			
Complete unit log and review (Note 3)	X		
Visually inspect unit for loose or damaged components		X	
Inspect thermal insulation for integrity			X
Clean and paint as required			X
Electrical			
Check terminals for tightness, tighten as necessary			X
Clean control panel interior			X
Visually inspect components for signs of overheating		X	
Verify compressor heater operation		X	
Test and calibrate equipment protection and operating controls			X
Megger compressor motor (Note 4)			X
Refrigeration			
Leak test		X	
Check sight glasses for clear flow	X		
Check filter-drier pressure drop (see manual for spec)		X	
Perform compressor vibration test			X
Acid test oil sample			X
Condenser (air-cooled)			
Clean condenser coils (Note 5)			X
Check fan blades for tightness on shaft (Note 6)			X
Check fans for loose rivets and cracks			X
Check coil fins for damage			X

Notes:

1. Monthly operations include all weekly operations.
2. Annual (or spring start-up) operations includes all weekly and monthly operations.
3. Log readings can be taken daily for a higher level of unit observation.
4. Never Megger motors while they are in a vacuum to avoid damage to the motor.
5. Coil cleaning can be required more frequently in areas with a high level of airborne particles.
6. Be sure fan motors are electrically locked out.

R-410A Refrigerant

Terminology

Bubble Point: The temperature/pressure where bubbles first appear when heat is added to a liquid refrigerant. Used to measure sub-cooling.

Dew Point: The temperature/pressure where droplets first appear when heat is removed from a refrigerant gas. Used to measure superheat.

Fractionalization: A change in refrigerant composition due to the tendency of the higher pressure refrigerant to leak at a faster rate, should a system have leakage from a static two-phase region.

Glide: The total difference of Dew and Bubble Point at a specific condition. **Mid-Point or Mean:** Measurement half way between Dew and Bubble Points.

Miscibility: The ability of a refrigerant and oil to mix and flow together.

Solubility: The effect of refrigerant on the viscosity of a lubricant.

Safety

- ANSI/ASHRAE safety group A1.
- Always carry and be familiar with MSDS information for R-410a.
- Store refrigerant in clean, dry area out of direct sunlight.
- Never heat or store cylinders above 125° F. Note vehicle precautions!
- Never tamper with cylinder valves or pressure relief valves. (Typical relief for R-410A is 525 psig).
- Never refill disposable cylinders.
- Verify cylinder hook-up.
- Verify cylinder label and color code match. R-410A is rose/light maroon. Must be DOT approved, R-410A with 400 psig rating. Open cylinders slowly.
- Avoid rough handling of cylinders and secure as appropriate. Cap when not in use.
- Do not overfill recovery cylinders or overcharge units.
- Check gauge calibration before every use and manifold set for leaks regularly.
- Be aware of pneumatic and possible hydrostatic pressure potentials.
- Never pressurize systems with oxygen or ref/air mix. R-410A, R-407C, R-134a, & R-22 are flammable with low air mix.
- Wear protective clothing. Impervious gloves and splash goggles should be worn.
- Avoid contact with liquid refrigerant (R-410A -60.8°F @ atms.) due to corrosion and freezing hazards.
- Avoid exposure to vapors. 1000 ppm/8 hr.
- Evacuate areas in cases of large releases. R-410A is heavier than air and can cause asphyxiation, narcotic and

cardiac sensation effects.

- Evacuate systems and break vacuum (0 psig) with nitrogen before welding or brazing.
- Always ventilate work areas before using open flames. Exposure to open flames or glowing metal will form toxic hydrofluoric acid & carbonyl fluoride. No smoking!
- Make sure all tools, equipment, and replacement components are rated for the refrigerant used.

POE Lubricants

WARNING

POE oil must be handled carefully using proper protective equipment (gloves, eye protection, etc.) The oil must not come in contact with certain polymers (e.g. PVC), as it may absorb moisture from this material. Daikin Applied recommends against the use of PVC and CPVC piping for chilled water systems. In the event the pipe is exposed to POE oil used in the refrigerant system, the pipe can be chemically damaged and pipe failure can occur. Also, do not use oil or refrigerant additives in the system.

Polyolester (POE) oil is used for compressor lubrication. This type of oil is extremely hygroscopic which means it will quickly absorb moisture if exposed to air and may form acids that can be harmful to the chiller. Avoid prolonged exposure of POE oil to the atmosphere to prevent this problem.

It is important that only the manufacturer's recommended oils be used. Acceptable POE oil types are:

- CPI/Lubrizol Emkarate RL32-3 MAF
- Copeland Ultra 32-3 MAF
- Parker Emkarate RL32-3MAF
- Virginia LE323MAF
- Nu Calgon 4314-66

Procedure Notes

- Use only new sealed metal containers of oil to insure quality.
- Buy smaller containers to prevent waste and contamination.
- Use only filter driers designed for POE and check pressure drops frequently.
- Test for acid and color at least annually. Change filter driers if acid or high moisture (> 200 ppm) is indicated (< 100 ppm typical).
- Evacuate to 500 microns and hold test to insure systems are dry.

Control and Alarm Settings

The software that controls the operation of the unit is factory-set for operation with R-410A taking into account that the pressure/temperature relationship differs from R-22. The software functionality is the same for either refrigerant.

Refrigerant Charging

CAUTION

When moving refrigerant to/from the chiller using an auxiliary tank, a grounding strap must be used. An electrical charge builds when halo-carbon refrigerant travels in a rubber hose. A grounding strap must be used between the auxiliary refrigerant tank and the end sheet of the chiller (earth ground), which will safely take the charge to the ground. Damage to sensitive electronic components could occur if this procedure is not followed.

If a unit is low on refrigerant, you must first determine the cause before attempting to recharge the unit. Locate and repair any refrigerant leaks. Soap works well to show bubbles at medium size leaks but electronic leak detectors are needed to locate small leaks.

Charging or check valves should always be used on charging hoses to limit refrigerant loss and prevent frostbite. Ball valve type recommended. Charge to 80-85% of normal charge before starting the compressors.

Charging procedure

The units are factory-charged with R-410A. Use the following procedure if recharging in the field is necessary:

To prevent fractionalization, liquid must be charged from the refrigerant cylinder, unless charging the entire cylinder contents.

The charge can be added at any load condition between 25 to 100 percent load per circuit, but at least two fans per refrigerant circuit should be operating if possible.

- Start the system and observe operation.
- Trim the charge to the recommended liquid line subcooling (approximately 15-20°F typical).
- Verify the suction superheat (10 degrees F for EEVs and 10 – 12 degrees F for TXVs) at full load conditions.
- Use standard charging procedures (liquid only) to top off the charge.
- Check the sight glass to be sure there is no refrigerant flashing.

With outdoor temperatures above 60°F (15.6°C), all condenser fans should be operating and the liquid line temperature should be within 5°F to 10°F (2.8°C to 5.6°C) of the outdoor air temperature. At 25-50% load, the liquid line temperature should be within 5°F (2.8°C) of outdoor air temperature with all fans on. At 75-100% load the liquid line temperature should be within 10°F (5.6°C) of outdoor air temperature with all fans on.

If the unit is at steady full load operation and bubbles are visible in the sight glass, then check liquid subcooling. The AGZ units have a condenser coil design with approximately 15% of the coil tubes located in a subcooler section of the coil to achieve liquid cooling to within 5-10°F (2.8-5.6°C) of the outdoor air temperature when all condenser fans are operating. Subcooling should be checked at full load with 70°F (21.1°C) ambient temperature or higher, stable conditions, and all fans running. Liquid line subcooling at the liquid shut-off valve

should be between 15 and 20 degrees F at full load.

If subcooling is low, add charge to clear the sight glass. Once the subcooler is filled, extra charge will not lower the liquid temperature and does not help system capacity or efficiency.

If subcooling is normal (15 to 20 degrees F at full load) and flashing is visible in the sight glass, check the pressure drop across the filter-drier. See page 97 for maximum allowable pressure drops.

It may be necessary to add refrigerant through the compressor suction. Because the refrigerant leaving the cylinder must be a liquid, exercise care to avoid damage to the compressor by using a flow restrictor. A sight glass can be connected between the charging hose and the compressor. It can be adjusted to have liquid leave the cylinder and vapor enter the compressor.

Overcharging of refrigerant will raise the compressor discharge pressure due to filling of the condenser tubes with excess refrigerant.

Service

With R-410A, fractionalization, if due to leaks and recharge has a minimal effect on performance or operation.

Special tools will be required due to higher refrigerant pressures with R-410A. Oil-less/hp recovery units, hp recovery cylinders (DOT approved w/525# relief), gauge manifold 30"-250 psi low/0-800 psi high, hoses w/800 psi working & 4,000 psi burst.

All filter driers and replacement components must be rated POE oils and for the refrigerant pressure (R-410A 600psig typical).

R-410A compressor internal relief is 600-650 psid.

Brazed connections only. No StayBrite or solder connections (solder should never be used with any refrigerant). K or L type refrigeration tubing only. Use nitrogen purge. Higher R-410A pressures and smaller molecule size make workmanship more critical.

R-410A must be charged from cylinder as a liquid unless entire cylinder is used. Use a Refrigerant flow restrictor if charging liquid to suction or to a system at pressure below a saturated temperature of 32° F.

EPA recovery and handling requirements for R-410A are the same as R-22.

Cooling the recovery cylinder will speed recovery and lessen stress on recovery equipment.

WARNING

Service on this equipment is to be performed by qualified refrigeration personnel familiar with equipment operation, maintenance, correct servicing procedures, and the safety hazards inherent in this work. Causes for repeated tripping of equipment protection controls must be investigated and corrected. Disconnect all power before doing any service inside the unit. Servicing this equipment must comply with the requirements set forth by the EPA in regards to refrigerant reclamation and venting.

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Compressor Will Not Run	1. Main or compressor disconnect switch open.	1. Close switch.
	2. Fuse blown. circuit breakers open	2. Check electrical circuits and motor windings for shorts or grounds. Investigate for possible overloading. Check for loose or corroded connections. Replace fuse or reset breakers after fault cause is corrected.
	3. Thermal overloads tripped	3. Overloads are auto-reset. Check voltages, cycle times and mechanical operations. Allow time for auto-reset.
	4. Defective contactor or coil.	4. Replace.
	5. System shutdown by equipment protection devices	5. Determine type and cause of shutdown and correct it before restarting equipment.
	6. No cooling required	6. None. Wait until unit calls for cooling.
	7. Liquid line solenoid will not open	7. Repair or replace solenoid. Check wiring.
	8. Motor electrical trouble	8. Check motor for opens, shorts, or burnout.
	9. Loose wiring	9. Check all wire junctions. Tighten all terminal screws.
Compressor Noisy Or Vibrating	1. Low lift, inverted start	1. Control issues or condenser fan VFDs needed.
	2. Compressor running in reverse	2. Check unit and compressor for correct phasing.
	3. Improper piping or support on suction or discharge	3. Relocate, add, or remove hangers.
	4. Worn compressor isolator bushing	4. Replace.
	5. Compressor mechanical failure	5. Replace.
High Discharge Pressure	1. Noncondensables in system	1. Extract noncondensables with approved procedures or replace charge.
	2. Circuit overcharged with refrigerant	2. Remove excess, check liquid subcooling.
	3. Optional discharge shutoff valve not open	3. Open valve.
	4. Condenser fan control wiring not correct	4. Correct wiring.
	5. Fan not running	5. Check electrical circuit and fan motor.
	6. Dirty condenser coil	6. Clean coil.
	7. Air recirculation	7. Correct.
Low Suction Pressure	1. Rapid load swings	1. Stabilize load.
	2. Lack of refrigerant	2. Check for leaks, repair, add charge. Check liquid sight glass.
	3. Fouled liquid line filter drier	3. Check pressure drop across filter drier. Replace.
	4. Expansion valve malfunctioning	4. Repair or replace and adjust for proper superheat.
	5. Condensing temperature too low	5. Check means for regulating condenser temperature.
	6. Compressors not staging properly	6. See corrective steps - Compressor Staging Intervals Too Low.
	7. Insufficient water flow	7. Correct flow.
	8. Excess or wrong oil used	8. Recover or change oil
	9. Evaporator dirty	9. Back flush or clean chemically.

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Compressor Will Not Stage Up	1. Defective capacity control	1. Replace.
	2. Faulty sensor or wiring	2. Replace.
	3. Stages not set for application	3. Adjust controller setting for application.
Compressor Staging Intervals Too Short	1. Control band not set properly	1. Adjust controller settings for application.
	2. Faulty water temperature sensor	2. Replace.
	3. Insufficient water flow	3. Correct flow.
	4. Rapid temperature or flow swings	4. Stabilize load.
	5. Oversized equipment	5. Evaluate equipment selection
	6. Chiller enabled with no load	6. Evaluate BAS sequence and settings
	7. Light loads	7. Evaluate need for HGBP or thermal inertia
Compressor Oil Level Too High Or Too Low	1. Oil hang-up in remote piping	1. Review refrigerant piping and correct.
	2. Low oil level	2. Verify superheat, add oil.
	3. Loose fitting on oil line	3. Repair.
	4. Level too high with compressor operating	4. Confirm correct superheat, remove oil.
	5. Insufficient water flow - Level too high	5. Correct flow, verify superheat.
	6. Excessive liquid in crankcase - Level too high	6. Check crankcase heater. Check liquid line solenoid valve operation.
	7. Short cycling	7. Stabilize load or correct control settings for application.
	8. HGBP valve oversize or improperly set-up	8. replace or adjust HGBP valve
	9. Expansion valve operation or selection	9. Confirm superheat at minimum and maximum load conditions
	10. Compressor mechanical issues	10. Replace compressor
	11. Wrong oil for application	11. Verify
Motor Overload Relays or Circuit Breakers Open	1. Voltage imbalance or out of range	1. Correct power supply.
	2. Defective or grounded wiring in motor	2. Replace compressor.
	3. Loose power wiring or burnt contactors	3. Check all connections and tighten, replace contactors.
	4. High condenser temperature	4. See corrective steps for High Discharge Pressure.
Compressor Thermal Protection Switch Open	1. Operating beyond design conditions	1. Correct so conditions are within allowable limits.
	2. Discharge valve not open	2. Open valve.
	3. Short cycling	3. Stabilize load or correct control settings for application
	4. Voltage range or imbalance	4. Check and correct.
	5. High superheat	5. Adjust to correct superheat.
	6. Compressor mechanical failure	6. Replace compressor.

<p>Attention: Warranty Department Daikin P O Box 2510 Staunton, VA 24402-2510 Email Address STN.Wty_Startup_Registration@daikinapplied.com</p>	<p>Scroll Compressor Equipment Warranty Registration Form This form must be completely filled out and returned to the Staunton Warranty Department within ten (10) days of start-up in order to comply with the terms of "Daikin Limited Product Warranty".</p>
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**Check, Test and Commissioning for
 Scroll Product (AGZ, ACZ, WGZ, TGZ)**

Job Name: _____ Startup Date: _____

Daikin G.O. No.: _____ Daikin S.O. No.: _____

Installation Address: _____ City/State/Zip: _____

Purchasing Contractor: _____ Phone: _____

City/State/Zip: _____ No. of units at site: _____

Unit Model No.: _____ Serial No.: _____

Compressor # 1 Serial #: _____ Compressor # 4 Serial No.: _____

Compressor # 2 Serial #: _____ Compressor # 5 Serial No.: _____

Compressor # 3 Serial #: _____ Compressor # 6 Serial No.: _____

Benshaw/DRC Control Box M/M #: _____ Benshaw/DRC Control Box S/N #: _____

I. PRE START-UP PROCEDURE

II. Pre Start-Up Checklist

Pre Start-Up Checklist, All NO checks require an explanation under "Description". Please check yes or no.

	YES	NO
A. Is the unit free of visible shipping damage, corrosion or paint problems?	<input type="checkbox"/>	<input type="checkbox"/>
B. Is unit installed level?	<input type="checkbox"/>	<input type="checkbox"/>
C. Does the unit meet all location, installation and service clearances per IM Bulletin?	<input type="checkbox"/>	<input type="checkbox"/>
D. Has sensor bulb been properly installed in the well?	<input type="checkbox"/>	<input type="checkbox"/>
E. Are all set screws on all fans tight?	<input type="checkbox"/>	<input type="checkbox"/>
F. Does electrical service correspond to unit nameplate? Nameplate: Volts _____ Hertz _____ Phase _____	<input type="checkbox"/>	<input type="checkbox"/>
G. Has electrical service been checked for proper phasing at each circuit power terminal block?	<input type="checkbox"/>	<input type="checkbox"/>
H. Has unit been properly grounded?	<input type="checkbox"/>	<input type="checkbox"/>
I. Has a fused disconnect and fuses or breaker been sized per product manual and installed per local code? Number of conduits _____ Number of Wires _____ Wire Size _____	<input type="checkbox"/>	<input type="checkbox"/>
J. Are all electrical power connections tight?	<input type="checkbox"/>	<input type="checkbox"/>
K. been operating for 24 hours prior to start-up?	<input type="checkbox"/>	<input type="checkbox"/>

- L. Does all field wiring conform to unit electrical specifications?
- M. Are all service and liquid line valves in correct position?
- N. Water Strainer installed? Shell & Tube Evaporators 0.125"(3.175mm) or smaller perforations
Brazed Plate Evaporator 0.063" (1.6mm) or smaller perforations
- O. Has a flow switch been installed per the IM manual?
- P. Has the chill water circuit been cleaned, flushed, and water treatment confirmed?
- Q. Does the chiller and condenser water piping conform to the IM manual?
- R. Are fans properly aligned and turn freely?
- S. Is wind impingement against the air cooled condenser a consideration?

T. Description of unit location with respect to building structures. Include measured distances.

Description: _____

III. REFRIGERATION SYSTEM

- | | N/A | YES | NO |
|--|--------------------------|--------------------------|--------------------------|
| A. Has all field piping been leak tested at 150 psig (690 kPa)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B. Has system been properly evacuated and charged? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C. Refrigerant R-____ Circuit 1 ____ lbs (kg) Circuit 2 ____ lbs. (kg) | | <input type="checkbox"/> | <input type="checkbox"/> |
| D. Does piping to unit appear to be adequately sized and installed according to the IM bulletin? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| E. Is a liquid line filter-drier installed in each circuit? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| F. Is level of oil in sightglass visible but not more than 1/2 glass with compressors running? | | <input type="checkbox"/> | <input type="checkbox"/> |
| G. Is a liquid line solenoid installed correctly in each circuit? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| H. Is expansion valve bulb or suction sensor properly installed and insulated? | | <input type="checkbox"/> | <input type="checkbox"/> |

IV. DESIGN CONTROLS

- A. CHILLER
 Water Pressure Drop: _____ psig(kPa) _____ Ft. (kPa) _____ gpm (lps)
 Water Temperatures: Entering _____ °F (°C) Leaving _____ °F (°C)
- B. CONDENSER
 Water Pressure Drop: _____ psig(kPa) _____ Ft. (kPa) _____ gpm (lps)
 Water Temperatures: Entering _____ °F (°C) Leaving _____ °F (°C)

V. START-UP

- | | YES | NO |
|--|--------------------------|--------------------------|
| A. Does unit start and perform per sequence of operation as stated in the IM Manual? | <input type="checkbox"/> | <input type="checkbox"/> |
| B. Do condenser fans rotate in the proper directions? | <input type="checkbox"/> | <input type="checkbox"/> |

MICROTECH STATUS CHECK-Each Reading Must be Verified with Field Provided Instruments of Known Accuracy?

		MicroTech	Verification
C. Water Temperatures:	Leaving Evaporator	_____ °F (°C)	_____ °F (°C)
	Entering Evaporator	_____ °F (°C)	_____ °F (°C)
	Entering Condenser	_____ °F (°C)	_____ °F (°C)
	Leaving Condenser	_____ °F (°C)	_____ °F (°C)
D. Circuit #1 Refrigerant Pressures:	Evaporator	_____ psig (kPa)	_____ psig (kPa)
	Liquid Line pressure	_____ psig (kPa)	_____ psig (kPa)
	Condenser Pressure	_____ psig (kPa)	_____ psig (kPa)
E. Circuit #2 Refrigerant Pressures:	Evaporator	_____ psig (kPa)	_____ psig (kPa)
	Liquid Line Pressure	_____ psig (kPa)	_____ psig (kPa)
	Condenser Pressure	_____ psig (kPa)	_____ psig (kPa)
F. Circuit #1 Refrigerant Temperatures:	Saturated Evaporator Temperature	_____ °F (°C)	_____ °F (°C)
	Suction Line Temperature	_____ °F (°C)	_____ °F (°C)
	Suction Superheat	_____ °F (°C)	_____ °F (°C)
	Saturated Condenser Temperature	_____ °F (°C)	_____ °F (°C)
	Liquid Line Temperature	_____ °F (°C)	_____ °F (°C)
	Subcooling	_____ °F (°C)	_____ °F (°C)
	Discharge Temperature	_____ °F (°C)	_____ °F (°C)
G. Circuit #2 Refrigerant Temperatures:	Saturated Evaporator Temperature	_____ °F (°C)	_____ °F (°C)
	Suction Line Temperature	_____ °F (°C)	_____ °F (°C)
	Suction Superheat	_____ °F (°C)	_____ °F (°C)
	Saturated Condenser Temperature	_____ °F (°C)	_____ °F (°C)
	Liquid Line Temperature	_____ °F (°C)	_____ °F (°C)
	Subcooling	_____ °F (°C)	_____ °F (°C)
	Discharge Temperature	_____ °F (°C)	_____ °F (°C)
H. Outdoor Air Temperature:	_____ °F (°C)	_____ °F (°C)	

NON-MICROTECH READINGS

I. Does the system contain glycol? Yes No
 Percentage by weight _____ or by volume _____ Glycol Type _____

J. If the chilled water system include glycol, have the freezstats been adjusted lower to meet acutal job requirements?
Note: See operation manual for low temperature on ice bank applications. Yes No

K. Chiller: _____ psig (kPa) _____ Ft. (kPa) _____ gpm (lps)
 Condenser: _____ psig (kPa) _____ Ft. (kPa) _____ gpm (lps)

L. Unit Voltage Across Each Phase: L1-L2 _____ V L2-L3 _____ V L1-L3 _____ V

M. Unit Current Per Phase: L1 amps _____ L2 amps _____ L3 amps _____

N. Compressor Current Per Phase:

Compressor #1:	_____ L1 Amps	_____ L2 Amps	_____ L3 Amps
Compressor #2:	_____ L1 Amps	_____ L2 Amps	_____ L3 Amps
Compressor #3:	_____ L1 Amps	_____ L2 Amps	_____ L3 Amps
Compressor #4:	_____ L1 Amps	_____ L2 Amps	_____ L3 Amps
Compressor #5:	_____ L1 Amps	_____ L2 Amps	_____ L3 Amps
Compressor #6:	_____ L1 Amps	_____ L2 Amps	_____ L3 Amps

VI. MICROTECH SETPOINTS

	MICROTECH Setting
A. Leaving Evaporator	_____ °F (°C)
B. Reset Leaving	_____ °F (°C)
C. Reset Signal	_____ ma
D. Reset Option	_____
E. Maximum Chilled Water Reset	_____ °F (°C)
F. Return Setpoint	_____ °F (°C)
G. Maximum Pulldown	_____ °F (°C)
H. Evaporator Full Load Delta T	_____ °F (°C)
I. Evap Recirc Timer	_____ sec.
J. Start-to-Stop Delay	_____ min.
K. Stop-to-Stop Delay	_____ min.
L. Stage Up Delay	_____ sec.
M. Stage Down Delay	_____ sec.

ALARM SETPOINTS MUST BE VERIFIED WITH INSTRUMENTS OF KNOWN ACCURACY

N. Low Pressure Hold	_____ psig (kPa)
O. Low Pressure Unload.....	_____ psig (kPa)
P. Evaporator Water Freeze.....	_____ psig (kPa)
Q. High Pressure Cut-Out.....	_____ psig (kPa)
R. Unit Type = _____	
S. Number of Compressors = _____	
T. Number of Stages = _____	
U. Number of Fan Stages = _____	
V. Software Version = _____	

VII. FOR TGZ Templifier CHILLERS ONLY (Must Be Taken At Full Load)

A. Place Unit in heat recovery mode.			
B. Condenser Pressure Drop:	_____ psig (kPa)	_____ Ft. (kPa)	_____ gpm (lps)
C. Condenser Temperatures:	_____ Inlet	_____ Outlet	
D. Head Pressure: Circuit #1	_____ psig (kPa)	Circuit #2:	_____ psig (kPa)
E. Evaporator Pressure Drop:	_____ psig (kPa)	_____ Ft. (kPa)	_____ gpm (lps)
F. Evaporator Temperatures:	_____ Inlet	_____ Outlet	
G. Suction Pressure: Circuit #1	_____ psig (kPa)	Circuit #2:	_____ psig (kPa)
F. Compressor Current Per Phase			
Compressor #1	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS
Compressor #2	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS
Compressor #3	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS
Compressor #4	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS
Compressor #5	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS
Compressor #6	_____ L1 AMPS	_____ L2 AMPS	_____ L3 AMPS

VIII. GENERAL

	YES	NO
A. Are all control lines secure to prevent excess vibration and wear?	<input type="checkbox"/>	<input type="checkbox"/>
B. Are all gauges shut off, valve caps, and packings tight after startup?	<input type="checkbox"/>	<input type="checkbox"/>

Refrigerant Leaks: _____

Repairs Made _____

Items not installed per IM Manual and/or recommended corrective actions _____

Performed By: _____ Title: _____

Company Name: _____

Address: _____

City/State/Zip Code: _____ Telephone: _____

Modem Number: _____

Signature: _____ Date: _____

Contractor's Signature _____

RETURN COMPLETED FORM TO: DAIKIN, WARRANTY DEPT., PO BOX 2510, STAUNTON, VA 24402



**DAIKIN APPLIED AMERICAS INC.
LIMITED PRODUCT WARRANTY
(North America)**

Daikin Applied Americas Inc. dba Daikin Applied ("Company") warrants to contractor, purchaser and any owner of the product (collectively "Owner") that Company, at its option, will repair or replace defective parts in the event any product manufactured by Company, including products sold under the brand name Daikin and used in the United States or Canada, proves defective in material or workmanship within twelve (12) months from initial startup or eighteen (18) months from the date shipped by Company, whichever occurs first. Authorized replaced parts are warranted for the duration of the original warranty. All shipments of such parts will be made FOB factory, freight prepaid and allowed. Company reserves the right to select carrier and method of shipment.

In addition, labor to repair or replace warranty parts is provided during Company normal working hours on products with rotary screw compressors, centrifugal compressors and on absorption chillers. Warranty labor is not provided for any other products.

Company's liability to Owner under this warranty shall not exceed the lesser of the cost of correcting defects in the products sold or the original purchase price of the products.

PRODUCT STARTUP ON CENTRIFUGAL AND SCREW COMPRESSOR PRODUCTS IS MANDATORY and must be performed by a Daikin Applied or a Company authorized service representative.

It is Owner's responsibility to complete and return the Registration and Startup Forms accompanying the product to Company within ten (10) days of original startup. If this is not done, the ship date and the startup date will be deemed the same for warranty period determination, and this warranty shall expire twelve (12) months from that date.

EXCEPTIONS

1. If free warranty labor is available as set forth above, such free labor does not include diagnostic visits, inspections, travel time and related expenses, or unusual access time or costs required by product location.
2. Refrigerants, fluids, oils and expendable items such as filters are not covered by this warranty.
3. This warranty shall not apply to products or parts which (a) have been opened, disassembled, repaired, or altered by anyone other than Company or its authorized service representative; or (b) have been subjected to misuse, negligence, accidents, damage, or abnormal use or service; or (c) have been operated, installed, or startup has been provided in a manner contrary to Company's printed instructions, or (d) were manufactured or furnished by others and which are not an integral part of a product manufactured by Company; (e) have been exposed to contaminants, or corrosive agents, chemicals, or minerals, from the water supply source, or (f) have not been fully paid for by Owner.

ASSISTANCE

To obtain assistance or information regarding this warranty, please contact your local sales representative or a Daikin Applied office.

SOLE REMEDY

THIS WARRANTY CONSTITUTES THE OWNER'S SOLE REMEDY. IT IS GIVEN IN LIEU OF ALL OTHER WARRANTIES. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT AND UNDER NO CIRCUMSTANCE SHALL COMPANY BE LIABLE FOR INCIDENTAL, INDIRECT, SPECIAL, CONTINGENT OR CONSEQUENTIAL DAMAGES, WHETHER THE THEORY BE BREACH OF THIS OR ANY OTHER WARRANTY, NEGLIGENCE OR STRICT LIABILITY IN TORT.

No person (including any agent, sales representative, dealer or distributor) has the authority to expand the Company's obligation beyond the terms of this express warranty or to state that the performance of the product is other than that published by Company.

For additional consideration, Company will provide an extended warranty(ies) on certain products or components thereof. The terms of the extended warranty(ies) are shown on a separate extended warranty statement.



Daikin Applied Training and Development

Now that you have made an investment in modern, efficient Daikin Applied equipment, its care should be a high priority. For training information on all Daikin Applied HVAC products, please visit us at www.DaikinApplied.com and click on Training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin Applied equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Applied representative for warranty details. To find your local Daikin Applied representative, go to www.DaikinApplied.com.

Aftermarket Services

To find your local parts office, visit www.DaikinApplied.com or call 800-37PARTS (800-377-2787). To find your local service office, visit www.DaikinApplied.com or call 800-432-1342.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinApplied.com.

Products manufactured in an ISO Certified Facility.